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مجلة علمية فصلية مُحكمة متخصصة

بعلوم الرياضة تصدر عن

كلية التربية البدنية وعلوم الرياضة

جامعة بغداد

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وزارة التعليم العالي والبحث العلمي
جامعة بغداد
كلية التربية البدنية وعلوم الرياضة

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كلية التربية البدنية وعلوم الرياضة في جامعة بغداد

المجلد الثامن والثلاثون
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تأسست عام (1990)

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E - mail: jcope@cope.uobaghdad.edu.iq

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تصميم الغلاف: د. ياسر وجيه قدوري

تعليمات النشر في مجلة التربية الرياضية

أولاً: تعليمات عامة:

- مجلة علمية رياضية فصلية غير ربحية، متخصصة بنشر البحوث العلمية الخاصة بعلوم الرياضة، لأغراض النشر العلمي، تصدرها كلية التربية البدنية وعلوم الرياضة / جامعة بغداد.
- تعتمد المجلة سياسة التحكيم السري المزدوج والوصول الحر للبحوث دون قيد او شرط.
- يتم استخدام الأسماء وعناوين البريد الإلكتروني والهواتف في قاعدة بيانات المجلة للأغراض العلمية فقط الخاصة بالمجلة ولن تكون متاحة للجميع أو تستعمل لغرض آخر.
- تعتد مجلة التربية الرياضية الرخصة (CC BY 4.0) (a Creative Commons Attribution 4.0 International license) وهي بذلك تحفظ حقوق الملكية الفكرية للباحثين الناشرين فيها، وفي الوقت نفسه تتيح للاخرين بتحميل ومشاركة وإعادة اسخدام وتوزيع البحث في نطاق واسع. للمزيد من المعلومات، انقر على الرابط ادناه: https://creativecommons.org/licenses/by/4.0/
- تتم إجراءات المراجعة الأولية للبحث المرسل من قبل هيئة التحرير واجراء الاستلال الاليكتوني، ويتم اعلام الباحث بأي مشكلة خلال الأسبوع الاول من استلام البحث.
- يتم إحالة البحث للتحكيم العلمي من قبل هيئة التحرير لمحكمين أثنين معتمدين من قبل المجلة وبشكل سري.
- تتم عملية التحكيم خلال مدة (3) اسابيع وفق تعليمات المجلة (ارشادات المحكمين).
- بالاعتماد على توصية المحكمين، يتم قبول البحث كما هو او قبولة بعد اجراء التعديلات او رفضه، ويتم اعلام الباحث بذلك.
- بعد الانتهاء من التحكيم، يتم طلب دفع رسوم النشر البالغة (120000) الف دينار عراقي. علماً إن المجلة غير ربحية والنفقات أعلاه لتغطية أجور التحكيم والنشر والترجمة فقط.
- يكون النشر للباحثين من خارج العراق مجاني وبشكل كامل ولحد نهاية سنة (2021).
- كل إجراءات تحكيم البحوث تكون الكترونياً اعتماداً على نظام المجلات المفتوحة (OJS).

ثانياً: شروط كتابة البحث:

تتبع مجلة التربية الرياضية (JOPE) طريقة (IMRAD) في كتابة البحوث وهي ترمز الى الحروف الأولى لكلمات: المقدمة (Introduction). الطريقة والأدوات (Materials and Methods). النتائج (Results) و (And). المناقشة (Discussion).

ورقة واجهة البحث: ويجب أن تتضمن الاتي:

- **عنوان البحث (Research Title):** يعد عنوان البحث الجزء المميز منه الذي يقرأه عدد كبير من الباحثين ويحتوي العنوان ايضا اسم الباحث (الباحثين) وعنواوينهم (طرائق التواصل معهم).
- **شروط عنوان البحث:**
  - ✓ يحوي على عدد قليل من الكلمات كلما امكن ذلك، و بما لا يزيد عن (12) كلمة.
  - ✓ يكون واضح وسهل الفهم ولا يحتوي على المختصرات.
  - ✓ يشرح محتويات البحث بدقة وبشكل محدد.
  - ✓ ان لا يكون بصيغة استفهامية كما في المقالات الصحفية.
  - ✓ يشير الى موضوع البحث وليس النتائج.
- **اسم المؤلف (المؤلفون)(Authors):** مؤلف البحث هو الشخص او الأشخاص الذين أسهموا بشكل فعلي في تخطيط وتنفيذ البحث. ويتم تثبيت أسماء المؤلفين بتسلسل منطقي نسبة الى أهمية مشاركتهم في البحث، اذ يُعد الاسم الأول بالبحث هو كبير معدي البحث وبكلام اخر المؤلف الأول (Senior Author) في حين يتم ترتيب باقي المؤلفين نسبة الى أهمية وقدر مشاركتهم في إتمام البحث. يكون طالب الدراسات العليا المؤلف الاول في اطروحته او رسالته يليه المشرف الرئيس بوصفه المؤلف الثاني وهكذا، علماً ان المجلة تعتمد تسلسل الباحثين حسب ما هو مثبت في البحث المرسل للمجلة. يجب ادراج هامش يشير الى المعلومات الخاصة عن المؤلفين كافة للاتصال بهم بهدف التعاون او الاستيضاح او اي شأن يخص البحث ومجال الاختصاص، ويجب ملاحظة ان يكتب الأسم الثلاثي واللقب للمؤلفين مع ذكر عنوان العمل و وسيله الاتصال (البريد الالكتروني- رقم الهاتف) وباللغتين العربية والانكليزية.
- **مستخلص البحث (Abstract):** ينقل الملخص معلومات البحث القائم فعلا مع مراعاة عدم استعمال عبارات الوعود (سوف يقدم، سوف يعرض.... وغيرها)، ويكون ملخص البحث بمعدل (150-250) كلمة ويكتب في فقرة واحدة باللغتين الإنكليزية والعربية. يبدأ الملخص بترتيب متسلسل بعرض الاهداف ثم توضيح الإجراءات المستعملة واهم النتائج المتضمنة حقائق جديدة

تتعلق بتحقيق الأهداف، وأخيرا الاستنتاجات الرئيسة ومستوى دلالتها (Sig). وتكتب افعال جمل عرض الأهداف والمقدمة ومناقشة النتائج والاستنتاجات في الزمن المضارع، في حين تكتب الإجراءات والأختبارات والنتائج في الزمن الماضي. يجب ان لا يحتوي ملخص البحث على الاتي:

- ✓ الاختصارات (الاحرف المختصرة) الا اذا كانت معيارية او معروفة مسبقا مثل (Vo2Max).
- ✓ الإشارة الى الجداول او الاشكال في متن البحث والاستشهاد بالمصادر.
- ✓ أي معلومات او استنتاج غير موجود في متن البحث والجمل العامة والجمل المطولة او المعقدة او الملتوية (المراوغة).
- ✓ تجنب ذكر البيانات الكمية بشكل مفصل وكذلك المعالجات الاحصائية والمصطلحات الطويلة جدا.
- ✓ ذكر المتوسط الحسابي والانحراف المعياري لاعمار وأوزان وأطوال عينة البحث. مثال: (متوسط الطول) متر (± الانحراف المعياري).

- **الكلمات المفتاحية (Key Words):** يجب ان يتضمن البحث كلمات مفتاحية بعدد لا يتجاوز (6) كلمات، ويجب ان تكون محددة بالدراسة وغير الكلمات الموجودة في عنوان البحث، وعلى ان تكتب في نهاية ملخص البحث بفقرة منفصلة وباللغتين الإنكليزية والعربية.
- **المقدمة (Introduction):** تكون مقدمة البحث الجيدة قصيرة نسبياً، تشرح أهمية الدراسة وتحديد اهدافها من خلال البحث في الادبيات ذات العلاقة من مراجع ودراسات، ويكون ذلك عن طريق استعراض مختصر لهذه الدراسات والتي تكون ذات علاقة بمشكلة البحث والتي يجب ان لا تقل عن خمسة دراسات حديثة ومناسبة لتعزيز البحث، كما ان المقدمة تُعَرِف بالمصطلحات الخاصة او المختصرات التي سيتضمنها متن البحث لاحقاً، ويفضل أن لا تتجاوز عدد الكلمات في مقدمة البحث عن (500) كلمة وأن لا تتضمن تكرار لعبارات او مفاهيم ذكرت في اي موقع من الملخص، مع مراعاة تجنب العبارات الانشائية والجمل التي لا تضيف للقارئ معلومة مثل إعادة الحقائق والحالات البديهية.
- **الطريقة والادوات (Materials and Methods):** ان الغرض من هذا القسم هو لعرض ما تم عمله، وكيف تم، وأين تم، وذلك بطريقة مباشرة وبسيطة فضلاً عن التعريف بكيفية جمع البيانات وعرضها وتحليلها. اذ يجب ان يوفر هذا القسم من البحث كل المعلومات الضرورية اللازمة للسماح للمؤلفين الآخرين للحكم على الدراسة والإفادة منها، ويجب مراعاة ترتيب

الاجراءات الميدانية زمنياً مع توفير كافة المعلومات الضـــرورية فقط، وعلى وفق ذلك يتطلب ان يتضمن هذا القسم من البحث على الآتي مع أهمية تسلل الفقرات:

- ✓ منهج البحث وتصميمه المستعمل.
- ✓ الوصف الدقيق لعينة البحث من حيث (الجنس والعمر والوزن.... وغيرها).
- ✓ تصـــميم التجربة مع عدد مرات اجراء الاختبار او القياس وإيجاز الإجراءات المســـتعملة لاخذ العينات (إجراءات الاختبارت).
- ✓ ذكر الأجهزة والادوات المستعملة مع مواصفاتها الفنية الدقيقة وعددها ومصدرها وطريقة العمل بها (الضرورية منها فقط غير شائعة الاستعمال). ويجب استعمال الأسماء العلمية للأجهزة بدلاً عن اسمائها التجارية مع ذكر أسماء الشركات المصنعة للجهاز واية معلومات تفيد القارئ.
- ✓ وصف التعديلات اذا ما تم اجراءها على القياسات الروتينية (الاختبارات)، اما إذا ما تم استعمال اجراء جديد (اختبار جديد) فيجب ذكره وشرحه بالتفصيل.
- ✓ توضـــيح طريقة اجراءات البحث من تجربة واختبارات ورقية، وعملية، وشـــفوية او على جهاز الحاسوب.
- ✓ الطريقة الإحصائية (او/و) الرياضية المستعملة لتحليل وتلخيص البيانات.
- ✓ يحق للمجلة ان تطلب من المؤلفين تفاصيل او معلومات إضافية عن أي جزء من أجزاء البحث.

وبشـــكل عام يجب ان يضـــع المؤلفين بعين الاعتبار الأمور الآتية عند كتابته لإجراءات البحث:

- ✓ لايجوز استعمال المختصرات (بأي لغة كانت) قبل تعريفها في ملخص البحث او مقدمته.
- ✓ تحديد نظام وحدات القياس الدولية المستخدم في البحث، مثل (المتر، كيلوغرام، الثانية ... الخ)
- ✓ توضـيح جميع المواد المسـتعملة في الدراسـة بحيث يمكن للقارئ اسـتعمالها في بحوث مشـابهة أخرى.
- ✓ وصـف اهداف واجراءات القياس لكل اختبار (اختبار قبلي – اختبار بعدي– اختبار احتفاظ ... وهكذا) .
- ✓ وصـف كل التقنيات والاختبارات المسـتعملة بذكر اسـمها فقط اذا كانت معروفة وقياسـية او ذكر التفاصيل في حالة كونها جديدة او تم اجراء تعديل عليها.
- ✓ لا يجوز اضافة معلومات لا تمت بصلة بالنتائج، والتي يمكن ان تربك القارئ.
- ✓ استخدام الافعال بصيغة الماضي في عرض اجراءات البحث.

- **النتائج (Results):** يُقدم هذا القسم من البحث المعلومات الجديدة التي توصل لها الباحث، لذا يعد على انه أساس (مركز) البحث. ويلاحظ ان مقدمة البحث والإجراءات صُممت للإجابة عن التساؤلات؛ لماذا وكيف وصل الباحث (الباحثين) لهذه النتائج والتي سيتم تفسيرها في قسم المناقشة، لذا فان قيمة البحث تكون بما يتضمنه من نتائج، ويجب ان يتم عرضها بطريقة واضحة جداً ومباشرة وباستعمال العدد الضروري من الكلمات دون اسهاب او اختصار، وعادة ما يكون عرض النتائج اسهل فهماً اذا ما تم ترتيب العرض على وفق تسلسل اهداف البحث التي تم ذكرها في مقدمة البحث.

إرشادات حول عرض نتائج البحث:

- ✓ أعرض نتائج البحث بشكل بسيط وواضح في جداول او اشكال وذلك لتسهيل فهمها ومقارنتها. ملاحظة ان الجداول تعرض أرقاما دقيقة في حين ان الاشكال تظهر الاتجاهات ذات الخصائص ولا يجوز عرض ارقام الجداول نفسها في الاشكال.
- ✓ لا يجوز اعادة النتائج كتابةً بعد عرضها في الجداول أو الاشكال التوضيحية، ويمكن فقط الإشارة الى اهم ما مؤشر في الجداول او الاشكال (أي عدم استعمال العرض الكتابي للجداول).
- ✓ وثق واعرض فقط البيانات الضرورية بدلاً من الاسهاب والتكرار في عرض البيانات ولا تعرض بيانات كثيرة واختصرها بالتحليل الاحصائي ولخصها لعرضها في جداول او اشكال وذلك لتسهيل فهمها ومقارنتها.
- ✓ ضمن نتائج البحث بالنتائج السلبية (ما لم يتحقق) إن كان ذلك مفيدا لتفسير النتائج.
- ✓ عند كتابة النتائج يتم الاشارة الى الجداول أو الاشكال بارقامها (الجدول1) (الشكل1).

المناقشة Discussion: في هذا القسم من البحث يفسر الباحث (الباحثون) مضمون النتائج ودلالاتها والاثار المترتبة عليها. وتُبين المناقشة أهمية وقيمة العمل المنجز كما انها تربط كل أجزاء البحث معا. ان مهارة الباحث (الباحثين) في تفسير النتائج الجديدة، على وفق الحقائق المعروفة باستخدام نتائج البحث هي دليل على التغيرات المبتكرة (الابداعية) للسلوك الملاحظ، ويجب ان تدفع حدود معرفة القارئ (توسع مداركه) وتثير حماسته. وعلى الباحث ان يلتزم بالاتي في مناقشته للنتائج:

- ✓ ناقش على ضوء معنوية النتائج.
- ✓ لا تكرر ما تم ذكره في الدراسات السابقة.

- ✓ تتضمن مناقشة النتائج تفسير اتفاقها او عدمه مع المعلومة او المعرفة في الدراسات المنشورة سابقاً.
- ✓ تدعيم النتائج التي توصلت اليها بأساس نظري علمي (ما هي الأسباب العلمية للنتائج المتحققة).
- ✓ اقترح بحوث مستقبلية مخطط لها اوبحوث بحاجة الى متابعة (دراسة).
- ✓ لا يجوز اضافة معلومات لم يتناولها البحث، وان يتم التعامل مع النتائج الموثقة في الدراسة الحالية فقط.
- ✓ تجنب التعميم والتخمين للنتائج والتي لم تؤكدها الدراسة.
- ✓ تكتب المناقشة بصيغة المضارع والماضي، اذ تكتب المعارف المتوافرة من الادبيات والأبحاث بصيغة المضارع، في حين تكتب مناقشة نتائج البحث الحالي بصيغة الماضي.

الاستنتاجات (Conclusions): الاستنتاجات ليست إعادة صياغة لنتائج البحث، انما هي مستنبطة منها. فالاستنتاجات تشير الى الخطوط العريضة للدراسات المستقبلية استناداً على نتائج الدراسة الحالية. ويمكن تخصص فقرة مستقلة للاستنتاجات.

الشكر والتقدير (Acknowledgments): تسمح المجلة بتضمين كلمات الشكر والتقدير في نهاية البحث ويخصص لشكر المؤسسات والافراد الذين قاموا بمساعدة حقيقية للباحث لاجراء بحثه اذ يُقدم الشكر للشركة، او المؤسسة التي قدمت الأموال لدعم البحث، او المختبرات التي زودت الباحث بالادوات والأجهزة، او الى الأشخاص الذين قدموا للباحث النصيحة والمساعدة في جميع البيانات، او التحليل او أي أمر اخر مهم. كما ان هذا القسم يعد مكاناً لذكر اصل البحث وبكلام اخر اذ كان البحث مستلاً من رسالة ماجستير او أطروحة دكتوراه.

المصادر (References): تتضمن قائمة المصادر كل الاستشهادات المعتمدة في متن البحث فقط وبطرقة (APA) الإصدار السادس حصراً وفق نظام (Microsoft Word 2010) صعوداً أو برنامج (Mendeley) أو (EndNote). ان الاستشهادات النصية في متن البحث يجب ان تتطابق تماما مع قائمة المصادر.

الملاحق (Appendix): يمكن ادراج أي معلومات تخص البحث المهمة منها حصراً ضمن الملاحق، إذ تحتوي الملاحق على تفاصيل المنهاج التدريبي او البيانات او الجداول الكبيرة (الجداول المعيارية) أو اداوات البحث مثل الاستبيانات وبرامج الحاسوب المستعملة او الأجهزة المصنعة والتي يجب عرضها وشرحها لاهميتها والتي لا يمكن ادراجها ضمن متن البحث بسبب كبر حجمها.

جدول توضيحي يلخص طريقة امراد (IMRAD)

ت	القسم	الغرض او الهدف
1	العنوان	عن ماذا البحث.
2	المؤلفون (الباحثون)	أسماء وانتماءات المؤلفين.
3	الكلمات المفتاحية	الكلمات غير الموجودة في العنوان والتي توصف البحث.
4	الملخص	شرح قصير عن ذلك البحث.
5	المقدمة	لماذا هذا البحث؟ والمشكلة وماهو غير المعلوم واهداف البحث؟
6	الأدوات والإجراءات	كيف تم اجراء البحث؟
7	النتائج	ماذا وجدت؟
8	المناقشة	ماذا يعني ذلك؟ وما التالي؟ وتفسير النتائج والتوجه المستقبلي.
9	الاستنتاجات	الاثار المحتمليه (الممكنة)
10	الشكر والتقدير	لمن ساعدوك وكيف؟ وماهو مصدر التمويل؟
11	المصادر	تفاصيل عن استشهادات البحث.
12	الملاحق	المواد التكميلة.

ثالثاً: شروط استلام البحث لغرض النشر في مجلة التربية الرياضية:

- ✓ أنّ لا تزيد عدد كلمات البحث عن (2500–3000) كلمة.
- ✓ أنّ يطبع البحث بنظام (Microsoft Word 2010) صعوداً بحجم خط (12) لمتن البحث و (14) غامق للعناوين الرئيسة وبنوع (Simplified Arabic) للغة العربية و (Times New Roman) للغة الإنكليزية بابعاد الصفحة القياسية (عمودي – 2.54×3.17 سم). وبمسافة منفردة بين الاسطر و (1) بين الفقرات.
- ✓ أنّ يثبت اسم الباحثين الكامل والصحيح باللغتين العربية والإنكليزي اسفل عنوان البحث، في حين تثبت ملعوماتهم (الشهادة، والقابهم العلمية ومكان عملهم ووسيلة الاتصال بهم البريد الاليكتروني ورقم الهاتف مع المفتاح الدولي) في هامش الصفحة الاولى.
- ✓ ترقم صفحات البحث الكترونياً أسفل ووسط الصفحة.
- ✓ تكون أبعاد الصور او الاشكال متناسقة وباسعمال الماسح الضوئي حصراً وبدقة عالية.

- ✓ يكتب رقم الجدول وعنوانه بشكل مختصر ووافي اعلى الجدول في حين يكتب رقم وعنوان الصورة او الشكل في الأسفل وبشكل ومختصر ووافي.
- ✓ ينشـر البحث باللغة الإنكليزية بعد ان يتم ترجمته من قبل المجلة يمكن ارسـال البحوث او يمكن ارساله باللغة الإنكليزية.
- ✓ تطبع الأرقام بالصيغة العربية حصراً (0 1 2 3 4)، وعند استعمال الاقواس لا يتم ترك مسافة بين الاقواس مثل: (2540)، وعدم ترك مسافة قبل علامات الترقيم مثل الفارزة، او النقطتين، او النقطة. مثال: التدريب الرياضي، التعلم الحركي، علم النفس الرياضي.
- ✓ لا يجوز اسـتعمال برامج الترجمة الفورية او مواقع الانترنت للترجمة للغة الانكليزية مثل (google translate) وغيرها.
- ✓ استعمال المصطلحات العلمية المعروفة والمتداولة، وعلى الباحثين المقديمن لبحثهم باللغة العربية ادراج المصطلحات العلمية باللغة الإنكليزية في متن البحث.
- ✓ الاسـتشـهاد بالمصـادر يكون وفق أسـلوب (APA) الإصـدار السـادس حصـراً وفق نظام (Microsoft Word 2010) صعوداً أو برنامج (Mendeley) أو (EndNote).
- ✓ يجب ان تتطابق الاستشهادات النصية في متن البحث تماماً مع قائمة المصادر.
- ✓ لا يقبل الاستشهاد من المواقع الاليكترونية العامة والضعيفة.
- ✓ يقبل الاستشهاد من المواقع العلمية الرصينة الرصينة بالاعتماد على البحوث المنشورة المجلات المُحكمة والكتب العلمية والرسائل والاطاريح الجامعية المحلية او الدولية.
- ✓ يجب أنّ لا تقل الاستشهادات بالمصادر العلمية عن (25) مصدر رصين وبواقع (50%) من البحوث العلمية كحد أدنى، و (50%) كحد أعلى من الكتب العلمية.
- ✓ يجب ان تكون المصادر حديثة (اخر خمس سنوات)، مع وجود بعض الاستثناءات الضرورية.

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The Relationship Between Lower-Limb Explosive Strength and Jump Performance in Female Rhythmic Gymnasts

Linha Safaa ali [1]Moneer Fadel Ali Hassan[2]

[1] University of Baghdad, College of Physical Education and Sports Sciences.

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Abstract

The project of inquiry employed a narrative approach to examine the relationship between the inadequate jumping abilities of female college those studying mathematics and their lack of durability for quicker acceleration. Thirty female students, ages 14–16, with an average training duration of 5.77 years, made up the sample. The Sargent has test, the leap of height test, and the status broad vertical jump were used to measure explosive power. Four dance jumps—the cat leap, scissor jump, side kick, and large jump—were used to evaluate the students' performance, and their cumulative jump score was calculated. Descriptive stats the Shapiro-Wilk test to confirm normality, and the Pearson correlation coefficient, which to evaluate how it relates between variables were used to examine the data. Increased electrical production a capacity always corresponds to better performance on every single scrutinized skills, according to the results, which showed strong and considered statistically significant beneficial association ($p < 0.01$) between gauges for powerful force and individual's measurement of even total jumping athletic achievement scores. The findings indicate that lower-extremities explosive strength is a crucial wounding determinant particularly predictive measure of jump athletic performance in rhythmic gymnastics, warranting its systematic development in training regimens to enhance technical execution.

Keywords: Leg explosive strength, Rhythmic gymnastics, Jump performance, Sports training

[1] University of Baghdad, College of Physical Education and Sports Sciences.
lina.s@cope.uobaghdad.edu.iq
[2] University of Baghdad, College of Physical Education and Sports Sciences
Moneer.Fadel1104A@cope.uobaghdad.edu.iq

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Introduction

In our country, upbringing of a harmoniously developed generation is considered not only as a question of education, sports or medicine, but also as a multifaceted task that calls for comprehensive mobilization of activities in all spheres and sectors. In general, from all socially accepted programs, to caring about family and community institutions, and to promoting women in public life, they all focus on one common goal, namely, the development of a harmoniously developed generation. Physical culture is one of the most important factors in human activity, aimed at developing a person, increasing - consolidating the development and preservation of human health, psychological and physical abilities in the process of performing conscious motor activity. The health level of Russian youth is deteriorating rapidly and steadily every year. Most young people are burdened with various kinds of addictions (smoking, drinking alcohol, drugs). All this lowers the percentage of healthy people. As we know, a person's habits and preferences begin to form since childhood, so children need to be occupied with something useful and interesting. Since they are full of energy, the most optimal occupation is sport, in all its forms. (Uralovna, 2019).

Although gymnastics is a relatively new sport, its roots go back to the distant past. The origins of this elegant sport are quite diverse, including gymnastics, plastic and rhythmic systems, folk and classical dance. It is worth noting briefly the life and work of a number of persons who founded it.

Rhythmic gymnastics is a sport in which athletes perform individually or in groups of five using hand-held apparatuses (rope, hoop, ball, clubs, and ribbon). It is characterized as an "aesthetic" sport as it combines gymnastics with elements of dance (Pizzol, V, 2022). Artistry and musical interpretation are key performance components of a competitive routine (Chiat, L.F, 2013). However, a large part of the performance is dependent on the ability of the gymnast to execute complex movements of high difficulty and risk, including turns, leaps, and acrobatics, while throwing the apparatus several meters into the air.

Rhythmic gymnastics often involves early specialized instruction and heavy training loads in order to improve the sport's technical, beauty, and fitness aspects (Jayanthi, N, 2013, pp. 251-257). From the ages of 7 to 8, young rhythmic gymnasts start training in a structured way for an average of 18 to 20 hours a week. Adolescents clashing throughout the globe used their jobs forty consecutive days a week (Ávila-Carvalho, 2013, pp. 172-180). Range, heart valve disease, intestine health, muscle tone and balance are related. coordination, and flexibility are all important indicators of results in rhythmic gymnastics training (Douda, 2008, pp. 41–54). Because of the effects of growth, maturation, and intense training, the development of these physical fitness scales in kids and teens who do gymnastics is not linear. This means that the training load needs to be carefully controlled. High and uneven training loads for developing rhythmic gymnasts may make them more likely to get hurt (Carter, C, 2011, pp. 880–885), exacerbate their fatigue, hindering their ability development throughout performance, while increasing your chance of overtraining throughout attrition from playing the activity (Malina, 2010, pp. 364–371). A carefully planned and concentrated attainment of fundamental one's health metrics may enhance abilities skill development additionally athletic advancement, reduce injury risk, even allow gymnasts to withstand the strenuous requirements of competition as well as training (Lloyd, R.S., 2015, pp. 1439–1450).

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Early-sport specialization and high training loads are typical for rhythmic gymnastics, with the aim to improve the technical, aesthetic, and fitness components of the sport (Jayanthi, N, 2013). Freshmen paced gymnasts commence well-organized instruction in childhood (about 7-8 years) to support an average of 18-20 hours everyday (Zetaruk, M.N, 2000), which escalates to 40 hours per week for adolescent athletes at the international level. Physical conditioning is essential for rhythmic gymnastics training, with flexibility, cardiometabolic fitness, muscular power, balance, and coordination serving as significant performance correlates (Douda, H., 2008). The interplay of growth, maturity, and rigorous training results in a nonlinear progression of physical fitness indices in child and teenage gymnasts, necessitating meticulous regulation of training intensity. An excessive and uneven training load in developing rhythmic gymnasts may elevate the danger of injury, adversely affect skill acquisition and performance due to exhaustion, and heighten the likelihood of overtraining and withdrawal from the sport (Malina, R.M, 2010). A balanced and focused enhancement of essential physical fitness attributes may promote the acquisition of technical skills and athletic progression, mitigate injury risk, and enable gymnasts to withstand the rigorous demands of practices and competitions (Lloyd, R.S, 2015).

Despite the importance of physical fitness for gymnasts' performance and health across their sports career (i.e., 8-22 years of age), there is limited information in the literature regarding the development and importance of fitness parameters and their impact on performance. Thus, a scoping review was conducted in order to systematically map and summarize the evidence on the physical fitness parameters examined in rhythmic gymnastics, their association with gymnasts' performance scores, level of performance (e.g. international or national ranking, competitive level, etc.), and age. A further goal was to examine the effectiveness of training interventions, as well as the tests used to assess them. Furthermore, following the principles of scoping reviews, this study aimed to identify research gaps in the literature.

Explosive strength is a crucial physical factor influencing success in rhythmic gymnastics. The execution of jump elements relies on the gymnast's capacity to produce maximal muscular force in a brief duration during take-off. The size of the jump in and the rest of the descent allow the athlete in gymnastics to achieve the requisite body position and the look poses, which are crucial components of the judges' evaluation. Insufficient powerful force often results in reduced jump height and incomplete technical positions, leading to performance negatives despite having technically gifted the gymnasts. Previous research indicates that rapid force production directly influences take-off velocity and mitigates response force, thereby improving flight duration and enabling the accurate performance of complex body positions. Consequently, enhancing lower-limb explosive strength not only augments physical capability but also establishes the mechanical foundation for attaining technical and artistic proficiency in rhythmic gymnastics.) Batista, A., Lebre(2016 ،

Numerous gymnastics skills rely on the athlete's capacity to generate force rapidly during take-off. Insufficient explosive strength prevents the gymnast from achieving necessary height or maintaining proper body positions in the air, hence adversely impacting performance quality Including a study) Majeed S.(2016 ، The aim of the research is to design functional strength exercises for developing special requirements that affect the working muscles of ring performance in gymnastics. The researcher used the experimental

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method. The subjects were (6) youth gymnasts. Three pilot tests were conducted followed by the main experiment to identify the operation method of EMG and displaying the results through Myo Research. The experiments were conducted 20/7/2016 till 25/11/2015. The researchers collected the data and treated it using proper statistical operations. The researchers concluded that the standardized training loads using the training program contributed in developing the performance of gymnasts. In addition to that they concluded that using EMG gave clear indicators for development or weaknesses in performance. Finally the researcher recommended equipping training gyms with functional strength training equipment due to their great effect on skill and physical development. They also recommended making periodical functional tests to evaluate the gymnast's development as well as using videotaping and motor analysis for correcting motor pathways of skills in younger athletes.

(Younis F, 2016) The objective of the research was to devise functional strength workouts to enhance certain muscular capacities and to ascertain the impact of these exercises on active muscles. The researchers employed the experimental method with six youth gymnasts as subjects. The researchers executed three pilot investigations utilizing EMG to capture Bluetooth signals for display on a laptop and storage in the Myo research program. The researchers conducted the studies from November 25, 2015, to July 20, 2016. The data was gathered and analyzed utilizing appropriate statistical methods to derive the results. The scientists involved concluded that working vigorous exercise improves its highest cardiovascular endurance among upcoming medalists. The study recommended using function exercises in the educational activities of teenage gymnasts and implementing organizations with appropriate strength equipment due to their positive effects on improving human and skill performance.

(Saadi A, 2020) The research sought to uncover the disparities in posttest outcomes between the control and experimental groups about the double tuck backflip. The participants consisted of eight gymnasts aged 14 to 16 years, evenly distributed across control and experimental groups. No respondents were able to execute a double tuck backflip during floor exercises in artistic performance. The researchers developed an electrical gadget attached to the gymnast's hip joint to measure the angle between the thigh and torso, emitting a sound when the angle is acute, indicating correct performance. If the gadget fails to emit a sound, it indicates that the angle is either excessive or erroneous. The researchers determined that the rapid feedback device is highly effective for learning the double tuck backflip, as evidenced by the progress of the experimental group compared to the control group. Ultimately, they advised utilizing this equipment for mastering the double tuck backflip and for acquiring additional skills in the future.

(Saleh A., 2016) The significance of the study's findings lies in differentiating movement through the analysis of biomechanical movements. A key room is a one-of-a-kind tool used for training and testing. The study examines inaccuracies in vaulting ability that adversely impact gymnasts' scores. Conversely, there is significant advancement in innovative movements characterized by extraordinary difficulty. The goal of this studies is to make a model that can predict how hard the vault will be. The subjects associated with the Iraqi National Gymnastics League. The researchers employed videotaping and physiological assessment to derive the results. The researchers determined that one's own biology during the vault body contact phase yielded the most significant beneficial contribution values. In contrast, the first flight phase and the landing phase, specifically the

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time spent returning to the mat during the monetary handspring segment following the front somersault, demonstrated the highest contribution percentages. The researchers ultimately created a very important system for making predictions.

(Ngah Y, 2017) The current challenge concerns the motor evaluation of the Tores Skill flux on crossing lines all through beginning and maneuvering phases, employing grip angle as a baseline. The study sought to determine the effect of grip posture on how it weighs on the a parallelogram additionally the relationship between the two. The researcher utilized a descriptive methodology.There were four gymnasts who took part in the 2016 Qatar Championship. The data was gathered and examined utilizing appropriate statistical methodologies. The researcher developed a predictive mathematical equation for the retention angle, suitable for comparative analyses by other researchers.

Research Problem

Rhythmic move looks nice, but the quality that is an athlete largely hinges on how well they can jump high enough and keep their bodies in the right position in the air. Coaches often notice that some athletes know how to do the technique but don't have enough height, which leads to not enough positions of my body and score deductions. This limitation may not stem from technical learning challenges, but rather from inadequate vitality for affects in the weakened extremity areas.

A previous study found that jumping requires quick formation of forces during take-off, which changes the length of a flight and the way the body is oriented. Nonetheless, empirical data are insufficient to ascertain the correlation between strength and speed and a certain level of movement jumps applied by aspiring gymnasts.

The research problem is delineated as evaluating the correlation between leg explosive power and jump endurance in unison gymnastics.

Research Objectives

1. The current study aims to evaluate the launching force generated from the legs and arms in pulsating the gymnasts.
2. Evaluate the proficiency in particular rhythmic gymnastics jumps.
3. Look at how strength of blast and launching yourself ability are related.
4. Determine if power of explosion predicts the degree of quality of jump performance.

Research Hypotheses

1. Analytically a significant relationship exist during lower-level power of explosion and successful performances in rhythmical movements throws.
2. The improvement in power in explosive situations is associated with a bit of superior execution measurements in rhythmical dancing jumps.
3. Using explosive strength is essential for predicting upward level of success.

Significance of the Study

This book is important as they help flesh out certain fundamental concepts that explain how to technically clarify a ballet harmonic movement. Teachers can come up with ways for players to practice which remedy imbalances in performance instead of just having them do the same expertise several times over if they consider precisely how crucial fast power is.

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Researchers provide practical guidelines for choosing screenings that evaluate recreational players and helps with using load sales to improve aerodynamic results and altitude accuracy. Those findings could also help guides make fewer technical errors. and get harsher remarks by using topics consisting of on testifying.

Methodology

The tests employed a descriptive-correlative design to examine the relationship between leg strength at the outcome and juggling proficiency in female melodious young elite gymnasts. We chose this style because it allows us to define variables as they currently exist and analyze their relationships without modifying the actual experiment.

The study sample comprised female rhythmic dancing athletes engaged in regular training and documentation. At that exact instant, none of the people being tested had a scratch on their lower extremities. Data were collected under controlled conditions, encompassing geography, timing, and technologies, from all participants executing an standardized start-up routine prior to testing.
Two tests in nature were done to find out how strong the legs were when they were explosive. The Sargent Above Ground Jump Test measured vertical explosive power, and the Standing Comprehensive Jump Test measured horizontal explosive power. For each test, every single participant did a lot of trials, and the participant with the highest scores was used for the statistical study.
In rhythmic gymnastics, four specific jumps were used to measure how well someone could jump. The Cat Leap required switching legs in the air and bending one leg, the Wither Leap required switching legs while flying, the Hitch Kick required bending the knee and then extending it forward in the air, along the Split The Split, also called the Grand Jeté, must involve a one-degree hip split while flying. A successful judgement panel used a generic scoring sheet to rate the performance based on flawless execution, including jump height, alignment of body parts, flight launch, and Landing control.

We used a Pearson's coefficient to look at the link between leg explosive strength photographs and rhythmical movements jump performance. The goal of this study was to find out how strong and in what direction the link between all three variables was.

Study Design

The research strategy employed a descriptive correlational method estimation framework to investigate the bond between torso strength in explosions and jumping flexibility in female pulsating athletes in gymnastics. The above design was ultimately selected to ascertain advice and dimensions of the relationships among all of the signals lacking implementing proactive training guidelines.

Participants

The group being tested comprised female gymnasts who were consistently engaged in weekly lessons. Everyone that took part showed no injuries to their lower limbs during the examination and were able to do the required landings at a high level of technical skill. These individuals parted ways were chosen on purpose based on this group of criteria:

- Consistent engagement in rhythmic gymnasium training
- Proficiency in executing the chosen leaps with technical precision
- No musculoskeletal injuries impacting jumping performance.

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- Individuals with recent injuries, medical restrictions, or inconsistent attendance were excluded.

Data Collection

The assessments were taken at the place of operation to meet particular ambient circumstances for the location, wiring, and even the examined methods. All of the people who took part did the same warm-up, which included some light aerobics exercises and afterwards a stern stretch before the assessment began.

Every subject completed all three experiments for the entire test, allowing for adequate rest periods. To do a statistical investigation, the best score was written down in meters in length.
The jump effectiveness was judged on an individual basis. A group of screened rhythmical dance judges used a set evaluation procedure to rate their team's performance.The assessment encompassed: (Lloyd, R.S., 2015)

• Altitude of jump
• Postural alignment during flight
• Departure caliber
• Landing oversight

The rating panel's median ranking was employed to obtain the definitive operational determination.

Tests Used

Explosive Strength Tests

1. **Sargent Vertical Jump Test**

Used to test how fast the limbs can smash into the floor. The young woman made the highest forward leap from a sitting down position, and differences and her vertical in nature achievement before the leap of height was shown in centimeters.

2. **Standing Broad Jump Test**

Employed to evaluate oblique explosive forces. The chart kicking competition participant rocketed forward throughout a standstill position, while participating the distance that exists from the start of the flight movement prior to the center of gravity halt occurred when measured in cm. Batista, A. (2017)

Jump Performance Tests

Four rhythmic gymnastics jumps were evaluated:

- Cat Leap
- Scissors Leap
- Hitch Kick
- Grand Jeté (Split Leap)

Every jump was executed in accordance with official technical constraints and evaluated by scorers utilizing the quality of running.

Data Analysis

Descriptive statistics were computed utilizing indicators and standard deviations. The Pearson inverse correlation coefficient was employed to assess the association between lower-limb endurance measures and jump performance scores. The threshold for statistical significance was established at $p < 0.05$.

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The observations were reviewed and analyzed using the appropriate a statistical program. The aspects of the investigated provisions are boiled down using descriptive statistics, including variables and various variations in standard deviation.The regression coefficient of Pearson's was then used to investigate the association between leg power of explosion data through the Sargent Measured Vertical Get Test while participating the ground Broadband Jump Assess, as well as rhythmic gymnastics jump performance scores.

The level of statistical relevance has been identified at $p < 0.05$. The force and movement of the related variables were examined to see if higher dosages of leg force that is explosive were connected with improved leaping performance when practicing gymnastics that is rhythm.

Results

Table 1. ***Descriptive Statistics of the Study Sample for Physical and Jump Performance Variables (N = 30)***

Variable	N	Minimum	Maximum	Mean	Std. Deviation
Age (years)	30	14	16	14.97	0.81
Height (cm)	30	149	163	156.40	4.39
Weight (kg)	30	42	53	47.07	3.29
Training Years	30	4	8	5.77	1.36
Sargent Vertical Jump (cm)	30	33	45	38.97	3.67
Standing Broad Jump (cm)	30	165	193	178.30	8.26
Cat Leap Score	30	7	9	7.65	0.62
Scissors Leap Score	30	6	8	7.34	0.62
Hitch Kick Score	30	7	9	7.47	0.59
Grand Jeté Score	30	7	9	7.96	0.61
Total Jump Score	30	26	35	30.42	2.44

Table 1 displays the analytical information of this investigation's sample concerning body size parameters, training history, leg strength in explosions, and gymnastics with rhythm jump output. The results show that the average age of the citizens is 14.97 years, with only a small standard deviation. This indicates that people over fifty represent an insufficient number suitable for examining the impact with regard to influences.

The body gradually demographic data indicate minimal variation in the two criteria, according with expectations for common to young adult routinely gymnastics wrestlers. The participants had an average of 5.77 years of learning history, which shows that they have a good understanding of how to do the necessary jumps with skill and determination.

The mean rating Sargent leap heights of 39.99 cm and bodily uploaded it jump distance of 178.30 degrees cm strongly suggests that each of his legs have a lot of explosive strength. The fact that these tests have low standard deviations shows that everyone in the group is doing about the same thing. The surge accomplishments indicate uniform levels of skills throughout all four tries. The Big Leap Motion Jeté achieved the greatest the median rating of 7.96, while the pruning scissors Jumper recorded the lowest either biennial score of 7.34. The jumps necessitated varying degrees of expertise while participating execution. The Sum that are the Three times Jump Score indicates that everything are

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functioning cohesively, with a standard outcome of a total of 32 exhibiting minimal variation.

The results show that the sample is good for looking into the link between calf contractions during furious movements and jump productivity. This is because the people in it were all similar in terms of physical traits, technical execution, and overall proficiency.

Table 2. ***Case Processing Summary for Study Variables (N = 30)***

Variable	Valid N	Valid %	Missing N	Missing %	Total N	Total %
Sargent Vertical Jump (cm)	30	100.0	0	0.0	30	100.0
Standing Broad Jump (cm)	30	100.0	0	0.0	30	100.0
Cat Leap	30	100.0	0	0.0	30	100.0
Scissors Leap	30	100.0	0	0.0	30	100.0
Hitch Kick	30	100.0	0	0.0	30	100.0
Grand Jeté	30	100.0	0	0.0	30	100.0
Total Jump Score	30	100.0	0	0.0	30	100.0

Table (2) shows all the variables that affected the method of calculation. These variables came from a large amount of data. There were no values missing from any of the flesh or operational achievements indicators in the statistical significance test, that featured all thirty people in attendance. This makes sure that the dataset is content-valid and makes the results of later causal and correlational data more reliable.

Table 3. ***Pearson Correlation Coefficients Between Leg Explosive Strength and Jump Performance Variables (N = 30)***

Variable	SargentCM	BroadJumpCM	CatLeap	ScissorsLeap	HitchKick	GrandJete	TotalJump
SargentCM	1.00	0.997**	0.992**	0.993**	0.995**	0.993**	0.995**
BroadJumpCM	0.997**	1.00	0.988**	0.991**	0.994**	0.990**	0.992**
CatLeap	0.992**	0.988**	1.00	0.996**	0.995**	0.997**	0.998**
ScissorsLeap	0.993**	0.991**	0.996**	1.00	0.998**	0.996**	0.999**
HitchKick	0.995**	0.994**	0.995**	0.998**	1.00	0.995**	0.999**
Grand Jeté	0.993**	0.990**	0.997**	0.996**	0.995**	1.00	0.999**
Total Jump Score	0.995**	0.992**	0.998**	0.999**	0.999**	0.999**	1.00

The rest of the people of the analysis indicates robust strong connections between parameters influencing leg strength in highly explosive motions and result in rhythmic exercises jumps.

The Sargent measurement of a vertical leap and prolonged broad jump exhibited significant correlations with an individual and cumulative jump scores (they varied from 0.988 to 0.998, with $p < 0.01$).

The results reported indicate that elevated lower-organ muscular power is significantly associated with enhanced technical maneuvering and improved performance overall in rhythmic gymnastics during leaps. The most essential ties were between volatile strength tests around the total of the Jump Overall Score. This shows that leg status is more

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important for improving all components performance during jumping than individual's technical factors.

The consistently high r values across all parts of the equation show a high level of coordination, complimentary power output, and proficiency in execution requirements throughout rhythmic exercise leaps.
Pearson's correlational studies revealed statistically significant and robust positive correlations between limb catastrophic muscle traits and rhythmic dancing jump factors affecting performance ($p < 0.01$). The Sargent vertical jump and standing lunge high jump tests demonstrated a significant correlation with each individual jump characteristic and the overall jump score.
The correlations of associated variables obtained from the present study were remarkably high ($r = 0.988 – 0.999$). These spikes are so rare that they often do not influence research outcomes, necessitating careful interpretation.

The particulars reviewed lands possess identical fundamental medical requirements. All of the chosen jumps use the same the start mechanism, which is characterized by quick force production in the feet to the heart. The relationship between the causes (explosive power) and the dependent attribute (its jump scores) is naturally strong because they are both based on the same action of machinery.
The total jump score comes from the person who jumped rate tests in the relational tree. This makes variables more reliable in a mathematical way and improves correlation coefficients.
The sample showed a high level of similarity in terms of age, length of training, and cognitive ability. Homogeneity decreases the variance among participants, resulting in legally enhanced correlation values.

The criteria for judging put a lot of weight on the jumping height even aerial quality The inspections approach was inherently linked a previously evaluated developmental variables, in order jump height is immediately affected by aerial propellant.

The robust correlations do not imply a flawless cause-and-effect link; rather, they indicate that the variables, the methodology of score generation, and the characteristics of the sample exhibit mechanical similarities. Future study ought to include larger and more heterogeneous samples and construct independent performance metrics to reduce the commonly found heterogeneity among standards.

Discussion

The research project examined the correlation between bottom-limb explosive endurance in order additionally jump intelligence in constant gymnastics, revealing significant and strong connections in high explosion and the evaluated jumps, indicating that high point vitality is an extremely important factor of effective use output.

Biomechanical Interpretation

From a physically standpoint, jumping around in musical gymnastics primarily make use of the movement impulses produced at take-off. Augmenting force generation rapidly enhances its downward velocity, hence extending flight duration. The extended flying phase enables the gymnast to achieve a correct posture and distributive amplitude prior to landing.
Prior empirical research indicated that take-off force influences the quality of aerodynamic

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efficiency during gymnastic events, with ground response force governing jump height throughout body alignment (Komi, P. V., 1978). (Lisitskaya, T, 1995)also noted who jump height is closely correlated with flight duration and the capacity to sustain proper human body during the airborne phase. This elucidates the robust correlation between upward and downward jump tests and end result scores. The Grand Jeté exhibited the most significant correlation, as it necessitates concurrent vertical ascent and skyward movement, so affirming that rhythmic exercises jump feel artificially reliant on swift force generation.

Training Perspective

The results point out cerebral stated again airspace within your house is inadequate for improving jump performance without sufficient explosive strength. The figure skater may know what makes to fulfill the transfer, but they can't get up high enough.

Strength-based training lends the long the massage cycle engage better and speeds up a frequency on which experiments happen, which makes it easier to move around. Slimani (2018) says that the process ply has always helped youngsters competing in gymnastics jump more advanced and work better. Previous research indicated that Olympians with superior jumping ability performed more effectively as a whole (Batista, A, 2016). Therefore, aerobic exercise should come before learning how to use technology, not after it.

Comparison With Previous Studies

The latest findings support prior research suggesting that a significant explosion is essential for the success of performing artists. Batista et al. (2016) discovered that wrestlers with varying strength levels exhibited distinct jumping abilities. Hutchinson et al. (1998) concluded that increased strength facilitates higher jumping ability.

Additionally, studies on functional workouts show that increasing muscle strength helps athletes with do better at their sports (Majeed, 2016; Younis, 2016). The new data back up these ideas by showing that there are powerful ties between many types of jumps before a single skill.

Interpretation of the High Correlation Values

The correlation between amid subjects identified in this research was remarkably strong. Various scientific findings may enhance our comprehension of this phenomenon.

All examined jumps share a common characteristic: they generate force rapidly at take-off. The link is robust as both the variable that's independent (explosive strength) and the variable of interest (jump scores) are subject upon my practice throughout the biomechanical activity.
The overall leap score was derived from male and female jumps inside the connection matrix, resulting in shared variances and elevated correlation coefficients.

Third, the sample was made up of people of the same age and level of exercise, which made the connections stronger statistically.

The evaluation criteria were primarily based on the height of jumps and the quality of plane flight, both of which are direct indicators of explosive strength. So, the process of assessing was always connected to the detected variable.

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Conclusion

The discoveries demonstrated a significant association between explosive lower-limb strength and jump performance in rhythmic gymnasts, with those achieving greater scores in both up and down a powerful explosion investigation receiving higher evaluations in all utilized leaps.
The craftsmanship of jump conviction is mostly dictated by the force produced during the take-off phase. Augmented force generation leads to extended flight time, enabling optimal body positioning and stable landing. Thus, jump performance in melody dancing is not merely technical nor is considerably limited by the candidate's physical attributes.

Explosive strength functions as a predictive indicator of performance in jumps ability. The comparable correlations across different types of jumps indicate that a similar physical mechanism regulates most helicopter maneuvers in rhythmic gymnastics.

Consequently, augmenting strength of blast is an essential prerequisite for improving technical performance, rather than only serving as an ancillary physical component.

Therefore, to summarize the conclusions

There is a strong and not noteworthy positive correlation between leg powerful force and improved performance in consistent gymnasts. The strength of the muscles in your lower body has a direct effect on how well you can vault.

Leg explosive force is an important physical measure for getting the most out of passionate vaulting. It affects the height and length of jumps, the fluidity of the air, and the landing oversight.

In rhythmic gymnastics, jumps require the simultaneous use of either either downward or upward forces. Vertical force is used to lift the gymnast, and horizontal force is used to control the the tide- and make smooth transitions between moves.

The significant uniformity evident in all jumps indicates one leg explosive force affects efficiency over the serving merely as a discrete skill.

The Grand Jeté requires extraordinary explosive force due to the hip file format, ankle separation, and body elevation before takeoff, making explosive power essential for peak performance. The uniformity in age, training their duration, and ability in technology of the sample's strengthened the correlation between lightning-fast pace and flying productivity, while reducing the variability due to experience or physical maturation.

The correlational design of the study prevents the presumption of a direct causal relationship. There is a strong link between a leg explosive force and jumping earnings, but it is not safe to assume that more power will always lead to better performance without taking into account things like technical skills, adaptability, coordination, and artistic expression.

Recommendations

1. Participants ought to incorporate advanced capacity computers for the diminished limbs into classes in dance protocols.
2. To alter travel electrical power and raise rush extent a variety of must be done on a regular basis.
3. Programming demand needs to be changed based on a person's age and level of help. Weight lifting must be combined with technical methods to improve the transfer of

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skills.
Basic field tests like the vertical fly and sprawling jump must become used to see how much athletes have improved.

4. In skill training, the inner workings of its the flights are deemed given a lot of thought. To keep performance from going down because of tiredness, there must be enough time to recover.
5. Mobile and flexible training workshops shall assist building power programs. To make landslides more stable, training programs need to include exercises for balance and tranquility.
6. Subsequent research ought to examine the impact of volatile muscular endurance and strength on rhythmic spectacle of dancing.

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Training the tennis serve skill according to the kinetic chain model and its effect on biomechanical variables and the angular kinetic energy index among young players

Abdulkareem Jabbar Nasser [1]

[1] **University of Ashur, College of Physical Education and Sports Sciences**.

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Abstract

Based on kinetic chain concept and angular kinetic energy index, we aimed to assess the effect of a training program to improve tennis serve biomechanics among young players in Iraq. A pre-test/post design was applied; twelve players (16-20 years old) from tennis clubs in Baghdad and Basra were given a serving training program as possible. Biomechanical variables were evaluated by3D motion analysis and high-speed cameras following an 8-week focused training program. Responses indicated that performance of the serve had improved ($\alpha \leq 0.05$) with respect to speed (from 95 km/h to 117 km/h) and precision (65% vs.85%). Improvements in angular indices were also noted and these augmented angular kinetic energy measures with more efficient motor coordination. It was concluded that specialized biomechanical training is successful in improving serve performance and should be incorporated into coaching/training factory practice, with implications for future research using a larger sample to corroborate the results.

Keyword: tennis serves, kinetic chain, angular kinetic energy, sports biomechanics, young athletes, sports training.

[1] University of Ashur, College of Physical Education and Sports Sciences.
abdulkareem.jabar@un.edu.iq.

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Introduction

Tennis serve is one of the most important and decisive offensive skills that determine the winning and losing of a match, Because research has indicated that about 60% points in elite tennis match are won or lost at the serve level. The successful performance of this complex skill rests upon accurate and coordinated control among various regions of the body, which is termed as the kinetic chain, scientifically. That is the key, it's how we generate that power from the legs and transfer it through our body to hit as fast and accurate as possible.

The index of Angular Kinetic Energy (AKE) is one important biomechanical variable to evaluate efficiency of rotational movements of body segments (e.g., trunk, pelvis, shoulder) in serving action. It contributes to assessing how much the player makes use of rotational energy and I know that it prevents its dissipation, involving the degree of motor performance.

The kinetic chain and linear and angular kinetic energy have been studied in several reports. For example, Movella (2024) investigated the applicability of Xsens MVN technology for performance analysis and biomechanical accuracy evaluation in young tennis players with significant better results as concerns knowledge about the kinetic chain. Fort-Vanmeerhaeghe (2020) further investigated the effect of maturation on neuromuscular symmetry in the lower limbs in elite junior competitive tennis players, and suggested that specific training likely plays a significant role. In addition, Sterner et al. (2020) studied the inverse dynamics of the throwing arm with body composition imaging, which could contribute to coverage on angular kinetic energy.

Despite increasing tennis interest in Iraq, young players encounter significant challenges related to a lack of scientifically based training programs emphasising appropriate biomechanical principles. I doesn't just mean compromised performance, it also equates to more injuries too due to poor movement patterns. Thus, there is an immediate need for an applied study which develops and evaluates a tailored training program to fill these gaps, namely the lack of appropriate studies to guide practice in this area, the scarceness of applied research and the dearth of targeted training interventions.

The specific objectives of this research are:

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- To determine the impact of a kinetic chain-based training program on biomechanical variables (speed, accuracy and joint angles) of the service action.
- To examine the trends of changes in the angular KEI and energetics among players.
- To offer guidelines for coaches and sports federations in prescribing training programs when aiming for effectiveness and safety.

The current research is guided by the following hypotheses:

- H 1 : There are statistically differences ($\alpha \leq 0.05$) between biomechanical variables of the serve at pre-test and post-test after intervention with the suggested training program.
- H2: There is a strong positive correlation between AK index and increase of server performance by speed and accuracy.
- H3 - Training according to the kinetic chain is beneficial for motor coordination and sequence of energy transfer from lower to upper extremities.

Methodology

This investigation was conducted using a quasi-experimental research design (One-Group Pretest/Post-test Design). Twelve competitive young tennis players (16-20 years) were purposefully selected from accredited tennis clubs in Baghdad and Basra. All subjects underwent medical screening in order to be free of any injury that could interfere with their performance.

Key Characteristics of the Homogeneity of the Sample Table 1 displays homogeneity (or lack thereof) in some variables (e.g., age, height, weight, years of training experience) to demonstrate that differences between at blast and post test were due to an intervention rather than initial disparities.

Table 1. ***Description and Homogeneity of the Research Sample in Basic Variables (n = 12)***

Variable	Unit	Mean	Std. Deviation	Skewness
Age	Year	18.25	1.48	0.45
Height	cm	179.5	5.6	-0.21
Weight	kg	72.8	6.2	0.15
Training Experience	Year	6.5	1.8	0.33

The table above shows that the skewness values for all variables are within (±1), and this suggests that the data satisfies normal distribution. This means that the sample was homogeneous for these basic variables before carrying out the training program, thus increasing the internal validity of results.

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Measurement Tools

The kinematic variables were recorded using a 3D analysis motion system (3D Motion Analysis) with high-speed cameras. Serve velocity was quantified with a dedicated radar machine and confirmed via video analysis. Serve accuracy was evaluated using a target-orientated test, in which players had to direct the serve at specific zones of the opponent's court.

- **Biomechanical variables:** Angular kinetic energy and major joint angles were calculated using specialized software such as *Kinovea* and biomechanical physics equations.

Below is a detailed description of each test employed in the research, including its purpose and measurement procedure:

1. Serve Speed Test

Purpose

To find the highest linear speed of tennis ball as it leaves the racquet. Serve speed is a reflection of explosive power and kinetic chain efficiency.

Measurement Method

Two complementary techniques were used for accuracy:

- **Speed Radar:** An electronic device positioned behind the player aimed at the ball trajectory to instantly record ball velocity.
- **3D Video Analysis:** High-speed cameras were used to capture the serve, and ball displacement over a precise time frame was analyzed to calculate speed accurately.

2. Joint Angle Measurement

Purpose

Calculating the exact joint angles of relevant joints (shoulder, elbow and knee) at crucial time points during the serve (ball toss phase as well as ball impact) to evaluate movement efficiency and technical faults.

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Measurement Method

The motion analysis software Kinovea was utilised. Digital markers on the joints of the subjects in high-speed video frames were used to annotate, enabling digital angle calculation for each phase.

3. Angular Kinetic Energy Calculation

Purpose

To estimate the kinetic energy from rotation of various body segments. This parameter represented the ability of the players to create and transfer force to the racket effectively via use of trunk, pelvis and shoulder rotation.

Measurement Method

There is no direct measurement for this, but the value is obtained through a systems of biomechanical equations. The researcher enters motion analysis system data (e.g. angular velocity, mass of each body segment) into formulae to obtain angular kinetic energy in Joules (J).

Definition

The energy of an object spinning is called angular kinetic energy. It is controlled by the laws of energy and angular momentum conservation.

Formula:

$$K_{rot} = \frac{1}{2} I\omega^2$$

Where:

- **I** = Moment of inertia (mass × radius²)
- **ω** = Angular velocity (rad/s)

Application in Tennis

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During the serve, they first turn the trunk and arms away from the target (high inertia, low angular velocity), and then quickly drive them forward (low inertia, high angular velocity), creating a significant amount of stored rotational kinetic energy that is available for transfer to the racket and ball.

4. Serve Accuracy Test

Purpose

To assess the player's ability to direct the ball into specified target zones within the service box. Accuracy reflects control and motor precision.

Measurement Method

A target-based test was conducted. The serving box was compartmentalized into target areas, and players made a pre-determined number of serves in each. The efficiency of serves landing in the target areas was measured.

Table 2. ***Research Variables and Measurement Methods***

Study Variable	Measurement Method
Serve Speed	Speed Radar + 3D Video Analysis
Joint Angles	Kinovea Motion Analysis System
Angular Kinetic Energy	Quantitative calculation using biomechanical equations
Serve Accuracy	Target-based service test

Training Program

The duration of the training programmed was 8 weeks (3 sessions per week, 90 min each session). The intervention was conducted specific exercises aimed at improving the kinetic chain phases in serve and consisted in:

- Plyometric exercises for lower limb explosive power
- Trunk and pelvic rotation drills using medicine balls
- Shoulder strengthening and arm–trunk coordination training
- Full-serve simulation drills emphasizing correct movement sequencing

Result

Table 3. ***Independent t-test results for differences between pre- and post-test measurements of the study variables (n = 12)***

Variable	Pre-test Mean ± SD	Post-test Mean ± SD	Mean Difference	Std. Error	t-value	Sig. (p)	Effect Size

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Serve speed (km/h)	95 ± 8.5	117 ± 7.2	22	4.55	4.83	0.001	1.20
Serve accuracy (%)	65 ± 10.2	85 ± 5.5	20	4.85	4.12	0.001	1.05
Angular kinetic energy – hip (J)	45.8 ± 11.2	68.5 ± 9.8	22.7	5.89	3.85	0.01	1.23
Angular kinetic energy – shoulder (J)	38.2 ± 9.5	59.1 ± 8.1	20.9	5.90	3.54	0.01	1.14
Angular kinetic energy – arm (J)	29.6 ± 7.8	46.3 ± 6.4	16.7	5.20	3.21	0.05	1.07
Motor coordination (index)	0.68 ± 0.15	0.89 ± 0.09	0.21	0.046	4.50	0.001	1.13

Discussion

The obtained results actually prove the effectiveness of the training procedure based on kinetic chain theory. These magnitude positive changes can be justified in terms of biomechanics and Science and they are as follows:

1. Interpretation of the Increase in Serve Speed and Accuracy

Results The average serve speed and accuracy increased statistically significantly from 95–117 km/h and from 65% to 85%, respectively. This rather remarkable improvement is almost entirely due to kinetic linking. The training was based on teaching the players how to develop force from the larger and more powerful segments (legs and trunk) to project it to smaller and quicker segments (shoulder and arm) until reaching maximum transfer in the racket.

This appropriate succession allow one to have the sum of angular velocities, and a high linear velocity on the racket at ball impact. These results are in agreement with Movella (2024) who demonstrated that the use of motion analysis techniques to analyse and correct kinetic chain in young tennis players provides noticeable performance enchancements. The rise in speed and accuracy goes hand-in-hand with better motor control, as movement becomes more fine-grained.

2. Improvements in Angular Kinetic Energy as a Core Factor

It should be noted that the above described observation, which is of interest for any results interpretation, reveals also a large enhancement of angular kinetic energy indicators. The intervention successfully improved participants' potential for safely accessing trunk and pelvic rotation, the predominant source behind the modern tennis service motion. The increase in rotational energy indicates that hockey players depended less on muscular contraction of the shoulder/upper arm to deliver the slapshot, and more on body opening and greater amounts of distant muscle groups with less fatigue as well as with higher efficiency.

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This finding is in agreement with Sterner et al. (2020) who performed inverse dynamics analysis and demonstrated the significance of trunk and shoulder rotation to generate kinetic energy for the hitting arm. Therefore, the pursuit of this variable was not an attempt in the dark, but sound arrived at from it's power progenitor.

3. Enhancement of Motor Coordination and Energy Transfer

Results This finding suggests that KC-based training may enhance the coordination and sequencing of energy release. It is because of this improvement that everything else firms up-- those prophylactic elements are essential for greater speed and accuracy. Also causing these problems in tennis are the bad movement patterns and using arm too much. Improved neuromuscular coordination means mechanical stress is distributed through your body rather than concentrated into smaller joints like your elbow or shoulder, and that makes it less likely you'll end up with overuse injuries.

This observation is in line with Fort-Vanmeerhaeghe (2020) study which highlights the need for early and specialized training intervention to address neuromuscular asymmetry and develop adequate movement pattern according to maturation status of tennis players.

4. Local Relevance and Research Contribution

These findings are particularly important because they apply in a sample of young football players in Iraq. They validate that universal biomechanical concept can be translated and implemented for the benefit of local environments, providing a best practice reference model for coaches and academies in Iraq to create successful training programmes beyond traditional methods. The current research also covers a significant gap in the literature that lacks of applied studies done on Arab and Iraqi specifically samples.

Overall Interpretation

The results strongly support the positive effect of the kinetic chain–based training program in improving one's serve. Increased serve speed (in average +22 km/h) is mainly due to better transfer of energy from legs and trunk in the hitting arm, confirming what Movilla (2024) analyses have already found.

Furthermore, the bias of the programme towards angular kinetic energy made for more economic movement. Rather than focusing on the force generated solely by the arm, card games players learned how to optimally use trunk and pelvis rotation which would decrease the waste of energy and provide a greater amplitude of forces when being

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transmitted to the ball. This is in agreement with the results reported by Sterner et al. (2020) on the use of inverse dynamics to interpret segmental involvement in motion.

One of the most impressive results was an improvement in motor coordination, which doesn't just help you do better, but also works to prevent injury. A large number of tennis-related shoulder and elbow injuries are caused by over-using the upper extremities as a compensation mechanism, due to weakness or lack of efficiency in the kinetic chain.

Conclusions

The results of the study clearly indicate that the kinetic chain-analysis-angular kinetic energy-based training program is very efficient in enhancing biomechanical parameters of tennis service. The findings underscored the need for a shift from empirical exercise building towards scientific, biomechanical based training in maximizing performance. Moreover, this study represents a scientific reference to future studies for working on developing tennis and sport performance in Iraq.

Recommendations

It may be advisable to include concept of the kinetic chain and angular kinetic energy index in training programs for young athletes. It is necessary to educate and train coaches with modern technologies on the need for performance analysis. Further research should be extended to other samples (increased sample size), youth age groups, and populations with varying distributions to women athletes. It is recommended to include further variables (e.g., muscular strength, flexibility) to achieve an even more detailed insight into performance. The implementation of AI in performance diagnostics and individualized training should be endorsed. It is necessary to invest in the advanced motion analysis technology in national training centers and specify the scientific standard criteria for practice program, which contributes to cultivating talents soundly. Finally, promoting cooperation and research affiliations with foreign centers of sports biomechanics is greatly recommended.

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The Reality of the Use of Artificial Intelligence Applications in Education by Faculty Members of Scientific and Humanities Colleges at the University of Baghdad

Abeer Dakhil Hatem [1], Nazik Subhi Mutar [2], Huda Idan Muhammed [3], Hind Salem Tayeh [4], Shahbaa Ahmed [5], Baydaa Abbas Kadhim [6], Suad Sabti [7]

[1,2,3,4,5,6,7] University of Baghdad, College of Physical Education and Sports Sciences for women.

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Abstract

Artificial intelligence (AI) aims to develop systems that achieve a level of intelligence similar to or surpassing human intelligence. AI applications are designed to mimic human cognitive behaviors, with the goal of embedding human knowledge into computers through what is known as knowledge bases. Computers can then use software tools to search these bases, perform comparisons, and conduct analyses to derive and infer the best solutions to various problems. This process resembles how humans solve new problems in their daily lives by relying on past experiences, predicting potential outcomes, and using reasoning skills to evaluate the best available solutions. This study investigates the current use of AI applications in education by faculty members in scientific and humanities colleges at the University of Baghdad, as well as the challenges they face. It also aims to identify differences in the use of AI and the associated challenges based on variables such as academic degree (Master's, PhD), gender (male, female), academic specialization (scientific, humanities), and years of service (1–10 years, 11 years or more). The research sample included 279 faculty members from the College of Physical Education and Sports Sciences for Women and the College of Education for Women at the University of Baghdad for the academic year 2020 2021. The study utilized a scale developed by Sabah Eid Al-Subhi (2020) to measure the reality of faculty members' use of AI applications. The scale consisted of 23 items divided into two axes: the reality of AI use in education (11 items) and the challenges faced by faculty members (12 items). Responses ranged from "very high degree" to "very low degree." The scale's validity was confirmed by a panel of experts, and its reliability, calculated

[1] University of Baghdad, College of Physical Education and Sports Sciences for women. abeer@copew.uobaghdad.edu.iq
[2] University of Baghdad, College of Physical Education and Sports Sciences for women. nazik@copew.uobaghdad.edu.iq
[3] University of Baghdad, College of Physical Education and Sports Sciences for women. hoda.m@copew.uobaghdad.edu.iq
[4] University of Baghdad, College of Physical Education and Sports Sciences for women. hind.s@copew.uobaghdad.edu.iq
[5] University of Baghdad, College of Physical Education and Sports Sciences for women. shahbaa.hussein@copew.uobaghdad.edu.iq
[6] University of Baghdad, College of Physical Education and Sports Sciences for women. baida.a@copew.uobaghdad.edu.iq
[7] University of Baghdad, College of Physical Education and Sports Sciences for women. suadsabti@copew.uobaghdad.edu.iq

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using Cronbach's alpha, was 0.88. The results revealed that the use of AI applications by faculty members in scientific and humanities colleges at the University of Baghdad was very low, while the challenges they faced were very high. Based on these findings, the researchers recommended providing intensive lectures to raise awareness among faculty and students about the importance of using AI in education to save time, effort, and costs. They also suggested organizing discussion sessions and workshops on AI and its applications.

Keywords: Artificial Intelligence, Faculty Members in Scientific and Humanities Colleges, University of Baghdad.

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Introduction

There have been tremendous developments in the field of learning and education ever since technology has witnessed fast growth. Influence of the Internet in Higher Education Internet-based research has become an essential aspect of academic studying, and laptop computers have replaced supplementary or full textbooks at universities. But all these now around the world standing out may be behind in just a few years as artificial intelligence (AI) integration to education, which has already started up and is likely going to be an unprecedented revolution. The goal of artificial intelligence is to create systems that can demonstrate intelligent behavior equivalent or superior to human-level intelligence, whereas AI applications focus on replicating human intellectual function. The main focus is on how human knowledge could be embedded into the computer system that can use such a form of family. Software tools can then search these bases and compare, analyze, and generate optimal answers/solutions to problems. This process is similar to how humans solve novel problems in everyday life by drawing from our past experiences, predicting likely outcomes, and applying reasoning and comparative decision-making skills across available alternatives.

The scientific problem also lies in determining the current reality of using applications of artificial intelligence in teaching at scientific and humanities colleges at the University of Baghdad The study also aims to find out the difficulties that face faculty in using AI applications in education. In addition, the study seeks to find out differences in using AI applications among faculty members according to the following variables: academic qualification (Master's, PhD), gender (male, female), academic specialization (scientific, humanities) and years of service (1–10 years, 11 years and above). The study also explores the differences in challenges faced by faculty members in adopting AI applications in education with respect to the same variables. The research problem is further translated into the following sub-questions:

1. What are the barriers facing scientific and humanities colleges faculty members at the University of Baghdad in using AI applications in education?
2. What is the impact of academic qualification (Master's, PhD) on faculty use of AI applications in education?
3. Does gender (male, female) affect the use of AI applications in education by faculty?
4. Does academic specialization (scientific, humanities) have any effect on the faculty members using AI applications in education?
5. Does faculty members with years of service (1–10 years, 11 years and above) have an impact on the use of AI applications in education?
6. What is the impact of academic qualification (Master, PhD) on the constraits of faculty to utilize AI apps in education?
7. How does gender (male, female) influence the problems encountered by educators using AI applications in education?
8. As a domain what are the challenges of higher education faculty using AI applications; does this differ from scientific to humanities faculties?
9. Does years of service (1–10 years, 11 years and above) have an impact on the challenges encountered by faculty in using AI applications in education?

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The study aims to

1. Identify the reality of using artificial intelligence applications in teaching within scientific and humanities colleges at the University of Baghdad.
2. Determine the challenges faced by faculty members in using artificial intelligence applications in education.
3. Identify differences in the reality of AI application usage in education according to the variables of academic qualification (Master's, PhD), gender (male, female), academic specialization (scientific, humanities), and years of service (1–10 years, 11 years and above).
4. Identify differences in the challenges faced by faculty members in using AI applications in education according to the same variables.

The current study was restricted to faculty members from the College of Physical Education and Sports Sciences for Women and the College of Education for Women at the University of Baghdad, during a time frame extending from 12 February 2020 –23 June 2021. The research community consisted of (279) teachers, including (113) teachers from the College of Physical Education and Sports Sciences for Women and (166) from the College of Education for Women for the academic year 2020–2021. The characteristics of research sample are presented in Table (1).

Table 1. *Characteristics of the Research Sample*

Category	Frequency	Percentage
Academic Specialization		
Scientific	113	40.5%
Humanities	166	59.5%
Gender		
Male	74	26.52%
Female	205	73.48%
Years of Service		
1–10 Years	145	51.9%
11 Years and Above	134	48.1%
Academic Qualification		
Master's Degree	89	31.9%
PhD	190	68.1%

Methodology

In this study, researchers used a descriptive–analytical approach. Statistical analyses were performed on data collected using the research scale including assessment of mean, standard deviation, t-test and one-way analysis of variance (ANOVA), respectively.
The extent of use of actual applications of artificial intelligence among faculty members was measured using a scale developed by Sabah Eid Al-Sabahi (2020). The reason is that the scale was considered most appropriate tool to measure actual use of AI applications as it was designed specifically for faculty members. The scale includes 23 items grouped in two dimensions: actual use of artificial intelligence applications in education by faculty members (11 items) & challenges faced by faculty members when it comes to using artificial intelligence applications (12 items).
A five-point response scale was used for each item: very high degree, high degree, moderate degree, low degree and very low degree with the scores of 1, 2, 3, 4 and 5 respectively. Its content validity was pre-tested by experts in the field.

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Table 2. *Experts' Opinions on the Validity of the Scale Items*

No.	Item Sequence	Number of Items	Agreeing Experts	Disagreeing Experts	Calculated Chi-Square	Tabulated Chi-Square	Significance Level
1	10, 5, 19, 21, 18, 22	6	13	2	8.06	3.84	0.05
2	15, 16, 4, 14, 7, 3, 17, 23	8	14	1	11.26	3.84	0.05
3	6, 1, 12, 8, 2, 13, 11, 9, 20	9	15	0	15.00	3.84	0.05

The researchers also relied on self-validity, which was calculated as the square root of the reliability coefficient of the scale, reaching a value of 0.93.

Results

The study finds that the current using level of artificial intelligence (AI) applications in teaching was moderate based on faculty members at scientific and humanities colleges from University of Baghdad. The prevalent applications were computer-based education, instructional software and virtual reality technologies. Conversely, the use of sophisticated applications like intelligent tutoring systems and adaptive learning technologies showed relatively lower numbers.

When it comes to the challenges faced by the faculty members in implementing AI applications at the higher education level, this study identified several barriers which include ineffective technological infrastructure, restraining training opportunities, resistance to change as well as concerns regarding job security. Statistical findings also revealed significant differences between the use of AI applications as well as obstacles faced by faculty members based on variables academic qualification, gender, academic specialization and years of service.

After statistically processing the data, the results are presented in Tables (3) and (4).

Table 3. *Mean, Standard Deviation, and Ranking of Items Related to the Reality of AI Application Use by Faculty Members in Scientific and Humanities Colleges at the University of Baghdad*

Scale Order	Item Description	Mean	Std. Deviation	Rank	Level of Use
4	Converting written course texts into immersive virtual environments using virtual reality technologies	1.12	0.292	1	Very Low
8	Using intelligent educational games to meet students' learning needs	1.09	0.287	2	Very Low
11	Accurately summarizing long texts using AI-based text summarization applications	1.07	0.263	3	Very Low
1	Responding to students' inquiries using intelligent chat applications	1.06	0.281	4	Very Low
2	Enhancing subject explanation through augmented reality applications	1.05	0.220	5	Very Low
3	Providing audio learning interaction using voice-generation applications	1.04	0.189	6	Very Low
9	Identifying students' strengths and weaknesses using intelligent assessment applications	1.03	0.198	7	Very Low
10	Converting printed or handwritten images into editable text using OCR applications	1.02	0.292	8	Very Low

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5	Providing suitable solutions for students with limited experience using expert systems	1.01	0.195	9	Very Low
6	Using intelligent educational games based on motivation, challenge, imagination, and competition	1.01	0.159	10	Very Low
7	Providing adaptive intelligent learning to meet individual student needs	1.01	0.152	11	Very Low

Table 4. *Mean, Standard Deviation, and Ranking of Challenges Facing Faculty Members in Using AI Applications in Education*

Scale Order	Challenges	Mean	Std. Deviation	Rank	Challenge Level
15	High financial cost of equipping classrooms for AI applications	4.99	0.238	1	Very High
16	Belief that using AI applications requires more effort than traditional teaching	4.97	0.249	2	Very High
20	Heavy workload of faculty members limiting AI use	4.95	0.267	3	Very High
21	Insufficient lecture time to use AI applications	4.94	0.291	4	Very High
22	Lack of moral incentives for faculty using modern technologies	4.91	0.376	5	Very High
12	Limited awareness of the importance of AI applications in education	4.90	0.394	6	Very High
13	Students' limited ability to solve problems while using AI applications	4.88	0.415	7	Very High
14	Lack of adequate technical support	4.86	0.398	8	Very High
17	Lack of sufficient time for training on AI applications	4.84	0.421	9	Very High
10	Weak student response to the new learning pattern	4.71	0.347	10	Very High
19	Large class size limiting control of AI application use	4.04	0.322	11	High
23	Insufficient training programs on AI applications	4.01	0.504	12	High

Table 5. *Analysis of Differences in Artificial Intelligence Applications and Their Challenges According to Demographic and Academic Variables*

Variable	Category	N	AI Applications Mean	Std. Dev.	t-value (Calc.)	t-value (Tab.)	Sig.	AI Challenges Mean	Std. Dev.	t-value (Calc.)	t-value (Tab.)	Sig.
Academic Qualification	Master's	89	1.32	0.125	3.88	1.96	Significant	1.39	0.189	2.08	1.96	Significant
	PhD	190	1.39	0.154				1.13	0.177			
Gender	Female	205	1.025	0.134	2.80	1.96	Significant	4.79	0.109	10.00	1.96	Significant
	Male	74	1.084	0.175				4.67	0.112			
Academic Specialization	Scientific	113	1.24	0.181	1.87	1.96	Not Significant	4.76	0.106	0.05	1.96	Not Significant
	Humanities	166	1.12	0.163				4.78	0.109			
Years of Service	1–10 Years	145	1.39	0.189	2.08	1.96	Significant	4.48	0.129	8.20	1.96	Significant
	11 Years and Above	134	1.13	0.177				4.59	0.114			

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Discussion

As illustrated in table (3), it can be concluded that there is a weak dependence on artificial intelligence, which suggests that incorporating AI applications into the educational process prevails during developing stages and faculty members do not heavily rely upon these technologies at least within their teaching practices. This could be due to lack of awareness about the possible AI use cases, limited tech ecosystem, or not enough training on how to implement it effectively.

faculty members' challenge in adopting the use of AI applications in education for scientific and humanities colleges is very high as it has been shown in Table (4). Indeed, the main causes for these challenges are financial costs, increased workload, lack of time and insufficient incentivizing system. So suitable actions must be taken to cope up with these challenges and help the faculty members incorporate AI technologies with more effectiveness in the teaching functionality.

The data covered in table (5): descriptive statistics show the differences in means and standard deviations across groups for each variable of the study (namely: academic qualification, gender, academic specialization and years of service). Independent samples t-test were conducted to examine whether these differences are statistically significant. Data (up to October 2023) revealed that even the academic qualification (Master's or PhD) had a significant positive impact on both AI applications use and challenges faced, with Master's degree holders using more AI applications as well as facing more issues associated with their use compared to their PhD counterparts. The fact that female faculty members presented more involvement and difficulties with AI applications than their male colleagues also outlines the gender differences in our dataset. On the other hand, there was no statistically significant effect of academic specialization on either AI application use or challenges associated with doing so; that is, these technologies are ubiquitous across all academic settings. In terms of years of experience, faculty who had less experience (1–10 years) were more engaged with AI applications but also faced more difficulties than faculty members with longer professional experience.

Conclusions

The study aims to know the reality of artificial intelligence (Ai) applications used in teaching in scientific and humanities colleges at the University of Baghdad. It also highlights the barriers encountered by faculty and validates the need to address these obstacles for successful implementation of AI-based technologies in academia.

The results highlight the need for improving the higher education utilization of artificial intelligence, as it is critical to establish tools directed towards boosting faculty adoption of these technologies because some subgroups showed lower levels of usage (e.g. female faculty and Master´s degree). Most importantly, existing challenges should be reduced given the high rate of obstacles faced by faculty members; hence, intensive training programs and continuous technical support are needed to cope with this (particularly among female staff and Master degree holders).

The findings also highlight the need to promote gender equity because, although there are no statistically significant differences in terms of level and challenges between male and female faculty members, a gap seems to exist (with females being underutilized) that impacts equal opportunities for their access and use of AI technologies.

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In line with the above, the study suggests providing adequate technology infrastructure and expanding professional training opportunities; fostering a culture of innovation and organizational change; and consideration of job security concerns of faculty members for facilitating at successful adoption of AI within higher education institutions.

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The Reality of The Organizational Crises Inside Iraqi Football Association from The Perspective of Iraqi Stars League Coaches

Abu Baker Yousif Mohammed [1], Mandoob Makki Ati [2], Hayder Talib Jasim [3]

1 Ministry of Education, Baghdad Al-Karkh 1 Directorate of Education
2,3 University of Baghdad, College of Physical Education and Sport Sciences.

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Abstract

This study aimed to identify the reality of the organizational crises experienced by the Iraqi Football Association during the Iraqi Stars League. This was achieved by developing and applying a scale to measure the reality of these organizational crises from the perspective of the Iraqi Stars League coaches. The research population consisted of 76 coaches and assistant coaches from the Iraqi Stars League clubs, and the research sample was the same size. The researchers developed a questionnaire based on the organizational crisis scale and administered it to the research sample. The researchers reached several conclusions, including identifying several levels of crisis based on the results and statistics obtained (very high, high, medium, low, and very low). The results showed that the crises were at the very high level, affecting 36% of the research sample. The results also revealed a clear crisis in the continuity of league matches, particularly during the preparation periods for the World Cup qualifiers preceding FIFA international windows. This is due to the Federation announcing sudden and lengthy league suspensions, followed by compressing the match schedule to compensate for these unnecessary breaks. This constitutes an organizational crisis as it is inconsistent with the schedules of other Arab leagues.

Keywords: Organizational crises, Iraqi Stars League, Iraqi Football Association, Football.

[1] Ministry of Education, Baghdad Al-Karkh 1 Directorate of Education.
abu.Bakr1104a@cope.uobaghdad.edu.iq
[2] University of Baghdad, College of Physical Education and Sport Sciences.
mandoob.m@cope.uobaghdad.edu.iq
[3] University of Baghdad, College of Physical Education and Sport Sciences.
hayder.t@cope.uobaghdad.edu.iq

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Introduction

Management is one of the most interesting disciplines for the leaders who desire success in every field of work. Theoretical foundations and modern applications it is based on help, in practice, to achieve goals set by federations or clubs considering the realistic time sequence. So, it is the execution of available resources in accordance with an acceptable methodology that could be monitored directly over time and successively (Khudhair et al., 2022; Waleed Abdulkareem & Sattar Jabbar, 2025).

Public administration is a very formal, scientific, and collective activity. Therefore, management is the art of combining science with the impact that seeks to lay modern scientific foundations for institutions and bodies to pursue their objectives in a systematic and applied manner. In other words, management is the one who leads individual labor toward the organization's overall and sports federation goals. Hassan and Abdul Razzaq (2013) reflect the same point of view; they explain that management can be classified as both science and art, and most of the contemporary approaches for administration represent this mixed orientation.

One of the main benchmarks in realizing good governance is acculturation, which is a policy that also has an important role for any sports federation or football association. Organizational culture must provide a framework for how employees behave and interact with each other in line with the values and beliefs of the federated organization. The more employees share the same values and beliefs, and the more they align with their own personal value systems, the better a federation is at achieving its objectives. The Iraqi Football Association runs several domestic tournaments and is a central partner in the organization of international competitions. So, the role of sports management is vital to ensuring that these tournaments and events succeed without any glitches in administration. In this sense, management works to manage the industry by site operation in advance, determining when the event will be held or if its duration can potentially conflict with these local or global sporting movements (Jasim et al., 2019; Abdulghani et al., 2025).

Crisis management is a significant challenge, undoubtedly, for individuals and organizations in sports and federations of different types, sizes, and origins. These crises will lead to operational problems and breakups in the organizations and limit the material and human resources of the organization, causing a decrease in organizational success. One of the federations that cannot escape from its use (to complain or speak about difficulties during their organization process) is the Iraqi Football Association. However, FIFA international match days and FIFA World Cup qualification matches take precedence over even midweek domestic league matches, where applicable. Such interruptions create administrative headaches in terms of compensating for postponed matches and also shorten recovery time between games, putting pressure on the league's calendar. So it is on high-ranked officials of the Iraqi Central Football Association to keep up with their business carefully through managing different internal championships or sport events by adopting modern known global organizational mechanisms and dealing with internal or external crises. Crisis management processes do not occur during the moment of the level, if you will, but through forecasting, preparedness, obtaining information before the events happen, and implementation of procedures that have a scientific base scaled from past experiences and practice instead of human perception or soft speculation. It is important to correctly forecast the crises; false or many prophecies may create administrative havoc,

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and these will also be another crisis to manage (Talib Jasim & Lazim, 2023; Hassan & Abdulkareem, 2025).

A significant factor for success is management, organization and supervision executed by staff members of a sport federation. All members and working committees must operate towards the implementation of activities in seasonal operational plan by available capacity and within provisions and objectives. Thus, the closeness of individuals' personal culture to the organizational culture in a federation will increase institutional success, with better administrative performance and vice versa (Jasim et al., 2023).

By integrating the administrative process itself to arrange the administrative work based on available energies and within a specific time frame. This is how it allows sports federations to thrive and clubs to develop their own plans and organize themselves on the basis of the federation's system. These processes form an intertwined series in which the administrative functions are interdependent, and consequently no local organization is able to shape its own charter to organize itself without coordinating with that of the Football Association. The current situation of displaced people and those living in areas outside the control of law, in addition to holding several sporting events sequentially, presents a challenge for the reality of the resources of the Iraqi Central Football Association Research to organize its activity this season of the Iraqi Stars League, where many matches were delayed or suspended. Within that structural imbalance these recurring ruptures assume league business management—from player contracts through the beginning and end of the competition. And because of unexpected cancellations caused by FIFA match windows, World Cup qualifiers, or other continental tournaments, coaches struggle to maintain the players at optimal readiness. These practices also diverge from scheduling systems used in overseas and neighboring leagues. The research problem is being crystallized in a clear question: Are there organizational crises facing the Iraqi Stars League? and what is the level of these organizational crises according to the specific model representing the framework of the Iraqi Central Football Association? It is important and necessary to identify the crises of these dimensions and scientifically diagnose them in a way that contributes to building their football performance as well as raising the efficiency of organizational work for them, thereby enhancing its efficiency, particularly in Iraq.

This study aims to construct and implement a scale measuring the reality of crises that are flung at organizational fronts faced by the Iraqi Central Football Association as represented by organizing the Stars League in Iraq. It also intends to establish the extent of organizational crises suffered by the Association and determine the type and size of organizational obstacles facing the management and organization of the Iraqi Stars League football championship.

Methodology

Due to the nature of this study, its topic and problem required the researchers to adopt a descriptive approach using the survey method. The sample population included only head and assistant coaches that worked in the Iraqi Stars League during the 2025–2026 football seasons that are officially registered in the Iraqi Central Football Association system as a head coach or assistant coach only. The total participants were (76) coaches.

The study sample represented the entire research population (100%) of the study community. The sample group was divided into two groups: a pilot study sample of (5)

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individuals selected from the research population to ensure the clarity and applicability of the procedures specified in this research, and a main study sample of (71) coaches who participated in implementing the scale used in this study, as shown in Table 1.

Table 1. *Distribution of Research Samples*

No.	Sample Type	Number of Participants	Percentage (%)
1	Pilot Study Sample	5	6.57
2	Scale Application Sample	71	93.42
3	Total	76	100%

Research Scale

In the study, researchers constructed a particular scale examining the organizational crises in the (Iraqi) Stars League for the Iraqi Central Football Association. To this end, the scale (Nazzal and Hassan, 2013) used for the same purpose previously was adopted, after making necessary modifications according to the nature of the study and its population. Based on the original scale, the prepared questionnaire was modified to (22) items. Items were positively worded and similarly spread into four domains: organizational crises, technical crises, financial crises, and administrative crises.

The suitability of the scale for the research problem, objectives, and study sample was assessed by a number of experts in the field of sports management, measurement, and evaluation. After the expert review and approval, the final version of the questionnaire was aired to the research sample for a response. In order to measure the responses, the researchers used a five-point Likert-type scale, ranging from (5) Always; (4) Often; (3): Sometimes; (2) Rarely and 1: Never. This so-called five-point scale that was deemed better sensitivity can discriminate more accurately the marks' level (Mamdouh & Issa, 1995).

Pilot Study

The pilot study served as a vital initial process that helped to ascertain possible strengths and weaknesses related to the main experiment; this exercise also facilitated researchers in identifying challenges that could arise during data collection and allowed them to proactively ensure these were avoided. On Saturday, December 13th (2025), a pilot study was completed with (5) coaches who went on to be excluded from the main study.

Validity of the Scale

The researchers used content validity to determine the scale is valid. This was done by ensuring that the items in the scale match with the objectives of the study and by presenting to several informed panels consisting of experts and specialists in fields such as management science, sports psychology, and measurement and evaluation.

Reliability of the Scale

The process of determining reliability is known as one of the necessary scientific procedures to evaluate that the scale shows even a dead measure of consistency. Because the retesting procedure on different samples is difficult to apply, they used the split-half

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reliability method, one of the most universal techniques of measuring data reliability (Al-Hakim, 2004). This technique enables reliability to be measured with a single administration, free from potential psychological or health changes that develop across repeated testing scenarios (Melhem, 2002).

To that end, the researchers split scale items into two halves (odd- and even-numbered items). We then computed the Pearson correlation coefficient between scores of both halves. As the obtained correlation coefficient is considered reliability for half of the scale, the Spearman–Brown equation was used to calculate the total-scale reliability coefficient. Table (2) showed a statistically significant correlation, indicating that this scale has high reliability.

Table 2. *Reliability Coefficient of the Research Scale Using the Split-Half Method*

Scale	Pearson Correlation Coefficient	Spearman–Brown Correlation Coefficient	Significance
Organizational Crises Scale	0.78	0.82	Significant

Not. Significance level at (0.05)

Main Study

The total number of participants from the main study included 71 head coaches and assistant coaches working in clubs participating in the Iraqi Stars League football competition. The final study was implemented from Saturday, December 20, 2025, to Wednesday, January 7, 2026. The research scale had been applied to the sample of study during this period so that it would help in gathering the data necessary for achieving the objectives of the present research.

Results

Table 3. *Mean, Standard Deviation, and Hypothetical Mean of the Organizational Crises Scale*

Scale	Mean	Standard Deviation	Hypothetical Mean
Organizational Crises	68.77	8.91	66

Table 4. *Levels of Organizational Crises and Percentage Distribution According to the Scale*

Level	Frequency	Percentage (%)
Very High	20	36%
High	15	27%
Moderate	9	16%
Low	7	12%
Very Low	4	7%

In Table (3), the level of organizational crisis at the Iraqi Central Football Association (from the coaches' standpoint) came to a mean score of (68.77) with a standard deviation of (8.91). We can conclude this value is above 66, which explains the presence of organizational crises in the Iraqi Central Football Association.

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Discussion

By determining the level of organizational crises that occur in these cases, Table (4) shows us that the organizational crises are relatively high for the Iraq Central Football Association. The distribution of coaches' responses between each of the five levels of severity (very high, high, moderate, low, and very low)—indicates discrepancies in the perception of the severity of the organizational crisis within the Association. The researchers find it on the higher side due to several organizational challenges that need proper monitoring and intervention by the Iraqi Football Association.

Some of the prominent organizational crises identified include the scheduling aspect of the league season, which is particularly ambiguous in terms of league opening and closing dates, along with recurrent interruptions taking place during the competitive season. Preparations for FIFA World Cup qualification matches often suspend league competitions for very long periods, and sometimes indefinite ones. The researchers noted that almost all Asian and Arab leagues surrounding Iraq are limited to suspending their league exclusively during officially scheduled FIFA international windows that have been published ahead of time in the international fixtures calendar. On the other hand, in the Iraqi league, these dates are often preceded by suspensions that end much earlier as national team players leave their clubs very early, leading to long pauses and then squeezed schedules for matches to recover lost time (Hassan & Abdulkareem 2026).

In terms of the organizational aspect, one of the main problems is the delays in announcing and approving the official sports calendar for various local competitions by the Iraqi Central Football Association. The league often only issues the competition schedule a few days before the league kicks off, which poses logistical problems for clubs, particularly those who must travel between provinces in early rounds of the competition. Also, a crisis was indicated in the systems consequential to haggling for national-team picks. Many coaches reflected on the unclear and unfair criteria in the selection processes, such as a successful youth-category coach clinching a league title but receiving no national appointments compared to other coaches with lesser achievements (Abdulhussein et al., 2026).

The research also highlighted weaknesses in organizational cooperation with coaches on administrative and financial issues. Besides coaches' commitment to the profession, many obstacles stand against achieving optimal performance considering limits in the working environment, like scarcity of licensed and endorsed stadiums. This scarcity directly ties into scheduling clashes across competitions and divisions. This creates what is commonly known as work-related crises due to causing stress and impeding efficiency in the organization.

That being said, some challenges come from organization-related issues through committees that exist within the Association such as: Competitions Committee, Disciplinary Committee and Player and Coach Affairs Committee. Given the difficulties associated with sustaining in-depth decisions without nearness to administrative machinery, these types of issue are likely to cause administrative mayhem and instability if we hold on past a specific level. Hence, such committees should be comprised of well qualified professionals who are knowledgeable on global movements and can provide an informed decision swiftly as per the desired norms. Good organizational performance

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protects the federation from potential crises while facilitating efficient time management, and the successful organization of events.

Resisting the pressures stemming from crises can also lead to poor decision-making and administrative errors that, in turn, become cumulative organizational crises. Since unexpected issues related to administration must be promptly and fairly addressed for the sake of continuity and stability in organizational processes. Tackling the causes of crises is most credible way to prevent recurring organizational disruptions and strengthen institutional efficiency and performance. Al-Rubaie (2010) adopted a similar view, focusing on the fact that directing athletes' matters is one of the most vital, yet complicated administrative tasks in sports and it necessitates having experienced and qualified staff to reach institutional goals.

The Iraqi Central Football Association needs a willingness to develop organizational performance based on the need for sports calendars long-term and in accordance with international plans that are compatible with league requirements globally. Ashour (2006) pointed out that effective organizational systems, regulations, and procedures contribute to operational clarity, flexibility, and stability in the body, as well as employee satisfaction. This article focuses on the evolution of modern-day physical education and sports administration systems being heavily reliant on scientific principles with systematic management approaches in their administration process (Salah, 2009).

Based on the results obtained by these researchers, they recommend conducting technical workshops and preparatory meetings before announcing the league competitions and sports events in which specialists and coaches can express their views directly. It is also advisable to create a committee of specialists for coaches and the ability to find routes of communication between coaches in all governorates with the Iraqi Central Football Association. This committee is thus expected to enhance the organization of tournaments, scheduling decisions, and financial incentives, as well as development opportunities using both local and international training programs (Jasim et al., 2021).

Moreover, organizations that utilize systematic approaches with long-term vision can also determine and monitor their strategic direction, making better preparations for uncertainties. Marwan (2002) defined planning as the part that provides a real direction and meaning to an organization; thus, it helps organizations foresee difficulties due to changes in world affairs and make use of their previous experience for new strategy formulation.

In conclusion, the organizational crises scale developed in this study is valid for the research population and showed that the level of systematic crises within the core competitive activity unit (Iraqi Central Football Association) is very high, whereas the application sample fell at a mature level or ranged from a very high to very low position. The research also established an evident organizational crisis as far as the league's continuity is concerned, especially in stages before FIFA international windows, where long suspensions of all forms are immediately succeeded by condensed match schedules contradictory as compared to international league norms. Resource allocation, strategic planning objectives, and implementation efficiency are other challenges (Jasim et al., 2023; Khalif, 2025).

Accordingly, these researchers recommend the use of the developed scale as a scientific tool in diagnosing and defining organizational crises in the Iraqi Central Football Association, involving federation committees in specialized training programs on modern

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crisis management methods, encouraging reliance on scientific approaches for managing local competitions such as the Iraqi Stars League and Iraq Cup, and establishing a clear format for competition by announcing it at an early date that helps limit league suspensions only to official international breaks. Moreover, capitalizing on the knowledge of sport management experts and doing more research on a contemporary basis will help in clarifying issues and pinpointing organizational barriers before they become a full-blown crisis.

Appendix (1)
Organizational Crises Scale

No.	Statements	Always	Often	Sometimes	Rarely	Never
1	There is an adopted strategy for organizing festivals and championships similar to those followed by international federations.					
2	A scientific classification system is applied to evaluate the levels of both players and coaches.					
3	There is a clear organizational structure for all local leagues.					
4	Coordination between the Central Association and clubs is clear in determining league schedules and season interruptions.					
5	There is accurate knowledge of the timing of international championships, and clubs are informed of these dates in advance.					
6	The Association establishes an organized sequence for scheduling sports championships.					
7	There is alignment between the orientations and objectives of clubs and the Central Association.					
8	Committees within the Association are formed based on specialization.					
9	There is continuous preparedness to avoid any crisis that may hinder the continuity of local football leagues.					
10	A clear operational plan is formulated for organizing championships based on accurate assessment of local and international events.					
11	Championships are organized according to the financial capabilities of participating clubs.					
12	The financial revenues obtained by clubs are proportional to seasonal expenditures.					
13	Financial funding provided to clubs by state institutions is delivered at fixed and appropriate times.					
14	Members of the Competitions Committee possess prior organizational experience in managing local leagues.					

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15	The number of competitions during a single football season is appropriate and does not create difficulties for clubs.
16	Consideration is given to the time required for clubs to complete the preparation of all teams participating in local championships.
17	Workshops are conducted prior to the football season to discuss upcoming sporting events.
18	Clubs have a significant number of players represented in national teams.
19	Iraqi Stars League clubs are able to continue playing matches before international break periods.
20	National team coaching staff are selected according to previously established criteria.
21	Local championship schedules are distributed across different time periods throughout the season.
22	The Association does not frequently change league match schedules during the season.

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The Contribution of Dialogical-Based Leadership to Sustainable Development in Youth and Sports Forums from the Perspective of Employees

Aseel Taher Suleiman [1]

[1] Directorate of Education AL-Karkh 1.

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Abstract

The study aimed to construct two measurement scales—one for dialogical leadership and another for sustainable development—in youth and sports forums in Baghdad, and to identify the levels of both variables as perceived by employees. It also examined the contribution and effect of dialogical leadership on sustainable development. The researcher hypothesized that the results of the dialogical leadership scale would be significantly correlated with and positively influence the results of the sustainable development scale. A descriptive correlational approach was adopted, with a population of 1,161 employees from three youth and sports forums in Baghdad (Al-Karkh, Al-Rusafa, and Sadr City). The main sample was purposively selected from the Al-Rusafa Forum, consisting of 431 employees (37.12% of the population). After excluding non-relevant participants, the final sample included 225 employees (19.38%), divided into three subsamples: 10 for the exploratory sample, 120 for scale construction, and 95 for the main application. Data were collected between February 9 and 27, 2025, and analyzed using SPSS. The results showed acceptable levels of both dialogical leadership and sustainable development, confirming their measurable nature in the context of sports management. The findings also indicated that enhancing dialogical leadership positively contributes to sustainable development. The study recommends periodic evaluation of these two variables and involving employees in administrative development programs to strengthen dialogue and promote sustainability in youth and sports forums.

Keywords: dialogic leadership, sustainable development, youth forums.

[1] Directorate of Education AL-Karkh 1.
aseelsulaiman98@gmail.com .

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Introduction

The lack of continuity in administrative and technical operations of youth forums along with taking over leadership responsibilities have demanded to cope with developments in both the fields of administration and leadership. Making a difference here depends on being able to manage but, critically, also lead youth forums up to the standards of institutions in developed countries. There cannot be leadership without millions of followers who trust and support their leader. So while every leader manages, not every manager leads. While managers depend on their formal authority as outlined in laws and regulations, administrative leaders also rely on their personal, psychological and social traits to build relationships with their subordinates (Sulaiman & Al-Kathairi, 2013, p.12). Administrative leaders need to build a good social environment that encourages creativity and innovation in the organization because leaders who make employees feel valued help improve their morale, self-confidence and motivation towards exerting greater effort and innovativeness (Shadhan & Ali, 2021:127). Management seeks to progress in the management strategy from conventional methods of thinking and beyond it since this could lead towards creativity, technology, innovation and global level quality standards (Ghareeb:2019,p.85). Control over which decision making mechanisms are blocked, where authority can be delegated, and internal coalitions formed around them in the name of collective collaboration to achieve excellence (Čirjevskis, 2021, p.385). If we define leadership as a social role or function that individuals (the leader) perform through interaction with members of a group, the most important of which is its ability to influence others, guide their behavioral performances, improve social interaction among its members and retain the cohesiveness of society in order for the group to actualize common goals(Siham 2018,p.22). The definition in sports context of sport leadership is that it is the individual responsible for the action of athletes as they pursue a common goal (Naomi, 2020, p.213)

It is impossible for an administrative head to achieve institutional progress unless they communicate directly with all employees and make the effort to reach dialog even with those who oppose their views. General Definition of Dialogue: It involves free and honest discussion between leadership and employees, openness to discuss new ideas (Al-Fatlawi & Saleh, 2021, p.7). Administrative leaders who want to enhance mutual trust follow dialogical-led ways based on openness, understanding and creativity in their way of working toward management (Fathi, 2019, p.121). Listening significantly contributes to developing trust and creating composition between leaders and subordinates, as it is known that listening attentively, empathically, or actively strengthens the relationship (Khorakian et al., 2018 p.219). Focused on real dialog, key components of dialogical leadership include self-awareness, transparency, ethics, balanced processing and self-regulation with morality at its centre (Van & Dijk 2015 p64). It has four defining characteristics: conjuring authentic voices, deep listening, honouring the legitimacy of others' opinions and broadening consciousness by suspending preconceptions (Al-Ansari, 2019, p.101). This kind of leadership promotes mutual understanding, respect and cooperation in order to minimize conflict and at the same time to achieve the purposes of an organisation (Soni & Shukla, 2019, p.872). Furthermore, leaders' personal characteristics and competencies greatly impact the willingness of others to engage in positive interactions (Robbins et al., 2013, p.27). The very future events can never be predicted with full certainty, meaning administrative leaders also need فaaring plans

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based on foresight and crisis data (Fendi, 2013, p.89). Management effectively sets priorities, strategies and policies for the use of an organization's resources in order to achieve its objectives (Mahmoud, 2012, pp.10–11).

The researcher also supports that one of the strategic administrative goals in youth and sports forum should be to endeavor to achieve sustainable development; Therefore, it will lead toward realizing objectives with each Forum's vision and mission. Linguistically, the term "development" suggests growth and increase, which indicates a transition from a simple to more of an advanced and stable state (Mahdawi, 2013, p.4). The concept "development" does not have a single, rigid definition as it may refer to economic, social or environmental growth (Al-Obaidi, 2012:23). Education is referred to as a transformative process whereby learning is recognized—by UNSECO—as the main factor leading to sustainable development in humanity material and moral improvement over an ongoing period (Bourn et al., 2023, p.11) It also means satisfying the needs of the present generation without jeopardizing future generations to satisfy theirs (Mohsen, 2016: 27).

Theoretical significance: This research contributes to sports management literature by highlighting the importance of dialogical leadership and its role in promoting sustainable development in youth and sports forums in Baghdad, enriching academic discourse and providing a foundation for future studies.

Practical significance: It provides two measurement tools for assessing dialogical leadership and sustainable development from employees' perspectives, offering practical guidance to the Iraqi Ministry of Youth and Sports in fostering leadership dialogue and sustainability within its forums.

Based on this extended conceptual framework, the research problem lies in the question of how dialogical leadership and sustainable development coexist and interact within Baghdad's youth and sports forums. This study aims to develop legitimate scale for both variables as prior tool for measurement was not appropriate and to explore the impact of independent variable on dependent variable, so that these can help in enhancing the administrative reality of sports institutions which are key youth development centers. The research therefore aims to: (1) develop two scales for dialogical leadership and sustainable development, (2) identify their levels from employees' perspectives, and (3) examine the contribution and effect of dialogical leadership on sustainable development, hypothesizing that dialogical leadership results are positively correlated with and predictive of sustainable development outcomes.

Methodology

The nature of the research problem required the adoption of the descriptive method using the correlational approach, which is defined as "a systematic procedure for measuring two or more variables and determining the relationship between them, based on their natural state without any interference by the researcher in the outcomes of their measurement" (Al-Saleh, 2024, p.199).

The population boundaries of the study included employees working in three youth and sports forums in Baghdad: Al-Karkh, Al-Rusafa, and Sadr City, with a total population of 1,161 individuals. From this population, the main research sample was purposively selected from the Al-Rusafa Forum, which included 431 employees, representing 37.123% of the total population. After excluding individuals not covered by the research

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procedures—such as technicians and service workers—the final sample size consisted of 225 employees, representing 19.38% of the total population.

The sample was treated as one whole group, which was divided into three subsamples based on the needs and requirements of research. A pilot (exploratory) sample of 10 individuals (0.861% of population size) was randomly selected. Furthermore, 120 subjects (10.336%) were selected randomly to account for the scale-construction sample based on how we subsequently assigned five respondents each to the largest scales with respect to items 1-24 as this would increase accuracy by minimizing possible measurement error. The remaining 95 (8.183 of the total population) had also been residing within the Al-Rusafa Forum; this group constituted the numerically dominant part of the application sample, as shown in Table (1).

Table 1. *shows the description of the distribution of the research sample*

Characterization of numbers from the total origin community				Total Sample Number	Distribution of the three samples from the parent community		
					Number of Survey Sample	Number of Construction Sample	Application Sample Number
Forum	Research Sample	Excluded (206) On Leave	Service				
Al-Rusafa	431	57	149	225	10	120	95
Percentage (%)	37.123%	17.743%	19.38%	0.861%	10.336%	8.183%	

At the outset of the field procedures, the characteristics of the target sample for measurement were analyzed, revealing that participants' ages ranged between **22 and 61 years**, with actual service durations ranging from **7 months to 39 years**, and educational attainment ranging from **primary education to doctoral degrees**. The specificity of the measurement excluded variables associated with participants' tenure or work duration in the youth and sports forums in Baghdad. The construction process proceeded **procedurally together but analyzed separately statistically**.

The research problem highlighted the essential need to **diagnose and measure the two investigated phenomena** through the development of **two paper-and-pencil scales**, following a scientific methodology to reach the required solutions. Accordingly, the researcher adopted the following procedural steps and statistical treatments:

Clarifying the rationale for scale construction

The specificity of this research in addressing these two phenomena in sports management justified the development of the two scales from the employees' perspective as a logical basis for their construction.

Adopting the theoretical framework

The definitions and explanations presented in the theoretical frame of the study was taken as a guide for conceptualizing both phenomena relevant to sports management and to formulate scale items appropriate target sample.

Preliminary preparation of scale items

The researcher also followed conditions for item development, taking into account the relevance of each to sports management and to the target sample. The items were

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constructed in terms of three response options, “Always Agree,” “Sometimes Agree” and “Disagree,” that were rated using a Likert scale (3, 2, 1) respectively.

Face and content validity

To verify these psychometric criteria, a **paper-based questionnaire** was distributed to **17 experts in sports management**, including copies of both scales. Experts unanimously agreed (100%) to retain all items without modification in number or content, during the period from **Sunday, January 5, 2025, to Sunday, January 19, 2025**, confirming face and content validity.

Pilot testing of the scales

The pilot test was conducted on **10 individuals** from the experimental group at the youth and sports forum premises in Baghdad between **Tuesday, January 21, 2025, and Thursday, January 23, 2025**. The objectives were to identify potential difficulties in administering the scales during the main survey and to calculate the mean response time, which was approximately **8 minutes** per scale.

Construct validity (discriminatory power and internal consistency)

To meet this psychometric criterion, the scales were administered to the **scale-construction sample of 120 individuals** from **Sunday, January 26, 2025, to Wednesday, February 5, 2025**. Item scores were recorded, and statistical analyses were conducted as follows:

Discriminatory power of the scales

The **extreme groups method** was applied. After arranging the item scores in descending order, **27% of the total sample** was used to define two equal groups, each comprising **approximately 33 individuals**. Statistical analysis between these independent groups was performed using the **t-test for independent samples** to determine differences for each item, as presented in **Tables 2 and 3**.

Table 2. *Discriminatory Power Results for the Items of the Dialogical Leadership Scale in Youth and Sports Forums in Baghdad*

Item No.	Extreme Group	N	(M)	SD	T value	Sig.	Difference	Discrimination
1	High	33	2.55	0.506	13.533	0.000	Significant	Distinctive
	Low	33	1.12	0.331				
2	High	33	2.52	0.508	14.857	0.000	Significant	Distinctive
	Low	33	1.06	0.242				
3	High	33	2.45	0.506	10.437	0.000	Significant	Distinctive
	Low	33	1.24	0.435				
4	High	33	2.48	0.508	11.676	0.000	Significant	Distinctive
	Low	33	1.18	0.392				
5	High	33	2.52	0.508	12.541	0.000	Significant	Distinctive
	Low	33	1.15	0.364				
6	High	33	2.70	0.467	12.133	0.000	Significant	Distinctive
	Low	33	1.30	0.467				
7	High	33	2.79	0.415	14.761	0.000	Significant	Distinctive
	Low	33	1.24	0.435				
8	High	33	2.61	0.496	11.408	0.000	Significant	Distinctive
	Low	33	1.27	0.452				
9	High	33	2.73	0.452	11.079	0.000	Significant	Distinctive
	Low	33	1.42	0.502				
10	High	33	2.91	0.292	14.311	0.000	Significant	Distinctive
	Low	33	1.45	0.506				
11	High	33	2.70	0.467	16.760	0.000	Significant	Distinctive

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	Low	33	1.09	0.292				
12	High	33	2.82	0.392	20.312	0.000	Significant	Distinctive
	Low	33	1.09	0.292				
13	High	33	2.55	0.506	13.533	0.000	Significant	Distinctive
	Low	33	1.12	0.331				
14	High	33	2.67	0.479	14.471	0.000	Significant	Distinctive
	Low	33	1.15	0.364				
15	High	33	2.73	0.452	14.178	0.000	Significant	Distinctive
	Low	33	1.21	0.415				
16	High	33	2.76	0.435	15.461	0.000	Significant	Distinctive
	Low	33	1.18	0.392				
17	High	33	2.79	0.415	14.761	0.000	Significant	Distinctive
	Low	33	1.24	0.435				
18	High	33	2.58	0.502	9.619	0.000	Significant	Distinctive
	Low	33	1.39	0.496				
19	High	33	2.61	0.496	10.250	0.000	Significant	Distinctive
	Low	33	1.36	0.489				
20	High	33	2.97	0.174	18.454	0.000	Significant	Distinctive
	Low	33	1.33	0.479				
21	High	33	2.15	0.364	3.581	0.001	Significant	Distinctive
	Low	33	1.82	0.392				
22	High	33	2.45	0.506	5.854	0.000	Significant	Distinctive
	Low	33	1.79	0.415				
23	High	33	2.21	0.415	4.537	0.000	Significant	Distinctive
	Low	33	1.73	0.452				
24	High	33	2.39	0.496	5.381	0.000	Significant	Distinctive
	Low	33	1.79	0.415				

Note: Item discrimination: Sig. < 0.05 at the significance level of 0.05 with df = 64

Table 3. *Discriminatory Power Results for the Items of the Sustainable Development Scale in Youth and Sports Forums in Baghdad*

Item No.	Extreme Group	N	(M)	SD	T value	Sig.	Difference	Discrimination
1	High	33	2.82	0.392	14.286	0.000	Significant	Distinctive
	Low	33	1.30	0.467				
2	High	33	2.79	0.415	12.027	0.000	Significant	Distinctive
	Low	33	1.42	0.502				
3	High	33	2.91	0.292	13.974	0.000	Significant	Distinctive
	Low	33	1.48	0.508				
4	High	33	2.94	0.242	14.548	0.000	Significant	Distinctive
	Low	33	1.52	0.508				
5	High	33	2.58	0.502	13.195	0.000	Significant	Distinctive
	Low	33	1.15	0.364				
6	High	33	2.55	0.506	14.311	0.000	Significant	Distinctive
	Low	33	1.09	0.292				
7	High	33	2.48	0.508	10.243	0.000	Significant	Distinctive
	Low	33	1.27	0.452				
8	High	33	2.52	0.508	11.416	0.000	Significant	Distinctive
	Low	33	1.21	0.415				
9	High	33	2.61	0.496	12.942	0.000	Significant	Distinctive
	Low	33	1.18	0.392				
10	High	33	2.73	0.452	12.159	0.000	Significant	Distinctive
	Low	33	1.33	0.479				
11	High	33	2.82	0.392	14.839	0.000	Significant	Distinctive
	Low	33	1.27	0.452				
12	High	33	2.64	0.489	11.337	0.000	Significant	Distinctive

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	Low	33	1.30	0.467				
13	High	33	2.76	0.435	11.220	0.000	Significant	Distinctive
	Low	33	1.45	0.506				
14	High	33	2.94	0.242	14.857	0.000	Significant	Distinctive
	Low	33	1.48	0.508				
15	High	33	2.79	0.415	18.023	0.000	Significant	Distinctive
	Low	33	1.12	0.331				
16	High	33	2.85	0.364	17.903	0.000	Significant	Distinctive
	Low	33	1.18	0.392				
17	High	33	2.58	0.502	13.195	0.000	Significant	Distinctive
	Low	33	1.15	0.364				
18	High	33	2.70	0.467	13.094	0.000	Significant	Distinctive
	Low	33	1.24	0.435				
19	High	33	2.76	0.435	13.590	0.000	Significant	Distinctive
	Low	33	1.27	0.452				
20	High	33	2.79	0.415	15.418	0.000	Significant	Distinctive
	Low	33	1.21	0.415				
21	High	33	2.18	0.392	4.364	0.000	Significant	Distinctive
	Low	33	1.73	0.452				
22	High	33	2.21	0.415	5.381	0.000	Significant	Distinctive
	Low	33	1.61	0.496				
23	High	33	2.30	0.467	6.564	0.000	Significant	Distinctive
	Low	33	1.52	0.508				
24	High	33	2.42	0.502	8.093	0.000	Significant	Distinctive
	Low	33	1.42	0.502				

Note: Item discrimination: Sig. < 0.05 at the significance level of 0.05 with df = 64.

Secondly: Internal Consistency of the Two Scales

To fulfill the second psychometric requirement for the construct validity of the scales, the scores of the construction sample were statistically analyzed using the Pearson correlation coefficient. This analysis assessed the correlation between the score of each item and the total score of the scale to which it belongs. The results are presented in Tables (4) and (5) below:

Table 4. *Internal Consistency: Correlation between Each Item and the Total Score of the Dialogic Leadership Scale in Youth and Sports Forums in Baghdad*

Item No.	Correlation with Total Score (r)	Sig.	Item No.	Correlation with Total Score (r)	Sig.
1	0.638*	0.000	13	0.555*	0.000
2	0.642*	0.000	14	0.611*	0.000
3	0.532*	0.000	15	0.445*	0.000
4	0.685*	0.000	16	0.624*	0.000
5	0.553*	0.000	17	0.541*	0.000
6	0.462*	0.000	18	0.529*	0.000
7	0.616*	0.000	19	0.447*	0.000
8	0.524*	0.000	20	0.478*	0.000
9	0.692*	0.000	21	0.511*	0.000
10	0.614*	0.000	22	0.542*	0.000
11	0.572*	0.000	23	0.701*	0.000
12	0.656*	0.000	24	0.682*	0.000

*Item consistency: Sig. < 0.05 at a significance level of 0.05 with df = 118

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Table 5. *Internal Consistency: Correlation between Each Item and the Total Score of the Sustainable Development Scale in Youth and Sports Forums in Baghdad*

Item No.	Correlation with Total Score (r)	Sig.	Item No.	Correlation with Total Score (r)	Sig.
1	0.678*	0.000	13	0.575*	0.000
2	0.495*	0.000	14	0.561*	0.000
3	0.823*	0.000	15	0.605*	0.000
4	0.445*	0.000	16	0.482*	0.000
5	0.543*	0.000	17	0.641*	0.000
6	0.402*	0.000	18	0.543*	0.000
7	0.541*	0.000	19	0.647*	0.000
8	0.462*	0.000	20	0.418*	0.000
9	0.472*	0.000	21	0.482*	0.000
10	0.648*	0.000	22	0.545*	0.000
11	0.542*	0.000	23	0.584*	0.000
12	0.433*	0.000	24	0.639*	0.000

*Item consistency: Sig. < 0.05 at a significance level of 0.05 with df = n – 2 = 118

Reliability of the Two Scales

The researcher verified the reliability of the two scales by statistically analyzing the scores obtained from their application to the construction sample in this study using Cronbach's alpha coefficient. The reliability coefficient for the Dialogic Leadership Scale in Youth and Sports Forums in Baghdad was **0.914**, while the reliability coefficient for the Sustainable Development Scale in Youth and Sports Forums in Baghdad was **0.936**, with **df = 118** at a significance level of 0.05.

Normal Distribution of the Two Scales

To ensure the suitability of each scale for the targeted measurement sample, the scores of both scales were statistically analyzed for the construction sample to determine the normal distribution. The results are presented in **Table (6)**:

Table 6. *Final Statistical Indicators and Normal Distribution Values for Each Scale*

Scale Name	Construction Sample Size	Number of Items	Total Score Range	Mean	Standard Deviation	Skewness
Dialogic Leadership in Youth and Sports Forums in Baghdad	120	24	24–72	51.95	2.397	0.496
Sustainable Development in Youth and Sports Forums in Baghdad	120	24	24–72	54.25	2.639	0.302

Note: The distribution is considered approximately normal if the skewness value lies within ±1.

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Final Versions of the Scales

Upon completing the construction procedures and statistical analyses on the construction sample, both scales were finalized (Appendices 1 & 2), with a total score range of **24–72** for each scale and a theoretical midpoint of **48**. This means that higher scores on each scale indicate a higher perceived level of the respective phenomenon from the perspective of the responding individual.

Main Survey Procedure (Application of the Scales)

The testing scenario ran from February 9 -February 27, 2025 for the main application sample of 95 subjects. This has been done directly to collect the perceptions of the employees at Al-Rusafa Youth and Sports Forum regarding the two investigated phenomena. Each paper-based scale was coded and entered separately for analysis.

Statistical Methods

The data were processed electronically using **SPSS**. Analyses included percentages, means, standard deviations, independent-sample t-tests, Pearson's correlation coefficient, Cronbach's alpha, Pearson skewness coefficient, one-sample t-tests, and linear regression analysis.

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Results

Table 7. *Comparison of the Mean Score of Each Scale with Its Theoretical Midpoint*

Scale	Total Score	Theoretical Midpoint	Mean	Standard Deviation	Mean Difference	t	Sig.	Significance
Dialogic Leadership in Youth and Sports Forums in Baghdad	72	48	52	2.768	4	14.087	0.000	Significant
Sustainable Development in Youth and Sports Forums in Baghdad	72	48	54.08	2.945	6.08	20.136	0.000	Significant

Unit of measurement: points. The difference is considered significant if (Sig) < 0.05 at df = n–1 = 94 and significance level = 0.05.

Table 8. *Correlation between Scale Scores, Simple Linear Regression, Contribution Percentage, and Standard Error*

Independent Variable	Dependent Variable	Pearson Correlation (R)	Linear Regression Coefficient	R^2 (Coefficient of Determination)	Contribution (%)	Standard Error of Estimate
Dialogic Leadership	Sustainable Development	0.825	0.68	0.677	67.7%	1.674

Table 9. *Results of the F-Test for Evaluating the Fit of the Linear Regression Model Between Scale Scores*

Independent Variable	Dependent Variable	Source of Variation	Sum of Squares	df	Mean Square	F	Sig.	Significance
Dialogic Leadership	Sustainable Development	Regression	554.756	1	554.756	197.997	0.000	Significant
		Residual	260.571	93	2.802			

Interpretation: The regression model is considered significant if the Sig. value < 0.05 at a significance level of 0.05.

Table 10. *Results of Constant and Slope (Effect) Estimates for the Scale Scores*

Dependent Variable	Independent Variables	Beta (β)	Standard Error	t	Sig.	Significance
Sustainable Development	Constant	8.44	3.248	2.598	0.011	Significant
	Dialogic Leadership	0.878	0.062	14.071	0.000	Significant

Interpretation: The effect is considered significant if the Sig. value < 0.05 at a significance level of 0.05.

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Discussion

The results in Table (7) indicate that the mean scores of the two investigated phenomena exceeded the hypothetical mean for each respective scale. Moreover, a review of Table (8) demonstrates that an increase in dialogic leadership is positively correlated with sustainable development, such that higher levels of dialogic leadership correspond to a greater positive effect on sustainable development, as perceived by employees in the Youth and Sports Forums. This relationship was further confirmed by the F-test results in Table (9), which indicated the strong fit of the linear regression model. Subsequently, Table (10) confirmed the significance and effect of dialogic leadership on increasing sustainable development outcomes in the Youth and Sports Forums in Baghdad.

The researcher attributes these findings for the dialogic leadership scale to the participants' perception of the forum director as consistently demonstrating the following behaviors: being decisive in discussing various decisions with employees, reconciling differing employee opinions when making decisions, clearly defining responsibilities with impartiality, implementing the annual plan in a climate of employee satisfaction, avoiding speculation regarding employee responses in various circumstances, maintaining accountability without delay in difficult situations, occasionally correcting employee errors through immediate guidance, relying on trusted intermediaries to convey information, communicating respectfully with employees who disagree, striving to gain the cooperation of all employees rather than engaging in conflict, providing guidance smoothly and logically, delegating certain responsibilities to enhance coordination, simplifying instructions to facilitate understanding, mitigating employee stress in challenging situations, reviewing policies following mistakes, managing complex disagreements constructively, supporting competent human resources, and refraining from biased opinions when evaluating employee input.

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Similarly, the sustainable development scale results are attributed to employees' perception that management consistently encourages participation in decision-making for future planning, clearly explains budgetary details for upcoming activities, avoids speculative assumptions regarding employee task performance, identifies potential delays in implementation, capitalizes on opportunities to support the annual program, sometimes utilizes media to clarify available resources, immediately addresses technical errors, mitigates employee stress during difficult situations, reviews actions following mistakes, handles complex challenges decisively, uses databases to inform annual planning objectives, establishes timelines to facilitate supervision, considers the capabilities of staff in implementation, monitors task execution effectively, expresses goodwill toward employees, assumes non-supervisory responsibilities when necessary, anticipates potential obstacles, communicates ministry evaluations to employees, allows some flexibility in task evaluation, and ensures alignment between supervision and achievement of planned goals. Collectively, these practices demonstrate the positive contribution of dialogic leadership to enhancing sustainable development in the Youth and Sports Forums in Baghdad.

This aligns with previous research indicating that:

Dialogic leadership fosters a healthy work environment, increases positive employee emotions, enhances creativity, and promotes an open climate with improved understanding of human interaction (Lemmetty & Collin, 2020, pp. 197–198).

Successful leadership is a process of influencing a group toward specific goals, requiring polite, persuasive, and practical approaches to gain respect and compliance (Abdulrahman, 2021, p. 26).

Effective administrators must develop their capabilities to contribute to problem-solving (Raja & Ibrahim, 2019, p. 122).

Dialogic leadership promotes mutual understanding, listening, respect, conflict resolution, and cooperative work toward shared administrative goals (Soni & Shukla, 2019, p. 872).

Effective management involves scheduling tasks chronologically and linking them systematically (Al-Ajmi, 2013, p. 66).

Employees perceive distributive justice by comparing their received benefits relative to others' inputs and outputs (Atef, 2011, p. 312).

Achieving institutional objectives requires competent personnel with high scientific, leadership, and administrative capabilities (Nouri, 2017, p. 20).

Senior management bears responsibility for adopting modern technologies and keeping pace with administrative competition (Al-Khasawneh, 2018, p. 23).

Workplace social competencies depend on advanced social skills that allow adaptation to the work environment and practical application of knowledge (Birknerová, 2011, p. 243).

Organizational advancement is hindered if authority overlaps create conflicts with established procedures (Al-Roudan, 2024, p. 173).

Positive work attitudes enhance performance, satisfaction, and reduce turnover, while understanding these attitudes is essential for effective human resource management (Peláez-Fernández et al., 2020, p. 2).

A competent dialogic administrative leader strategically exploits, explores, and responds to implement sustainable practices (Jacobs & Maritz, 2020, p. 3).

Inclusive management integrates diverse employee input into organizational strategy, strengthening relationships and fostering engagement (Brogan, 2018, p. 8).

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Higher levels of sustainable development indicate effective administration, the achievement of vision and goals, and sound planning (Armstrong, 2014, p. 167). Sustainable development can be achieved by activating mutual understanding between employees and management (Al-Tamimi, 2018, p. 177).

In conclusion, these findings suggest that dialogic leadership positively impacts sustainable development in Youth and Sports Forums by fostering participatory decision-making, systematic planning, and a supportive organizational climate.

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Conclusions

1. It can be said that the scales of Dialogic Leadership and Sustainable Development in Youth and Sports Forums in Baghdad are appropriate for their intended purpose (to measure the aspect of employees), as well as having scientific foundations with psychometric properties to assess these two phenomena in sports administration.
2. Employees perceive a moderate level of dialogic leadership in the Youth and Sports Forums in Baghdad.
3. The level of sustainable development that can, according to the employees' point of view, identified in Baghdad Youth and Sports Forums.
4. In the youth and sports forums in Baghdad, an increase is also created with regard to dialogic leadership and contributes positively to sustainable development displaying a positive direct efficiency.
5. Regular measurement and evaluation of dialogic leadership and sustainable development must be improved in the assessment of the status of dialogic leadership and s...
6. The necessity to engage employees in the Youth and Sports Forums in Baghdad with administrative development to prepare employees capable of dialogue with their leaders and promote sustainable development within their respective forums.

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The Effect of Elastic Resistance Band Training on Developing Muscular Power and Reactive Agility in Under-18 Basketball Players

Dhulfiqar Fadhil Mohammed [1] Hussein Jassim Samoum 2 Ahmed Amer Abdulhussein[3]
1,2.3 University of Baghdad, College of Physical Education and Sports Sciences

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Abstract

The study aimed to identify the effect of elastic resistance band training on developing lower- and upper-limb muscular power and reactive agility among under-18 basketball players. The experimental method was used with a pre- and post-test design for two equivalent groups (experimental and control). Twelve Al-Defaa Al-Jawiy volleyball players were randomly assigned into two groups of six individuals. The experimental group underwent an 8-week training program using elastic resistance bands, with a frequency of three times per week, independent of the traditional intervention applied to the control group. Strength of the lower-limb musculature was assessed by vertical jumping, strength of the upper-limb musculature by medicine ball throwing and reactive agility using visual reaction time testing. The post-test results showed statistically significant differences that favored the experimental group in all research variables and exhibited a tendency of muscular power and reactive agility improvements when compared with the control group. It was founding that elastic resistance band training can be an effective and safe way to develop these physical abilities associated with skill performance in youth basketball due to its generation of the progressive resistance, which contributes to the neuromuscular benefits and movement efficiency.

Keywords: elastic resistance bands, muscular power, reactive agility, basketball, youth players.

[1] University of Baghdad, College of Physical Education and Sports Sciences.
Thulfiqar.F@cope.uobaghdad.edu.iq
[2] University of Baghdad, College of Physical Education and Sports Sciences.
hussain.j@cope.uobaghdad.edu.iq
[3] University of Baghdad, College of Physical Education and Sports Sciences.
ahmed.a@cope.uobaghdad.edu.iq

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Introduction

Basketball is one of the most dynamic and high-intensity team sports that demands advanced levels of physical, neuromuscular and perceptual capabilities in order to execute successfully under constantly changing game scenarios. Two of the most important influences on match performance in youth basketball are increasing muscular power and enhancing reactive agility as these can help young players directly with sprinting, jumping, defensive transitions, and rapid decision-making during competitive play. Indeed, current sports science has stressed the importance of integrating strength training with perceptual-motor training to reach maximum performance effects in open-skill sports such as basketball (Sacot et al., 2022).

Reactive agility is defined as the ability of an individual to redirect his or her body in response to a stimulus and forms part of a complex interrelationship between cognitive tasks, neuromuscular coordination and biomechanical performance. In basketball, such an ability is of paramount importance as offensive and defensive actions develop unpredictably and players must react at the cognitive level based on information gathered from the eye. In youth basketball players, large effects in multidirectional speed, jumping performance and agility have been found when comparing neuromuscular training versus control (Sacot et al., 2022; Hassan & Abdulkareem, 2025).

Highly explosive muscular power in both the leg and arm muscles also contribute to basketball performance. It has a direct bearing on vertical jump, rebounding ability, shooting skill, sprint acceleration and defensive effort. Explosive strength indicators are significantly improved by resistance training in adolescent basketball players sharing the view that no damage is caused to their physical development and health (Santos & Janeira, 2012). In addition, organized strength training programs are important in enhancing rate of force development and sport-specific performance (Zhu et al., 2024; Abdulghani et al., 2025).

Elastic resistance band training has gained popularity as a practical and effective modality in strength and conditioning programs in current times. They exert variable resistance which grows with stretching and thus athletes can feel the effect of progressive loading across the entire range of motion, influencing neuromuscular activity patterns (Stanković et al., 2025; Amer & Al-juboori, 2024). A mechanical load of this type is compatible with the so-called strength curve of muscles, and may more potently stimulate force production, as well as coordination, compared to constant-load resistance training in certain situations (Ferreira et al., 2025; Hassan & Abdulkareem, 2026).

Increasing evidence from literature has endorsed the beneficial effects of elastic resistance band training in enhancing performance related physical characteristics. In a systematic review and meta-analysis with team-sport athletes, the authors of that study concluded that there would be likely changes in lower-limb explosive power, change-of-direction performance, and sprint time after elastic band training interventions (Stanković et al., 2025). Furthermore, experimental studies have demonstrated that resistance band

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exercises are effective in improving muscle strength and functional performances of young athletes (Granacher et al., 2016).

Sport-specific elastic band training has also shown positive effects designed for basketball players. Studies have shown that resistance band training can stimulate the increase of arm leg muscular power, passing improvement, and shooting from a farther distance while increasing basketball players overall performance as well as beneficial to rebounding actions (Mulya & Kusdinar, 2025). Furthermore, complex elastic band training sessions have proven to be effective in physical performance factors like strength, agility and speed during controlled periods of development (Naclerio et al., 2013).

Elastic resistance training exercises also seem to be effective in improving multidirectional speed and movement efficiency, which have a high correlation with reactive agility. Short-term interventions with elastic band sidestep exercises have achieved meaningful enhancements in multidirectional sprint performance, suggesting a potential for agility development (Núñez-González et al., 2025). These results support the implementation of resistance band training into sport-specific conditioning models aimed at enhancing physical and reactive performance characteristics.

Although increasing amount of research on resistance training, few studies have investigated the effects of elastic resistance band training on muscular power and reactive agility in male adolescent basketball players. Much of the available literature has also examined only strength, sprint, or general agility characteristics in isolation without exploring the relationship between neuromuscular power production and reactive movement responses within a basketball-specific setting (Sousa et al., 2025).

Additionally, these interventions were particularly effective due to the rapid evolution of neuromuscular adaptations during adolescence when strength training is focused. Safe and versatile training tools such as elastic bands are particularly appropriate for this population, enabling progressive loading with minimum amount of mechanical stress while stimulating coordination and functional movement patterns (Coşkun 2025; Kumar & Amer, 2024).

When it comes to basketball training for youth, most programs only use traditional and often outdated strength exercises to prepare young athletes for playing time. Although the use of elastic resistance band training is increasing within strength and conditioning, to our knowledge little is known about their simultaneous effect on these two performance variables in U18 basketball players with a clear research gap for evidence-based practice.

Research Objectives

1. Identify the effect of elastic resistance band training on muscular power in under-18 basketball players.
2. Determine its effect on reactive agility.
3. Compare post-test results between experimental and control groups.

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Research Hypotheses

1. Elastic resistance band training positively affects muscular power and reactive agility in under-18 basketball players.
2. Significant improvements will appear in post-tests for the experimental group.
3. Post-test results will favor the experimental group over the control group.

So, examining the possibility of the utilization of elastic resistance band training in improving muscular power and reactive agility amongst under- 18 basketball players will be scientific and practicality. Knowledge of this relationship may facilitate the development of evidence-based training programs and enable coaches to deliver effective, safe and sports specific conditioning programs for the enhancement of performance development in young athletes.

On that basis, the objective of this study is to investigate the influence of elastic band resistance training towards developing muscular power and reactive agility in U18 basketball players, providing some empirical evidence to support contemporary strength and conditioning methodologies for junior basketball development.

Methodology

Study Design

This experimental research used a pre-test–post-test design with experimental and control groups to examine the impact of elastic resistance band training on muscular power and reactive agility in under-18 basketball players. The study design was chosen because it is appropriate for identifying causal relationships between training interventions and performance outcomes in controlled settings. Physical performance testing by standardized tests was performed for both groups before and after the intervention.

Participants

Study Sample The sample included 12 male basketball players (age <18 years) Al-Defaa Al-Jawiy Sports Club who were currently registered in adolescent training programs and participated regularly in team practice sessions. All the subject were recruited using a purposive sampling method with specific inclusion criteria of at least 2 years' regular training history, no musculoskeletal injuries in the past 6 months.

The participating players (n=12) were randomly divided in two groups, an experimental group (n = 6), which performed elastic resistance band training combined with normal basketball practice, and a control group (n = 6), who continued with traditional training exclusively.

Subjects were also assigned into two groups at random: a training group who used elastic resistance band exercises as well as regular basketball practice and a control group who only had traditional basketball training. The two groups in the study were identical

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with regard to the research variables (muscular power and reactive agility), before implementation of intervention, As indicated by table 1.

Table 1. Pre-Test Equivalence Between Experimental and Control Groups in Research Variables

Variable	Group	Mean	SD	t-value	Sig. (p)
Lower-Limb Muscular Power (Vertical Jump, cm)	Experimental (n=6)	46.8	3.9	0.41	0.69
	Control (n=6)	45.9	4.2		
Upper-Limb Muscular Power (Medicine Ball Throw, m)	Experimental (n=6)	4.72	0.41	0.38	0.71
	Control (n=6)	4.68	0.39		
Reactive Agility (sec)	Experimental (n=6)	7.21	0.34	0.37	0.71
	Control (n=6)	7.28	0.31		

Training Intervention

The experimental group did a comprehensive elastic resistance band protocol that was added to the regular basketball training. The intervention was carried out in 8 weeks with 3 sessions per week. Each training session was 25–30 minutes long and occurred during the core portion of the training module.

This training program also included exercises to improve muscle power and movement efficiency in the upper and lower extremities. Interventions included resisted jumps, lateral movements, sprint starts, arm extension exercises and sports specific movement patterns with elastic bands. Training loads were progressively increased by increasing band resistance, repetitions and movement velocity in order to maintain constant neuromuscular adaptation, as shown in table 2.

Table 2. Training Program Structure Using Elastic Resistance Bands for the Experimental Group

Week	Training Frequency	Session Duration	Training Intensity	Main Exercises Using Elastic Bands	Targeted Physical Aspect
1	3 sessions/week	25 min	Low–moderate	Resisted squats, arm extensions, lateral band walks	Neuromuscular adaptation
2	3 sessions/week	25 min	Moderate	Resisted jumps, side shuffles, chest press with band	Muscular activation
3	3 sessions/week	30 min	Moderate	Sprint starts with band, resisted lunges, overhead press	Lower & upper limb power

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4	3 sessions/week	30 min	Moderate–high	Lateral reactive movements, resisted acceleration drills	Reactive movement efficiency
5	3 sessions/week	30 min	High	Plyometric jumps with band, arm power drills, resisted cuts	Explosive muscular power
6	3 sessions/week	30 min	High	Multidirectional sprint drills, resisted defensive slides	Reactive agility
7	3 sessions/week	30 min	High	Complex drills (jump + sprint), sport-specific band movements	Power & agility integration
8	3 sessions/week	30 min	High (progressive)	Game-like reactive drills with band resistance	Performance optimization

The control group continued with traditional basketball training programs that included technical, tactical, and general physical preparation without the use of elastic resistance bands.

Measurements and Testing Procedures

Muscular Power Assessment

Muscular power was determined with two field standard tests widely used in basketball performance assessment. The maximal vertical jump test that has been reported to be valid in assessing neuromuscular function and force generation capabilities was used for determining LL-EP. All subjects performed maximal vertical jumps from a standing position and the jump height was measured to the nearest centimeter after several trials, with the best result being accepted for analysis (Markovic et al., 2004). Upper limb muscle power index was assessed using the seated medicine ball throw test, in which athletes were asked to push a standardized medicine ball forward from sitting position with both hands to focus on upper body explosive power. This was quantified in metres, and the best of several measurements was taken. This test has been shown to have high validity and reliability as an index of upper-body power in athletic populations (Stockbrugger & Haennel, 2001).

Reactive Agility Assessment

Reactive agility Performances were calculated with a specific sport reactive agility test used to measure subjects' ability to respond to visual external stimuli and to perform changes of direction rapidly within a game-context. Players were instructed to begin the test in a ready position and react to visual stimuli presented in random order (left, right or forward) for movement direction then sprinted and changed direction as fast as they could. Unplanned movement reactions, not pre-programmed direction changes, were emphasized within the protocol, in line with the perceptual–motor demands of basketball activity. Time to complete the test was recorded using electronic timing gates, in order to guarantee measurement validity and reliability, and the athletes performed a number of trials with their best performance used in statistical analysis. This type of reactive agility test has been well established as a valid tool to measure agility performance, which includes elements

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of decision-making and neuromuscular capacity in team-sport players (Sheppard & Young, 2006).

Pilot Study

pilot study was conducted to assess the feasibility of testing procedures, estimate appropriate resistance levels for elastic bands and test reliability of measuring tools. The pilot sample were demographically matched players to those in the main study who were excluded from analysis.

Statistical Analysis

Data were analyzed using SPSS ver.26. Means and standard deviations were computed for all variables. Equivalence between groups at baseline was evaluated by independent samples t-tests and within group differences extracted for pre- to post-test scores using paired samples t-tests. ANCOVA was utilized to detect the differences between experimental and control groups in post-tests using pre-test scores as covariates. Statistical significance was established at ($p \leq 0.05$).

Results

Table 3. Paired Samples t-test for Pre- and Post-Tests Within Each Group in the Research Variables

Variable	Group	Pre-test Mean ± SD	Post-test Mean ± SD	t-value	Sig. (p)
Lower-Limb Muscular Power (Vertical Jump, cm)	Experimental (n=6)	46.8 ± 3.9	54.6 ± 4.1	5.12	0.002
	Control (n=6)	45.9 ± 4.2	47.1 ± 4.0	1.21	0.25
Upper-Limb Muscular Power (Medicine Ball Throw, m)	Experimental (n=6)	4.72 ± 0.41	5.61 ± 0.46	4.63	0.003
	Control (n=6)	4.68 ± 0.39	4.85 ± 0.44	1.08	0.30
Reactive Agility (sec)	Experimental (n=6)	7.21 ± 0.34	6.32 ± 0.29	5.48	0.001
	Control (n=6)	7.28 ± 0.31	7.11 ± 0.33	1.17	0.26

Table 4. Independent Samples t-test for Post-Test Comparison Between Experimental and Control Groups in Research Variables

Variable	Group	Mean ± SD	t-value	Sig. (p)
Lower-Limb Muscular Power (Vertical Jump, cm)	Experimental (n=6)	54.6 ± 4.1	3.27	0.009
	Control (n=6)	47.1 ± 4.0		
Upper-Limb Muscular Power (Medicine Ball Throw, m)	Experimental (n=6)	5.61 ± 0.46	3.11	0.011
	Control (n=6)	4.85 ± 0.44		
Reactive Agility (sec)	Experimental (n=6)	6.32 ± 0.29	3.45	0.007
	Control (n=6)	7.11 ± 0.33		

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Table 5. ANCOVA Results for Post-Test Differences Between Experimental and Control Groups Controlling for Pre-Test Scores

Variable	Source	Sum of Squares	df	Mean Square	F-value	Sig. (p)	Effect Size (η^2)
Lower-Limb Muscular Power (Vertical Jump)	Pre-test (covariate)	42.31	1	42.31	4.18	0.071	0.32
	Group	156.84	1	156.84	15.49	0.003	0.63
	Error	91.12	9	10.12			
Upper-Limb Muscular Power (Medicine Ball Throw)	Pre-test (covariate)	0.84	1	0.84	3.92	0.079	0.30
	Group	2.97	1	2.97	13.86	0.004	0.60
	Error	1.93	9	0.21			
Reactive Agility	Pre-test (covariate)	0.51	1	0.51	4.06	0.075	0.31
	Group	2.14	1	2.14	16.98	0.002	0.65
	Error	1.13	9	0.13			

Discussion

The purpose of the present was to determine the impact of elastic resistance band training on muscle power (upper and lower extremity) as well as reactive agility among under-18 basketball players. The results of this study revealed statistically significant differences in all studied variables for the experimental group as compared to their pretest scores and with the control group at posttest. These findings substantiate that the application of elastic resistance band training is an efficient functional strength and neuromuscular development in youth basketball.

In lower extremity muscle power testing, significant improvement in the vertical jump performance of EG was noted for improved expression of explosive force. This could be explained by the resistance from the elastic bands which, through its variable nature, causes greater neuromuscular activation and improved production of force velocity during dynamic actions. Variable resistance training through accommodating resistance has been demonstrated to increase motor unit recruitment, and maximal strength in young athletes with the ability to match the natural, force-velocity curve of movement (Wilson, 2012; Shi et al., 2022). In addition, elastic resistance exercises can lead to increased concentric and eccentric muscle actions which may enhance neuromuscular coordination and power production during jumping tasks (Suchomel et al., 2016; Abdulkareem & Hassan, 2025).

Specifically, related to upper-limb muscle power, an improvement was also achieved in the medicine ball throws for experimental subjects. This finding implied that the training with resistance bands is successful in promoting upper-limb explosive strength, a key ingredient for basketball skills like passing, throwing and jumping. Prior studies have suggested that resistance-based training interventions enhance the upper-body power of individuals by enhancing neural-drive, intermuscular-coordination and movement efficiency (Comfort, et al., 2014; Finlay et al., 2022). They also offer a line of resistance designed to provide continuous tension during movement, promoting better

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force development and sport-related adaptations (Page & Ellenbecker, 2019; Abdel Abbas & Abdel Hussein, 2025).

It was observed that there were differences in the improvement measurements between two groups for the reactive agility, while an improvement was obtained of the experimental group, on the other hand it wasn't evidenced such kind of improving by the control group. This result suggests that a combination of sport-specific movement-based drills and resistive exercises are important for improving agility performance. Reactive agility is not only dependent on physical strength but also includes perceptual motor processing and decision-making speed. Integrative training, which consists of strength training combined with reaction and movement variability training for the improvement of agility performance, has been reported to be more successful than traditional types of training (Young & Farrow, 2006; Paul et al., 2016). The improvement in reactive agility may have been due to improved movement efficiency, rate of force development, and the level to which forces could be applied quickly while performing multidirectional tasks through elastic resistance training.

The results of ANCOVA further verified that the gains made by participants in the experimental group were unlikely to be accounted for by pre-existing differences between groups, but rather reflected intervention effects. There were large effect sizes for all variables as a result of elastic resistance band training suggesting that the practical significance of elastic resistance band training on youth basketball performance was actually quite substantial. These results are in agreement with modern strength and conditioning practices, when resistance training should be integrated to sport specific motor skills for maximum athletic development (Behm et al., 2017; Lloyd et al., 2012).

Developmentally, adolescence is a vital time for neuromuscular dynamic and motor aptitudes. Interventions delivered at this time during training have a great potential to affect subsequent years' performance. Elastic resistance bands offer a safe and adaptable form of resistance training, which a young athlete can use to progressively increase the regularity, volume and intensity of exercises without placing extraordinary mechanical load on themselves (Faigenbaum & Myer, 2010; Abdulkareem & Sattar Jabbar, 2025). The positive changes seen in the present study suggest that a structured resistance band program should be implemented in basketball training networks to improve both physical and reactive components of performance.

In summary, the findings of this study suggested that adding elastic resistance bands exercise to standard basketball training may be associated with substantial improvements in lower body muscle power and force, upper body muscle power and reactive quickness performance. The results of the present research validate variable resistance training as a challenging tool to enhance sport-specific physical performance in under-18 basketball players. They also provide increased support for the inclusion of both strength and perceptual–motor training into future developmental programs designed to optimize performance gains in young people.

Conclusions

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Results suggest that performing training exercise with elastics significantly improves the lower-extremity muscle power, upper- extremity muscle power and reactive agility of U18 basketball players. Results of performance variables showed significant differences for the experimental group compared with the control, in favor of VRT to improve neuromuscular efficiency and sport-specific performance characteristics. Such results support the importance of introducing elastic resistance training in youth basketball to assist with athletic development and physical performance.

Recommendations

Practical implications Coaches and strength conditioning professionals are recommended to incorporate elastic resistance band training in conventional youth basketball training regimens focused on muscular power and reactive agility. Your training should also include range-based workouts and sport-specific drills to increase the effectiveness of your program. It is suggested that future research should further investigate long-term effects of elastic resistance training in different age groups, playing position and other physical and skill characteristics in basketball.

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Analysis of Turnovers and Their Relationship with Total Shooting Attempts According to Game Situations for Teams Qualified for the Semifinals of the Iraqi Professional Basketball League (2023-2024)

Elaf Ahmad Mohammed [1] Ghadah Muayad Shihab [2]

[1,2] University of Baghdad, College of Physical Education and Sports Sciences.

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Abstract

This study aims to analyze ball possession loss (Turnovers) and its relationship with the total shooting attempts in different play situations for the teams that qualified for the semifinals of the professional Iraqi Basketball Premier League for the (2023-2024) season. Data were collected from the matches played by the four qualified teams: Al-Naft, Al-Karkh, Al-Shorta, and Al-Difaa Al-Jawi. The study examined the relationship between ball possession loss and total shooting attempts (considering each shot attempts as a possession, control, and offensive play), including two-point attempts, three-point attempts, and free throws resulting from minor personal fouls and compound fouls. The results revealed a negative correlation between ball possession loss and two-point shooting attempts, whereas a positive correlation was observed between ball possession loss and three-point shooting attempts. Furthermore, it was found that teams with fewer turnovers achieved higher shooting accuracy from inside the arc and lower shooting accuracy from beyond the arc. Based on these findings, the study recommends developing fundamental ball-handling skills (passing, dribbling, and fit timing), enhancing offensive tactical diversity and strategy, and reducing defensive errors to increase opportunities for executing free throws.

Keywords: Analysis, ball possession, shooting, basketball.

Introduction

Basketball is regarded as one of the most popular and widely played sports globally, relying on a combination of physical, technical, tactical, and strategic skills. This game

[1] University of Baghdad, College of Physical Education and Sports Sciences.
elaf.mohammed@cope.uobaghdad.edu.iq .
[2] University of Baghdad, College of Physical Education and Sports Sciences
dr.ghada@cope.uobaghdad.edu.iq

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necessitates precision in performance, rapid decision-making, and high coordination between the offensive and defensive aspects of the team. Among the factors influencing match outcomes, turnovers are a significant aspect (particularly psychologically) that can directly affect the flow of the game and its level, providing a positive performance and high morale for the team in possession of the ball, as well as for the team applying pressure effectively and accurately. The loss of ball possession grants the opposing team an additional opportunity to score while depriving the team that has lost possession of a chance to score, which may alter the trajectory of a quarter, half, or even the entire match and its result.

Turnovers are defined as instances in which a team loses the ball to the opposing team due to individual and collective violations (such as three seconds, traveling, double dribble, five seconds of various types, out-of-bounds, and collective violations like the eight-second backcourt violation due to defensive pressure, as well as the 24-second shot clock violation due to strong defense that does not allow for easy shooting opportunities), as well as incorrect passes and ball thefts committed by the opposing team as a result of significant pressure. These instances are considered factors that weaken the offensive performance of the team in general and of the players in particular, as they reduce the number of available scoring opportunities (after defensive efforts to transition to offense, only to lose the ball easily), leading to a rapid transition (from defense to offense) in favor of the opposing team.

On the other hand, the effectiveness of offensive performance depends on the ability to execute shooting attempts with high accuracy, whether from within the three-point arc (two-point shots) or from beyond the three-point arc (three-point shots), or by capitalizing on free throw opportunities. Thus, examining the association between turnovers and the overall shooting opportunities by game situations is an effective way to get some understanding of how to improve offense efficiency and prevent the negative effect brought by ball loss.

This study will also investigate turnovers and their relationship to the total number of shooting attempts when taking game situations into account for semifinals-qualified teams in the Iraqi Professional Basketball League over the 2023–2024 season, as it seeks to establish whether there are circumstances whereby turnovers affect a team's shooting performance as well as whether such variables exhibit correlational relationships. Furthermore, it will also help the others such as the coach and analyst to provide technical recommendations for each player and coach to prevent turnovers with reduction of time that an offensive opportunity is wasted.

The significance of this study is that it focused on one of the factors that affect the match result in basketball games, because it makes a clear relationship between turnovers and offensive performance for teams playing in Iraqi Professional Basketball League. Such outcomes might help the improvement of the teams' technical performance (by creating tactics that reduce intrusions and promoting a greatest use of every scoring opportunity) in order to reach better results, in future events.

Turnover problem is an important problem in basketball teams because more turnovers a team give away, less chances they have to score, and this situation can reduce the success of such basketball game: coach may lose the game (sometimes he would be forced to do so) when he gives his timeout at an unfortunate time. In view of the value of this possible aspect, investigations have been scarce that explore the importance of the ball

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possession loss on FG in different game play situations within a given league (e.g., Iraqi Professional Basketball League or any other local competition).

This research problem is summarized in the next primary question:

How much does ball loss of possession impact the overall number of shooting attempts by play situation in the teams that qualified for the semi-finals at Iraqi Professional Basketball League for season 2023-2024?

This leads to other questions, such as:

1. Do different have relationship between ball possession loss and two-point shooting attempts?
2. Wouldn't loss of ball possessions influence the number of three point shots?
3. Does turnover percentage relate to the fouls and free throws attempted?
4. What is the effect of losing possession on offensive outcomes and how does it vary between semifinal-qualifying teams?

This research should be pursued to meet a number of primary objectives, including the most important ones which are:

1. To investigate into the effect of losing ball possesson on the offensive play in a team's performance by examining as much at possible, how it affects the number of shot attempts of different kinds.
2. To examine the level of correlational relationship between the loss of ball possession and shooting attempts (including two point shot, three-point shot, and free throws).
3. To obtain findings and suggestions for coaches, analysts and players to minimize the loss of ball possession while improving offensive performance by generating effective playing strategies.
4. To compare the teams that reached the semifinal in order to determine how much does each team loses if it loses a ball possession, as well as how does this impact varies depending on which team is playing.

At the light of prior research and the preliminary data analysis, we are led to suggest:

1. There is a significant and negative relationship between loss of ball possession and numbers of two-point shot attempts which can be interpreted such that, the more frequently losing the ball, there are fewer two point shooting opportunities for these teams from inside the arc.
2. The increase in shots from 3-point range as a function of possessions lost could suggest that teams who are more frequent losers of the ball (and hence miss offensive chances) resort to taking longer, higher-risk shots.

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3. There is a negative relationship between loss of possession and free throw attempts, signifying that the more teams loose possession, they get less chances to score as free throws.

4. The effect that ball possession loss has on a teams' offensive outcome is different for the qualifying teams to the semi-finals, those being some of the competing teams may have better counter strategies at minimizing their own ball possession loss.

Methodology

Research Community

The study sample was all the teams that were playing in the Iraqi Professional Basketball League season 2023-2024. It consists of teams played in the season before of both preliminary rounds and play-off round. In as much as the objective of this work is to unpack the relationship between ball possession loss and shooting attempts in diverse match contexts, it is instructive that we narrowed our analyses to semifinalist teams because they represent an elite competitive segment of the league.

Research Sample

The four teams that qualified for the semifinals of the Iraqi Professional Basketball League for the 2023-2024 season have been selected as the research sample, which includes:

1. Al-Naft Club
2. Al-Karkh Club
3. Al-Shorta Club
4. Al-Defaa Al-jawi Club

Justifications for Sample Selection

1. The teams that makes it to the semifinals will be the best in the Iraqi Professional in Basketball League, which are considered elite teams and enhance higher performance analysis accuracy.

2. Statistical figures for these very few teams that have made the quarter-finals are easy to come by, unlike other teams who never got this far.

3. These groups display varying approaches to ball loss and shooting management, making it possible to assess the relationship between these two factors with some clarity.

4. With a reliance on teams in the same performance level, there will be an increase in preciseness regarding statistical analysis; as it reduces interferences not related to research.

Data regarding independent teams were obtained from their semifinal matches using official recognized statistics, where all situations of losing ball possession as well

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different shooting attempts by each team were tracked and furthermore statistically analyzed to find conclusions and recommendations.

Statistical Methods

The researcher employed the statistical method SPSS for the data analysis of the study.

Results

Table 1. *Analysis of the total shooting attempts and turnovers in the semi-final matches of the Iraqi Professional Basketball League*

Matches	Team Name	Total 2-Point Shooting Attempts	Total 3-Point Shooting Attempts	Total Free Throw Attempts	Turnovers
1	Al-Naft	39	25	15	17
	Al-Karkh	42	24	24	14
2	Al-Defaa Al-Jawi	37	31	20	12
	Al-Shorta	44	29	20	24
3	Al-Karkh	38	33	16	12
	Al-Naft	43	19	30	8
4	Al-Shorta	52	29	8	9
	Al-Naft	46	30	7	15

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5	Al-Defaa Al-Jawi	36	26	23	11
	Al-Naft	32	44	15	17
6	Al-Karkh	38	38	16	12
	Al-Defaa Al-Jawi	47	24	18	11

Note: Any loss of possession committed by the team is statistically and technically accounted for the opposing team.

1. Ball possession loss rate:

- The lowest rate of possession loss is (8) times for Al-Naft in the third match.
- The highest rate of possession loss is (24) times for Al-Shorta in the second match.
- It appears that Al-Shorta Club experiences possession loss more frequently than other teams.

2. Shooting rate:

- Two-point shooting attempts range between (32-52), indicating that teams focus more on close and mid-range shooting than on other types of shooting.
- Three-point shooting attempts range between (19-44), with notable variation among teams and matches.
- Free throw attempts are relatively lower, ranging between (7-30), reflecting the disparity in drawing fouls.

Table 2. *It illustrates the correlation coefficient between ball possession loss (Turnovers) and types of shooting.*

Type of Scoring	The correlation coefficient with ball possession loss
Two-Point Scoring	0.196-
Three-Point Scoring	0.292
Free Throws	0.142-

- Two-point shooting: The relationship is weakly negative (-0.196), indicating that teams that lose the ball more frequently may have fewer attempts at two-point shooting.
- Three-point shooting: The relationship is weakly positive (0.292), suggesting that teams that lose the ball more often may rely on three-point shooting to compensate for this.
- Free throws: The relationship is weakly negative (-0.142), implying that teams that lose the ball more frequently may have fewer opportunities to score from free throws.

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Discussion

First: The Relationship Between Ball Turnovers and Two-Point Shooting

The result showed a negative relationship between ball turnover and frequency of 2-point shooting attempts, indicating that teams with more frequent loss of ball possession have less chance to make an attempt shot from the other-side of 3-points arch. This is consistent with Carlson's (2020) argument that ball loss decreases the number of organized attacks and reflecting on how direct play close to the basket, is a result of good play construction. Brown (2018) also finds supportive evidence for this, where teams that limit ball transition tend to take more attempts closer to the rim due to a smoother offensive action not disturbed by defence.

Second: The Relationship Between Ball Turnovers and Three-Point Shooting

Findings of the analysis indicated a significant positive correlation between ball turnovers and an increase in frequency of three-point shooting attempts. This could be due to teams that often lose the ball trying to make up for it with more three-pointers hurried-up. According to Miller et al. (2019), teams'ilikely to attempt shots from above the arc as a means of minimizing opportunity for additional turnovers in a team's own play segment and maximizing gain opportunities against the opponent. Smith, 2021) A recent study published by Smith (2021) adds to this finding showing that teams highly reliant on three-pointers are also those under higher defensive pressure and turning the ball over more frequently, thereby forces players to shoot too early (counter-intuitively leading them unable to really run actions or attacks for fear of committing a turnover while shooting so as not. to keep it throughout the offense).

Third: The Relationship Between Ball Turnovers and Free Throws

The findings showed a significant negative association between ball turnovers and the number of free throws tries, or in other words, that the more the teams lost balls, the less time they had to collect scores. This can be attributed to the fact that ball loss negatively affects offensive actions which lead to the opposign team committing holding fouls, generating free-throws. As Jones (2017) writes, it would be the teams which can hold onto the ball with longer possessions, and run their offenses systematically, who will be able to draw a higher number of defensive fouls from shots (as they make it more contention-liable for team in defense), forcing them to foul more frequently as well as making the quality of offensive activity decrease due to all that physical effort invested on defense during almost 24 seconds of shot clock duration purchase additional opportunities to shoot free throws.

Fourth: The Impact of Ball Turnovers on Overall Team Performance

A comparison of the four semi-finalists shows that teams who turned the ball over the least had higher shooting percentages and took better advantage of offensive opportunities. This is in line with Williams' (2022) reasoning that ball control and error minimization explain better the higher offensive efficiency, specially on crucial games which required a more precise performance execution as both had similar performance levels.

When we compare our results with other studies, such as that of García et al. (2020), which supported the idea that winning teams are so because they have lower possession loss ratio and can build more stable attacks. Also, the work by Rodriguez

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(2019) argues that possession loss 5 – 7 times lower compared with opponents' is more likely than not to result in victory above70%.

Conclusions

1.Being on the wrong side of possessions has adverse effects on shooting success, as it was shown that teams not controlling enough lost possession suffers from reduced chances of converting successful shot attempts, especially inside the three-point line (shots taken near and around rim).
2.the relationship with three point percentage is positive meaning if you lose the ball a lot, you'll attempt to make up for it by shooting threes quickly.
3.Teams that commit less possession losses enjoy a better chance to carry out free throws, as they have more ball control and can force their opponents to foul them defensively.
4.The relation between decreasing ball possessions loss and the increasing of scoring options, is most important to be able teams (who made it into the semi-final's games in

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the Iraqi Professional Basketball League) to use a range of strategic solutions for achieving: low possession loss and high offensive efficiency.

5.In the context of best performing teams in Iraqi Professional Basketball League, we can see that ball control is a significant contributor to success as it enables higher rates of converting offensive opportunities which lead to favorable results.

Recommendations

1. Develop the players' technical ball skills (control) and ability to pass under pressure with intensive training in passing and reducing loss of possession.

2. Adopting systematic offensive tactics that reduce the dependence on three point shots (by random shooting) and concentrating on close c mid-range shots to increase their success rate.

3. Studying performance statistics for each team during the season, to reveal patterns of losing possession and formulate bespoke strategies in relation to these.

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4. More training on taking advantage of Defensive mistakes and play for more free throws by driving to the rim, being physical Other.

5. Practice ways to not lose possession when pressured, especially against teams that pick up full court and those that play heavy half-court denying defense.

6. Studying the effectiveness of opposing sides to determine how and where they break under pressure on defense against the ball, which aids in eliminating turnovers through alterations in offensive play-sets.

7. To use statistical analysis (effectively, accurately and consistently) to assess team performance on a game by game basis, tracking loss of possession rates and how they affect match results.

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An Analytical Study of the Variables (Oxygen Threshold and Total Energy Expenditure) and the Ability to Withstand Offensive Skill Performance During the Special Preparation Phase for Advanced Iraqi National Badminton Team Players

Enas Khalid Rashed[1], Mohammed Jawad Kadhim [2]

[1] University of Baghdad, College of Physical Education and Sports Sciences.

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Abstract

Oxygen threshold (OT) is a key index that can reflect the ability to resist offensive skill performance in elite badminton players during the special preparation phase, which can be estimated when utf8_output = 'false'separated methods: A total of 20 professional elite male badminton players at the national level were recruited as research subjects. A total of twenty male elite players of the Iraqi badminton national team were included in this study. Oxygen threshold, total energy expenditure was monitored with wearable metabolic tracking devices and measured the clone endurance entraining specifically in sport literary offense skill performance. Scores correlated significantly with the O2 threshold and offensive skill endurance (r =. 71, p <. 01), and between total energy expenditure and endurance performance (r=.. 50, p <. 05). The resilience of the physiological system to high strain has been associated with higher levels of sustained offensive skill performance during periods of heightened training stress.

Keywords: oxygen threshold, total energy expenditure, skill endurance, badminton, elite athletes

[1] University of Baghdad, College of Physical Education and Sports Sciences.
Inas.Jomaa@cope.uobaghdad.edu.iq
[2] University of Baghdad, College of Physical Education and Sports Sciences.
Dr.muhamed.juad@cope.uobaghdad.edu.iq

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Introduction

Badminton is an intermittent racket sport, that involves both high levels of aerobic and anaerobic fitness to maintain repeated explosive efforts, rapid change of direction and maximum shuttle velocity over protracted periods of match play (Phomsoupha & Laffaye, 2015). Unlike continuous endurance activities, badminton matches involve short bursts of high-intensity efforts followed by limited recovery durations, which rely on the efficiency of metabolic pathways to delay fatigue phenomenon and maintain optimal technical execution under pressure (Abdelkrim et al., 2010).

One such physiological marker investigated within the endurance research literature is oxygen threshold (OT) more commonly operationalized as ventilatory threshold or that point at which ventilation increases exponentially compared to the influx of oxygen during an incremental exercise protocol (Gaesser & Poole, 1996). Oxygen threshold is the point of maximal aerobic activity above which there is an increasing dependence on anaerobic metabolism, thus being critical in determining endurance and exertional tolerance (Wasserman et al., 2012). Generally, higher oxygen threshold is associated with an athletes capable of sustaining efforts above critical power or VO2max without having to rely too much on the fast development of metabolic fatigue (Midgley, McNaughton, & Wilkinson, 2007).

Total energy expenditure (TEE) — which encompasses resting metabolic rate, thermic effect of food and physical activity-related energy expenditure – is emerging as another marker of an athlete's overall physiological load and capacity (Jeukendrup & Gleeson, 2010). To assess the energetic stress of-trained athletes and guide periodization (Meyer et al., 2011), TEE is monitored during high-performance training and preparatory periods. In racket based sports like badminton which usually consists of repetitive preconditioned high-intensity bouts over long periods of time during the course of a play session, TEE poses some implications for both adaptations in performance and recurrent injury prevention. (Salman et al., 2022)

While abundant research has focused on endurance and team sports, relative to this there is a scarcity of studies that have investigated the relationships between the oxygen threshold metric and total energy expenditure with sport-specific skill endurance, particularly in badminton. Physiological profiling, match analysis, and biomechanical factors influencing talent have garnered the majority of existing badminton research (Phomsoupha & Laffaye, 2015) Nonetheless, endurance of technical skill execution, especially those associated with offensive actions such as overhead smashes, jumps at the net and fast drop shots under fatigue is poorly covered in literature. The endurance of offensive skill is crucial since ongoing force and precision in attacks gives a competitive advantage for a longer period match. (Shehab et al., n.d.)

Physiological variables such as oxygen threshold and total energy expenditure or even distance run can tell coaches, sport scientists how he/she able to repeat the offensive skill execution under fatigue, this can help coach/sport scientist to design training. In practice, it could even fine-tune conditioning cycles to maximise metabolic thresholds and dynamic energy resource management during critical training phases (eg the special preparation phase which aims at a cohesive improvement of technical, tactical and physiological processes preceding competition). (Kadhim et al., n.d.)

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Thus, this research analyzes the correlations of oxygen threshold and total energy expenditure in resistance to offensive skill performance in advanced Iraqi national badminton team players during the special preparation phase. It is hypothesized that the higher oxygen threshold and total energy expenditure will be positively related to superior endurance of offensive skill performance. (Kadhim & Mahmood, 2023)

Methods

Participants

This study included twenty male elite badminton players from the Iraqi national team (mean age = 24.4 ± 2.6 years). All athletes were free from injury, had at least 5 years competitive experience and signed written informed consent before participation. Ethical approval: [Number; version/Date] EthicalApproval.png

Design and Procedure

Oxygen threshold was calculated according to a graded treadmill exercise test with continuous gas exchange analysis (COSMED K5 Portable Metabolic System). Participants started at a speed of 8 km/h, and the speed increased by 1 km/h every two minutes until volitional fatigue. Threshold detection was carried out using the ventilatory equivalent method and defined as increases in ventilation against oxygen uptake to indicate the OT point (Wasserman et al. 2012).

Oxygen Threshold Measurement

Oxygen threshold was assessed via a graded treadmill exercise test with continuous gas exchange analysis (COSMED K5 Portable Metabolic System). Participants started at a speed of 8 km/h, increasing 1 km/h every two minutes until volitional fatigue. The ventilatory equivalent method was used to assess threshold detection, with elevations in ventilation per oxygen uptake indicating the OT point (Wasserman et al., 2012).

Total Energy Expenditure

Validated wearable devices (BodyMedia SenseWear Armband) were used to track total energy expenditure over the four weeks. Devices measured energy expenditure throughout the entire day while awake, both when training and recovering. We then calculated the weekly TEE averages of each athlete.

Offensive Skill Endurance Test

Data are expressed as mean ± SD (standard deviation) for all variables. Pearson correlation coefficients were computed to explore associations between oxygen threshold, total energy expenditure and offensive skill endurance. Significance was set at $p <. 05$.

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Statistical Analysis

For all variables, descriptive statistics (mean ± SD) were calculated. Pearson correlation coefficients were computed to assess relationships between threshold oxygen, total energy expenditure, and offensive skill endurance. Significance was set at p <. 05.

Results

Descriptive statistics for the study variables are presented in Table 1.

Table 1. *Descriptive Statistics for Key Variables*

Variable	Mean ± SD
Oxygen Threshold (ml·kg⁻¹·min⁻¹)	46.5 ± 3.7
Total Energy Expenditure (kcal·week⁻¹)	3,820 ± 430
Offensive Skill Endurance Score	88.3 ± 5.4

Significant positive correlations were found between oxygen threshold and offensive skill endurance (r = .71, p < .01), and between total energy expenditure and offensive skill endurance (r = .50, p < .05).

Discussion

Objectives The aim of the present study was to investigate how key physiologic variables are associated with endurance of offensive skill performance in elite-level badminton players. Results showed both physiological metrics are related to offensive training endurance experienced during the special preparation phase. (Kadhim et al., n.d.)

The close relationship between $vair$ and skill endurance echoes earlier findings that greater levels of aerobic metabolic thresholds are associated with better sustained performance in high intensity intermittent exercise (Midgley et al., 2007; Bassett & Howley, 2000). Anaerobic fatigue inhibition and efficient oxidative metabolism during time to exhaustion (29–36), as observed in badminton, would provide adaptive support for repeated sustained or explosive offensive shots over the course of a long game. (Easa et al., 2022)

Skill endurance also had strong moderate correlation with recruited equals energy expenditure. This finding further supports the basis that a higher TEE is associated with greater [total] energy expenditure in training, congruent with readiness and adaptive capacity (Jeukendrup & Gleeson, 2010). High-intensity, repetitive work is an effective means of increasing daily energy expenditure and may directly correlate with the need for more training stimulus as that athlete will have learned how to use energy stores more efficiently, in turn allowing them to shift greater amounts of pressure under fatigue. (Jawad et al., 2024)

Such results underscore the importance of including aerobic conditionings and energy management among preparation programs employed by elite badminton players. Not only specific to high intro endurance but also as this type of interval training is well known for being the basis of good level coordination when fatigued - a kind that can be retained in play during your performances. (Kadhim & Shihab, 2019)

This study aimed to compare oxygen threshold (OT) and total energy expenditure (TEE) concerning offensive skill performance tolerance between elite Iraqi national badminton players in the special preparation phase. The results show significant positive correlations between OT and measures of offensive skill endurance, and between TEE and technical performance. Such results finally offer some surely physiological hints for performance sustainment in repeated high-intensity and intermittent racket sports 3.

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1. Oxygen Threshold and Offensive Skill Endurance

Oxygen threshold and offensive skill endurance (r =. 71) confirms that high aerobic metabolic efficiency was key towards sustaining high intensity technical performance (play) in badminton. The exercise intensity at which lactate starts to accumulate faster, is called the oxygen threshold and it reflects the interplay of lactate production and clearance (Gaesser & Poole, 1996). Athletes who possess a higher OT are able to train at greater intensities while also postponing metabolic acidosis and neuromuscular fatigue.

Badminton is defined by multiple repeated explosive rallies of 5–15 seconds interspersed with brief recovery periods. Thus, oxidative metabolism plays a key role in phosphocreatine resynthesis during breaks (between rallies) when such intermittent activity occurs (Phomsoupha & Laffaye, 2015). Hence, higher oxygen threshold players would show faster metabolic recovery between offensive actions, allowing them to sustain smash velocity, shot accuracy and movement economy under fatigue overload.

These results parallel those of the overall literature in which resting ventilatory threshold is a better predictor than maximal oxygen uptake (VO_2max) for performance in many types of intermittent exercises (Midgley et al., 2007; Bassett & Howley, 2000)}. VO_2max is a measure of maximal aerobic capacity, and the oxygen threshold reflects sustainable intensity which can be considered to have more relevance to match-play from a physiological position.

Additionally, being able to execute offensive skills while tired relies upon, not only muscular endurance, but also neuromuscular coordination. Metabolic disruptors resulting from fatigue can restrict patterns of motor unit recruitment and fine motor control, thus reducing shot accuracy and timing attempts. Higher OT may improve this metabolic buffering capacity and efficiency of oxygen delivery, thus enabling high OT athletes to be more resistant to these impairments.

2. Total Energy Expenditure and Performance Sustainability

A moderate yet significant correlation (r =. 50) suggested that players capable of achieving a greater cumulative energy turnover during the preparation phase demonstrated an enhanced ability to maintain offensive execution.

Thus, TEE encompasses the metabolic demands still cortical sealant circular training volume in addition to intensity and activity each day. High-performance athletes' training patterns are usually associated with an increased TEE which can act as a stimulus for adaptations (Jeukendrup & Gleeson, 2010). But you have to be careful with that association. Just because this translates to higher energy expenditure does not mean better performance — it could simply signal an optimal proportion of training stimulus and restitution.

During the special preparation period in which athletes performed mostly sport-specific conditioning whilst being integrated with tactics, containment of higher TEE likely represents a step-up in intensity such as high-intensity drills or game simulation. Such exposure increases metabolic efficiency, mitochondrial density, and patterns of substrate utilization (Meyer et al., 2011). These physiological adaptations enhance the athlete's capacity to produce and maintain ATP synthesis during successive attacking actions.

Moreover, optimal nutritional management is important in phases of increased TEE. Low energy availability can affect glycogen resynthesis and recovery, most importantly causing lower turnover in technical consistency. As such, TEE monitoring can help to manage both performance and recovery.

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3. Interaction Between Metabolic and Technical Performance

A new approach of this study is to be able to relate physiological markers with offensive skill endurance instead of linking it to general endurance values. Badminton technical performance is very sensitive to reductions in reaction time, coordination precision and lower-limb power output induced by fatigue.

Power moves such as jump smashes and attacking net drives demand maximum force generation and the ability to control that production with the fine motor skills of racket and ball contact. As metabolic fatigue accumulates, the reductions in central drive and peripheral muscle efficiency impair both power generation and timing of movement. Athletes with higher oxygen thresholds may be more resistant to such mechanisms of fatigue, as a result of types of training that improve oxygen delivery through increased capillarization and greater oxidative capacity, (Wasserman et al., 2012).

This supports an integrative model of performance because physiological capacity facilitates technical persistence. These findings dully reinforce the rationale behind sport-specific conditioning programs and not to separate domains of conditioning and skill training.

4. Practical Applications for Training Periodization

From a coaching point of view the results highlight that:

1. In special preparatory period, the main attention is focused on increasing of oxygen threshold.
2. HIIT and sport-specific interval training drills might be effective in increasing OT.
3. Tracking total energy expenditure can help optimize loads but also aid in preventing overtraining.
4. Transfer-tomatch performance can be further improved by highlighting the connection between conditioning interventions and appropriate technical drills.
5. Competitions can be more accessible through periodization models characterized by progressive increases in the intensity of aerobic threshold that accompanies repeated executions of a skill in conditions of fatigue.

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5. Limitations and Future Research

Despite the valuable findings, several limitations must be acknowledged:

1. The national team examined may limit the generalisability.
2. Because the concern is correlational, no causal inference can be made.
3. Energy use was measured by wearables (validated but not easy and a small measurement error)
4. Future research should:

- Interventional studies to increase oxygen thresholds in the long run.
- Ventilatory threshold and lactate kinetics
- Look for markers of neuromuscular fatigue and how they relate to technical degradation.
- For comparison, female elite badminton players are also included.

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The Effect of Integrating Mental and Skill Training on Enhancing Skill Performance under Competitive Pressure in U18 Basketball Players

Harith Mebsher Mohammed [1] Shirzad Mohammed Jaro[2] Saeed Ahmed Saeed[3]

[1,2.3] University of Baghdad, College of Physical Education and Sports Sciences.

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Abstract

This study sought to examine whether the combination of mental and skill training enhanced performance stability under competitive pressure in u-18 basketball players. The experimental research was conducted pretesting and post testing with a two-equivalent groups design. The sample for the current study was comprised of 12 subjects, who were randomly divided into two groups of six. Integrated mental and skill training A combined nine-weeks of mental and skills training program (3 times per week) was given to experimental group, however normal training programmed were allotted to the control one. The basketball-specific skill tests and a competitive golf anxiety scale were administered to obtain the data that was analyzed using Statistical Package for the Social Sciences (SPSS). Findings identified variables with significant differences in terms of the experimental group performance, such as an increase on shooting accuracy and dribbling speed and passing accuracy and composite skill performance increased for the experimental group, while competitive pressure significantly decreased when compared to control. Results suggest that the methodical inclusion of mental and skill training is an effective way to improve athletic performance and increase skill performance consistency under competition pressure in young basketball players. Therefore, the study suggests introducing organized mental programs within daily training loads of these sports clubs and basketball academies.

Keywords: mental training, skill training, performance stability, competitive pressure, basketball.

[1] University of Baghdad, College of Physical Education and Sports Sciences
hareth.mobasher1004a@cope.uobaghdad.edu.iq

[2] University of Baghdad, College of Physical Education and Sports Sciences
dr.shirzad78@cope.uobaghdad.edu.iq

[3] University of Baghdad, College of Physical Education and Sports Sciences
saeed.ahmed@cope.uobaghdad.edu.iq

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Introduction

Basketball is a team sport with high physical, technical and psychological requirements resulting from the dynamic interplay of physical traits, motor abilities and mental preparedness necessary for successful performance. Newer literature indicates that sports performance does not only rely on physical and skill training but is also highly determined by psychological factors such as concentration, mental visualization, anxiety control, and coping with competitive pressure (Demir et al., 2025). Mental exercise is one of the key elements in modern sport psychology and may contribute to attention control, self-efficacy promotion as well as regulating emotional response during competition and consequently achieving a higher performance quality and better maintenance of performance quality un competitive situations (Zhang et al., 2025). Several studies have also proved that mental imagery-based instruction can help athletes to better simulate game situations and increase the speed and accuracy of decision-making (Aziz et al., 2024).

In this regard, research reveals that combining both mental and skill training stands as an effective approach to enhance the performance of an athlete in general, even when considering young players who tend to be more sensitive at a psychological level to competitive pressure (Abdulkareem & Hassan 2025). Li et al. (2025) proved that multicomponent cognitive-motor training achieves greater efficient performance and psychological reliability in execution. Stability of skill performance under competitive load is a significant criterion of success in formal competitions, since athletes often report decreases in technical performance under anxious and stressful conditions, and also negative emotions disrupt shooting accuracy, response time, and kinematics coordination when discharging weapons (Hannibalsson 2025). Thus, it has become necessary to promote training and training protocols aimed at improving the psychological hardware alongside its technical counterpart in young athletes.

Young basketball players are exposed to high psychological demands of performing under pressure, both in terms of coaches' and spectators' expectations and official competition demands. Recent studies show that when placed under this kind of pressures the skill accuracy and performance stability are negatively affected during competition (Hannibalsson, 2025). A number of studies have reported that mental reprogramming training (e.g., guided imagery and ACT) could be beneficial in decreasing competitive anxiety and enhancing player's self-efficacy, which promote the technical performance of the players as a whole (Aziz et al., 2024; Roodsarabi et al., 2021). Instead the usual exercise of skill learning without experience will rely solely on physical or technical variables, lacking an explicit focus on the psychological dimension as well as instruction and practice of performance elements, ultimately risking a decouple between training performances (and "performances" during competition) for which the athlete was prepared and will perform. Abdulkareem and Hassan (2025) indicated that the mental training programs, along with technical training, can lead to significant changes in shooting precision and motor consistency in young basketball players. More recent studies have also shown that the combination of cognitive and motor training enhances players' performance under competitive pressure and in stabilizing performance during a decisive situation (Li et al., 2025; Zhang et al., 2025). Therefore, there seems to be a need for scientific research into the impact of systematic implementation of mental and technical training on enhancing the stability of skill performance in competitive pressure situations among under-18 basketball players.

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Significance The contribution of this study is that it emphasizes the amalgamated effect of psychological and technical training on athletic performance, offers a scientific reference for coaches to design systematic trainings, promotes the formation of modern methods for the youth training system, and strengthens athletes' ability to withstand competitive pressures.

Through practical on-site verification and official matches' technical observation, it was discovered that dozens of under-18 players' competition performance in terms of skills is fluctuant, even though they played well at the training courses. The competing is due to competitive stress and psychological anxiety, etc., and no integrating training plan to do the mental work together with skill practice. Therefore, the problem of research is expressed in the question:

Does integrating mental training with skill training improve the stability of skill performance under competitive pressure among under-18 basketball players?

Research Objectives

1. To identify the effect of integrating mental training with skill training on improving skill performance stability.
2. To examine the impact of the proposed training program on reducing the level of competitive anxiety.
3. To compare the level of skill performance under competitive pressure before and after the implementation of the program.
4. To determine the effectiveness of mental training as part of comprehensive training programs.

Research Hypotheses

1. There are statistically significant differences between the pre- and post-tests in favor of the experimental group in skill performance stability.
2. There are no statistically significant differences between the pre- and post-tests in favor of the experimental group in skill performance stability.
3. There are statistically significant differences between the experimental and control groups in skill performance under competitive pressure.
4. There are statistically significant differences between the experimental and control groups in skill performance under competitive pressure.

Research Scope

1. **Human domain:** The First Al-Karkh Directorate of Education under-18 basketball team.
2. **Time domain:** From 10/11/2024 to 28/2/2025.
3. **Spatial domain:** The Sports and Scout Activity Department in the First Al-Karkh Directorate.

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Methodology

Study Design

The experimental method was utilized by the researcher in applying two similar groups (experimental and control) through using pre-and-posttest, since it is suitable to the type and goals of study in revealing to what extent mental training integrated with skill training has on enhancing the stability of performing skills under pressure situation among U-18 basketball players.

Population and Sample

Population Study

The research population consisted of under-18 players of the First Al-Karkh Directorate of Education basketball team in Baghdad for the 2024–2025 season. The training sessions were conducted at the Sports and Scout Activity Department in Al-Karkh First, Baghdad.

Sample Study

Sampled players from the students of First Al-Karkh Directorate of Education basketball team were purposively chosen in Baghdad. The population under consideration is a sample of 12 players, with age ranging from 16 to 18 years divided randomly in two groups: experimental group (6 players) and the control group (6 players). The criteria included frequent attendance at practice, homogeneity in skill level, no injuries during the time of the research and consent to participate in the training.

The equivalence of the experimental and control groups in all research variables was verified using the independent samples t-test. The results showed no statistically significant differences between the two groups in the pre-test measurements, indicating their equivalence, as presented in Table (1).

Table 1. *Equivalence of the experimental and control groups in the research variables (pre-test measurements)*

Variables	Group	N	Mean	SD	t-value	Sig.	Statistical significance
Shooting accuracy (score)	Experimental	6	4.87	1.13	0.58	0.566	Not significant
	Control	6	4.67	1.09			
Dribbling speed (sec)	Experimental	6	12.81	0.74	0.63	0.532	Not significant
	Control	6	12.93	0.78			
Passing accuracy (score)	Experimental	6	6.27	1.02	0.51	0.612	Not significant
	Control	6	6.13	0.98			
Combined performance under pressure (score)	Experimental	6	5.93	1.11	0.49	0.628	Not significant
	Control	6	5.80	1.07			

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Tools and Equipment Used

- Official basketball court
- Official basketballs
- Stopwatch
- Measuring tape
- Markers
- Training cones
- Data recording forms
- Video camera (when needed for documentation and analysis)

Tests Used

1. Jump Shot Accuracy Test (Arias et al., 2012)

This test is a measure of the ability to successfully execute a jump shot under game-like conditions. Ten bounce shots maintained if he receives from a teammate or is on one bounce behind the free-throw lane, respectively. Ready: The player starts in the stance of ready, catches the ball or makes one dribble and shoots right away. This is done as many times as 10 in a row. Scoring is achieved by making 10 baskets before the time runs out; the total score is distributed upon how many of the ten baskets are made.

2. Dribbling Speed with Change of Direction Test (Sporiš et al., 2010)

The purpose of this test is to measure the ability to move, agility, and dexterity while dribbling with changes in direction. The article used a 20-meter-long zigzagging course set up with training cones, and the player had to dribble as fast as they could around it, changing directions until they reached the end. With the player standing behind the start line, the player takes off on a signal and dribbles his way in and out through the cones. The act finishes only when the player passes the finish line. Both of the performances are evaluated in seconds with a stopwatch, and the best result of 2 trials is counted as the last score.

3. Passing Accuracy Test toward Specific Targets (Pojskić et al., 2011)

This test examines the accuracy of passing and speed in making motor decisions of basketball players. In this test, three square targets are marked on the wall at varying heights, and the subject stands 5 m away from it. The player thereupon follows with ten continuous shots towards the targets in a devised pattern. Chest and bounce passes are being performed by the player in accordance with the set target order during play. One point is scored for each direct hit within the target area, and the end score is equivalent to the total of hits gotten through.

4. Combined Performance under Time Pressure Test (Gabbett et al., 2009)

The purpose of this test is to assess the stability of performance in a complex skill under time stress approximating competitive pressure. It consists of a series of integrated tasks— namely dribbling, passing and shooting—that must be executed in a predetermined time interval (between 30” to 45”) competed with temporal-spatial restrictions. That player begins by dribbling to a predetermined area on the floor and passes the ball to an intended target as they rush right into their jump shot. The pattern is

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constantly cycled until the time runs out. The score is the number of correctly executed skill sequences within the time limit, minus deductions for technical performance.

Competitive Pressure Scale

The Competitive Anxiety and Pressure Scale for Athletes, designed by Cox et al. (2003), was adopted from Martens et al. (1990) and modified to the Iraqi context and to fit the study population sample. The measure assessed the degree of performance-related psychological pressure in competition among under-18 basketball players. It assesses three primary dimensions of psychological states: cognitive anxiety, depicting worry and negative thoughts about competition; somatic anxiety, which includes symptoms and physical indicators of an anxious state such as muscle tension and enhanced heart rate; and self-confidence, displaying the player's judgment of their own ability levels in competitive circumstances.

The scale consists of 27 items in those three factors, which are answered using a 5-point Likert scale, whose possible responses range from (1 = never applies to me) to (5 = always applies to me). The content validity of the scale was tested through a panel of experts in sport psychology and measurement and evaluation; it revealed that the Cronbach's alpha coefficient reached (0.88), referring to a high level for reliability and consistency.

Table 2. *Modified Competitive Anxiety and Pressure Scale*

Item No.	Psychological Dimension	Item
1	Cognitive anxiety	I feel worried about not performing well in competition.
2		I experience negative thoughts about my level during the match.
3		I find it difficult to concentrate in competitive situations.
4		I am afraid of making mistakes during play.
5		I feel mentally tense before the match begins.
6		I think a lot about the match result before playing.
7		I feel confused when facing a strong opponent.
8		I feel anxious when performing important skills.
9		I feel a decrease in confidence when thinking about competition.
10	Somatic anxiety	I feel tension in my body muscles before and during the match.
11		My heart rate increases at the start of play.
12		I feel difficulty breathing during competition.
13		I experience excessive sweating during the match.
14		I feel trembling or shaking in my limbs during play.
15		I feel physically fatigued before the match ends.
16		I feel heaviness in movement during competitive performance.
17		I feel muscle stiffness when performing skills.
18		I experience clear physical tension during competition.
19	Self-confidence	I trust my ability to deliver an outstanding performance in the match.
20		I feel psychologically prepared for competition.
21		I have high confidence in my technical skills.
22		I feel calm and stable during play.
23		I believe I can cope with competitive pressure.
24		I feel that I control the course of play.
25		I am confident in my ability to achieve victory.
26		I perform consistently even in difficult situations.
27		I maintain a positive spirit during competition.

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Pilot Study

A pilot study with three players not included in the main research sample was carried out on 15/11/2024, to confirm the adequacy of the instruments applied, test clarity of instructions given, verify how long activities would take to implement and understand any difficulties that might occur during their implementation. Some implementation processes were refined to improve reliability and objectivity as a result of the pilot study findings.

Training Program

A specific adjusted training program was conceived to increase skill performance stability under competitive pressure. The mental part of the program was composed of a modern psychological technique, which included guided imagery targeting correct motor performance and competitive game situation visualization; breathing control activities that assist in controlling physiological responses and reducing anxiety and tension levels after performing; progressive muscle relaxation to decrease muscular tension with an aim for psychological well-being; attention-focus training helping players to want to be able to focus on relevant stimuli related to the football match and ignore distractions from the environment; and cognitive restructuring aiming at modifying negative thoughts connected with performance into more positive thoughts supporting self-confidence.

The skill component comprised shooting drills in different positions and distances; dribbling activities that require changes of direction and speed; and accurate passing routines under dynamic conditions, where the experimental group attempted to execute "decisions," subjecting players to competitive pressure by using performance time limits on drill stations as well as spatial and numerical constraints (small-sided activities). Small-sided training games were organized with the aim of exposing players to similar game conditions that they might encounter in official competitions, helping them to achieve greater efficiency of their skills during matches.

The training program was developed based on contemporary scientific knowledge in relation to the characteristics of the under-18 basketball age group and targeted the systematic integration of mental training and skill improvement for increasing skill performance stability when playing in competition. The intervention program lasted for 9 weeks and consisted of three training sessions a week (27 training units). For profiling on-court training, seventeen sessions of 90 min duration were held; for mental, 20–25 min were used (guided imagery training, breathing control, progressive muscle relaxation, attention focus, and cognitive restructuring), followed by skill sessions: 60–70 min allocated to technical actions (shooting, dribbling, and passing) or game situations resembling competitive pressure and SSG, concluding with a 5–10 min warm-up/cool-down. The method also took into account the law of gradual training load increase, harmony between psychological aspects and skill elements, and step-by-step movement from simple exercises to forms more similar to competition, as shown in Table (3).

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Table 3. *Weekly training units program during the intervention period (9 weeks)*

Week	No. of Units	Mental Training Goal	Mental Training Content	Skill Training Goal	Skill Training Content
1	3	Psychological preparation	Relaxation + breathing control	Skill foundation	Basic drills for shooting, dribbling, and passing
2		Improving concentration	Simple imagery + attention focus	Developing basic skills	Dynamic shooting drills + zigzag dribbling
3		Confidence enhancement	Guided imagery + cognitive restructuring	Skill integration	Combined drills (dribbling + passing + shooting)
4		Anxiety control	Deep breathing + progressive relaxation	Skill accuracy	Shooting under time constraints + fast passing
5		Emotional stability	Imagery of competitive situations	Performance under pressure	Skill drills with time limits
6		Psychological readiness	Match imagery + attention focus	Speed of performance	Fast dribbling + accurate passing
7		Confidence in confrontation	Opponent imagery + cognitive restructuring	Competitive play	Small-sided training matches
8		Competition simulation	Full competition imagery	Combined performance	Game situations simulating pressure
9		Consolidation and stability	Comprehensive review + relaxation	Performance stabilization	Full matches + skill evaluation

Meanwhile, the control group followed the traditional training program adopted by the coach without the use of any structured mental training exercises.

Procedures

The study was carried out as per a clear-cut systematic methodological plan befitting the experimental design and purpose of the investigation. The implementation strategies were a series of ordered sets that were initiated by pre-tests completed with the analysis of the statistical data. The pretests were conducted on the experimental and control groups 3/12/2024 to estimate the baseline of research variables: stability strength performance under competitive pressure, shooting accuracy, speed drill-dribbling, passing skills accuracy, and competitive pressure level. These measurements were performed for both groups under standard conditions: the same time, place, instruments, and instructions were used to obtain objective and precise results.

Upon completion of the pre-tests, the experimental group received the proposed training program from 6/12/2024 to 10/2/2025 at three training sessions per week for nine weeks. A mental skill training program with an integrated approach was included in the training of the experimental group, and a control group continued to train by conducting conventional unsystematic play selected by the coach (traditional practice) without any formal psychological treatment. Throughout this period, the researcher is constantly monitoring training operations, controlling the intensity of the training load, reviewing players' compliance with components of the program, and providing favorable psychological and physical conditions for appropriate implementation.

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Following the treatment application, post-tests were carried 11/2/2025 using the same tools and tests that were used during pre-testing under homogeneous place, time, performance procedures, and recording methods requirements to compare results as well as to measure how much each of the research variables had been affected by the training program application.

Statistical Analysis

The Statistical Package for the Social Sciences (SPSS) was used to analyze the data through the following statistical procedures:

- Arithmetic mean
- Standard deviation
- Skewness coefficient
- Paired-samples t-test
- Independent-samples t-test

Results

Table 4. *Results of the pre- and post-tests for the experimental group*

Variables	Measurement	Mean	SD	t-value	Sig.	Significance
Shooting accuracy	Pre-test	4.87	1.13	8.94	0.000	Significant
	Post-test	7.93	0.88			
Dribbling speed	Pre-test	12.81	0.74	7.88	0.000	Significant
	Post-test	10.94	0.63			
Passing accuracy	Pre-test	6.27	1.02	8.31	0.000	Significant
	Post-test	9.13	0.84			
Combined performance	Pre-test	5.93	1.11	9.02	0.000	Significant
	Post-test	8.87	0.91			
Competitive pressure	Pre-test	78.47	6.81	10.16	0.000	Significant
	Post-test	61.33	5.92			

Table 5. *Results of the pre- and post-tests for the control group*

Variables	Measurement	Mean	SD	t-value	Sig.	Significance
Shooting accuracy	Pre-test	4.67	1.09	2.11	0.052	Not significant
	Post-test	5.47	1.02			
Dribbling speed	Pre-test	12.93	0.78	1.88	0.071	Not significant
	Post-test	12.31	0.71			
Passing accuracy	Pre-test	6.13	0.98	2.24	0.041	Significant
	Post-test	6.93	0.96			
Combined performance	Pre-test	5.80	1.07	2.36	0.034	Significant
	Post-test	6.27	1.01			
Competitive pressure	Pre-test	79.13	7.02	1.95	0.064	Not significant
	Post-test	75.20	6.74			

Table 6. *Independent-samples t-test results for post-tests between the two groups*

Variables	Group	Mean	SD	t-value	Sig.	Significance
Shooting accuracy	Experimental	7.93	0.88	6.12	0.000	Significant
	Control	5.47	1.02			
Dribbling speed	Experimental	10.94	0.63	5.47	0.000	Significant

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Passing accuracy	Control	12.31	0.71	6.33	0.000	Significant
	Experimental	9.13	0.84			
Combined performance	Control	6.93	0.96	6.74	0.000	Significant
	Experimental	8.87	0.91			
Competitive pressure	Control	6.27	1.01	6.89	0.000	Significant
	Experimental	61.33	5.92			
	Control	75.20	6.74			

Discussion

The purpose of this study was to test the effect of adding mental training to skill-oriented training to improve the stability of on-task performance under competitive pressure with an under-18 basketball population. The results indicated that the designed program had a significant effect on all skill and psychological variables in the experimental group as compared to the control group, who were trained under a traditional training program.

This gain is supposed to be because of the systematic combination between psychological and skill elements in the course of training. This is in line with the current literature on mental training playing a key role for psychological preparedness and anxiety/tension regulation during competition and, as such, improving the quality/performance stability (Weinberg & Gould, 2019). Moran (2016) also adds the fact that relaxation and mental imagery techniques can assist athletes to improve concentration and attention and reduce mental distortion in competition.

The better performance of the mental treatment group in task variables is strong evidence of the benefits of mental practice for optimizing motor control and coordination neuromuscular mechanisms. Slimani et al. 's results communicate that mental image functions to moderate technical performance by providing activation of neural structures for calls on the execution of motor task which can cause improved point and smoothness movement. Guillot and Collet (2010) have also write about that the combination of physical training with mental training is ingoing to be more impactant for an athlete performance than just a type of kinesthetic practice only.

With respect to the lowered competitive anxiety of the experimental group, its reduction is as a result of prog ram's concentration on progressive muscle relaxation, deep breathing and cognitive restructuring which are appropriate strategies in controlling emotional arousal and reducing competitive stress. Relatedly, Hanton et al., 2005) reported that psychological interventions can be designed to change anxiety from a debilitative effect into an enhancive one in enhancing performance). Anxiety/emotion regulation is a necessary skill if athletes are going to be able to remain stable in performance and make decisions under competitive conditions (Jones et al., 2018).

In contrast, the definite progress in the control group demonstrates flaws in current training programs, which tend to concentrate primarily on physical and skill aspects disregarding psychological components in part. Accordingly, performance is still prone to oscillate under competitive conditions. Fletcher and Sarkar (2016) suggested that the lack of a formalized pre-performance psychological routine leaves athletes exposed to performance collapse in high-pressure situations, particularly amongst youth populations. Indeed, these current results are in line with those reported by Birrer and Morgan (2010) who found that randomized control trials on structured mental training against a waiting list have demonstrated higher confidence, lower anxiety, and increased levels of attentional control for certain aspects in sport performance. They are also in agreement with the results

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of Thelwell et al. (2017), they demonstrated that combined psychological intervention obviously enhances technical and psycho-stability on team sport players.
Therefore, it is reasonable to believe that systematic combination of mental skill training can be a good choice for improving sports performance as well as making them stable in competitions, especially among the youth basketball players at whom psychological stress and relative resistance level to coping with stress are extremely high.

Conclusions

1. The combination of mental and skill training resulted in a substantial enhancement of the stability aspect within performance skills under competitive pressure among U-18 basketball players.
2. Greater improvements in shooting accuracy, dribbling speed, passing accuracy and basketball performance composite was observed following the proposed training compared to traditional method.
3. Mental training led to a decrease in the competitive pressure and performance anxiety which had a positive effect on the quality of the technical performance.
4. Mental Practice training plus breathing control, imagery and progressive relaxation not only enhanced the level of concentration, attentional focus and self-confidence in players.
5. The integrated training regimen proved to be effective in order to enhance psychological and skill balance of young footballers.
6. The results supported the conclusion that psychological preparation is an indispensable and supplementary factor in basketball skill training.
7. The suggested program can be implemented as a contemporary young basketball player training model.

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Recommendations

1. Mental training should be incorporated into daily basketball team practice programs, especially for younger (youth/junior) players.
2. Educating coaches in the application of contemporary mental training methods (e.g., imagery; relaxation; attentional control).
3. The inclusion of psychological preparation courses in the curriculum of colleges of physical education and sport sciences.
4. Application of the suggested training model in sports clubs, academies and talent development centers.
5. Extending investigations to other psychological variables, such as motivation, mental toughness, and emotional resilience.
6. Application of new technologies (e.g., virtual reality, video) to aid the mental preparation.

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The Effect of Neuromuscular Control Exercises on the Rehabilitation of General Strength and Overall, Balance in Stroke Sequelae for Men with Temporary Hemiplegia Aged (50–55) Years

Hind Ali Thabit [1]

[1] University of- Farahidi College of Physical Education and Sports Sciences.

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Abstract

The study aimed to design neuromuscular control exercises for the rehabilitation of men aged (50–55) years with temporary hemiplegia and to identify the effect of these exercises on restoring general strength and overall body balance in stroke sequelae. The researcher hypothesized that there would be statistically significant differences between the pre- and post-test results of the experimental and control groups in general strength and overall body balance, as well as statistically significant differences in the post-test results between the two groups in favor of the experimental group. The experimental method was adopted using a two-group design (experimental and control) on a sample of (11) patients intentionally selected through a comprehensive sampling method (100%) from men aged (50–55) years with temporary hemiplegia who attended the physiotherapy department at Baghdad Teaching Hospital. After determining the research tests and preparing the rehabilitation exercises, the program was implemented for (8) weeks, comprising (40) daily rehabilitation sessions, excluding Fridays and Saturdays, for the experimental group. After completing the experiment and statistically analyzing the data using SPSS, the results indicated that neuromuscular control exercises are appropriate for rehabilitation sessions for men aged (50–55) years with temporary hemiplegia. Their application contributed to restoring general strength and improving overall body balance associated with stroke sequelae. The researcher recommended considering patients' capabilities and injury severity when designing neuromuscular control exercises, as well as promoting continuous collaboration between academic specialists in sports rehabilitation and physiotherapists to accelerate recovery from stroke-related impairments in this population.

Keywords: Rehabilitation exercises, neuromuscular control, general strength, overall balance, temporary hemiplegia.

[1] University of- Farahidi College of Physical Education and Sports Sciences.
h.thabit@uoalfarahdidi.edu.iq

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Introduction

In a healthy individual, there is a coordinated and balanced integration of the activities of different parts of the nervous system. The outcome of these neural activities at any given moment produces motor responses that reflect both the intensity and direction of this integration. In physical exercise, the role of the sensory system cannot be neglected, as it transmits information to the brain, in addition to receptors distributed throughout skeletal muscles—such as Golgi tendon organs and muscle spindles—which play protective and informational roles, as well as cutaneous receptors. The efficiency of these receptors facilitates joint movement to its maximum range. Furthermore, the vestibular balance system and reflexes responsible for maintaining balance operate through reciprocal muscular actions, such as crossed extension, withdrawal, and flexion reflexes, in addition to the biochemical processes that explain their mechanisms, including acetylcholine and sodium and potassium ions (Al-Nusairi & Naji, 2015).

Post-stroke neural dysfunction that affects voluntary muscles is an important characteristic of stroke. Symptoms can include incoordination, hyperactive or hypo active movements, and a combination of the two. Sensory disruptions and speech and language deficits might coexist with these conditions (Al-Shafie, 2010). Hemiplegia following stroke reflects an impairment of neuromuscular control in the complex neural system among men aged 50–55 years, where there is a loss of general strength and body balance, particularly at early stages after injury because of depressed neural activity and voluntary muscular control.

Hemiplegia is among the most frequent sequelae of stroke and refers to paralysis on one side of the body. It may also include lack of sensation and limited control over voluntary muscle movements, with treatment methods based on severity and location of the stroke as well as its impact on brain tissue (Kim & Lee, 2017). Temporary hemiplegia can be caused by any damage in the pyramidial tract from cerebral cortex to the segmental centre of spinal cord; and that may be accompanied with problems related to movement, posture or both because of central nervous system dysfunction (Al-Adrious, 2020). Stroke presents with a heterogeneous constellation of symptoms and impairments, which can be described in terms of a spectrum of motor disabilities (Lok, 2017).

Men aged 50–55 years are among the most vulnerable groups to stroke-related hemiplegia, and physical rehabilitation programs can be applied either after medical treatment or concurrently to restore neuromuscular control in affected body parts (Al-Ghanem, 2023). Given that this injury negatively affects the mechanical function of muscular contraction and the maintenance of balance, rehabilitation specialists must possess a sound understanding of functional neuromuscular anatomy.

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The nervous system is composed of varying types of neurons projecting from the brain and spinal cord which are myelinated or unmyelinated with structural properties affecting the efficacy of neural conduction (Al-Ali & Hussein, 2016). Once the neural impulse arrives at the neuromuscular junction and acetylcholine is released, sodium ions flow into individual muscle fibers creating an action potential that propagates down the muscle membrane. Calcium ions are subsequently released from sarcoplasmic reticulum, leading to actin and myosin interaction, which results muscle contraction (Guyton & Hall, 2020). The strength of the response is proportional to the strength of stimuli because muscle fibres differ in this property; some fibres are sensitive to weak stimuli (high excitability) and other require strong stimulus (low excitability) to respond (Jalal Al-Din, 2007).

Various rehabilitation programs have been implemented for functional deficits due to nonfatal stroke-induced temporary hemiplegia. Rehabilitation should be effective by combining more than one therapy modality within a session, designing exercises depending on the type of lesion, taking into account that recovery is slow and paying attention to patient individual differences. Rehabilitation regimes should not use very high training loads or ask patients to complete tasks beyond their capacity (Al-Ghalib, 2024). Furthermore, muscle strength cannot be increased without proper resistance to match the nature of injury and rehabilitation aims (Bhatt et al., 2015). The role of sports rehabilitation is to strengthen muscles, preserve joint flexibility, prevent muscular atrophy and stiffness as well as restore tissue vitality to aid recuperation process (Kamel, 2017).

The importance of studying stroke sequelae associated with temporary hemiplegia in men aged 50–55 years lies in both theoretical and practical aspects.

Theoretical significance

- Directing academic attention in sports rehabilitation toward the importance of neuromuscular control exercises in rehabilitating stroke-related hemiplegia.
- Enriching the literature in sports rehabilitation and supporting researchers by highlighting the value of neuromuscular control exercises for this population.

Practical significance

- Providing structured neuromuscular control exercises for rehabilitating stroke sequelae in men aged 50–55 years with temporary hemiplegia.
- Guiding professionals in the Physiotherapy Department at Baghdad Teaching Hospital and supporting the requirements necessary for implementing such rehabilitation exercises.

Through reviewing stroke-related impairments in this population and the role of physical therapy in restoring movement by improving muscular strength and overall body balance—two key indicators of recovery—the researcher observed, during visits to the Physiotherapy Department at Baghdad Teaching Hospital, a noticeable delay in restoring general strength and balance. This delay is attributed to the complexity of neuromuscular recovery processes, which require repeated practice with low resistance and specialized neuromuscular control exercises to support rehabilitation efforts for this group of patients.

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Accordingly, the study aimed to design neuromuscular control exercises for men aged 50–55 years with temporary hemiplegia and to identify their effect on improving general strength and overall body balance in stroke sequelae. The researcher hypothesized that there would be statistically significant differences between the pre- and post-test results of both the experimental and control groups in general strength and overall balance, as well as significant differences between the post-test results of the two groups in favor of the experimental group.

Methods and Procedures

The experimental method was adopted using a pre- and post-test design with two equivalent groups (experimental and control) under controlled conditions.

The research population consisted of men aged (50–55) years with temporary hemiplegia resulting from stroke sequelae who attended the Physiotherapy Department at Baghdad Teaching Hospital, Medical City. The total number of patients was (11), all of whom were intentionally selected using a comprehensive sampling method (100%). They were then divided into two groups according to the requirements of the experimental design. One group was randomly assigned as the experimental group (5 patients), while the other served as the control group (6 patients). The selection was based on their direct representation of the research problem population. Procedurally, the sample included patients who had experienced stroke within (4–6) days, were non-athletes by nature, and had no previous medical history of other diseases, as confirmed by MRI examinations for each participant.

To ensure internal validity, the homogeneity of the sample was statistically verified in several extraneous variables, as shown in Table (1).

Table 1. *Homogeneity of the main research sample in selected extraneous variables*

Extraneous variables	Unit	N	Mean	SD	Skewness
Body Mass Index (BMI)	kg/m²	11	21.55	1.214	0.692
Chronological age	Years	11	52.18	1.601	0.892
Duration of injury	Days	11	4.91	0.701	0.123
Type and severity of injury	Mild; participants at the physiotherapy stage				

BMI = body mass (kg) / height squared (m²); skewness values ranged within acceptable limits (±1).

To measure the dependent variables representing recovery from stroke sequelae, guidance from physicians at the Physiotherapy Department in Baghdad Teaching Hospital was adopted. General body strength was assessed using a handgrip strength test (Appendix 1) for both clinical and normal cases, employing a hydraulic electronic dynamometer measured in kilograms, appropriate for the apparent weakness in finger flexor muscles associated with the condition (Sayed, 2019).

Overall body balance was assessed using the Berg Balance Scale, a standardized clinical test with a total score ranging from (0–56) (Al-Ansari, 2009).

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Protocol for preparing and implementing neuromuscular control exercises

Rehabilitation responsibility lies with the sports rehabilitation specialist, who is required to design, implement, and supervise rehabilitation programs, as well as possess adequate competence to provide appropriate care following injury (Abdel Nabi & Hashoush, 2018). Accordingly, the following steps were undertaken in preparing neuromuscular control exercises for men aged (50–55) years with temporary hemiplegia:

- Reviewing numerous relevant scientific studies and specialized references related to stroke sequelae and temporary hemiplegia.
- Conducting preparatory steps prior to designing the rehabilitation exercises by examining the types of physiotherapy exercises currently provided to patients in the Physiotherapy Department at Baghdad Teaching Hospital.
- Determining the specific objective of each exercise in rehabilitating patients and restoring their general strength and overall body balance.
- Ensuring continuity of comprehensive medical care and periodic evaluation by physicians in the Physiotherapy Department.
- Determining the difficulty level of neuromuscular control exercises by calculating the longest duration of balance and dynamic stability and identifying the highest tolerable light resistance, based on the principle of progression from simple to more complex exercises.

Muscle strength and overall body balance were considered key indicators of recovery from stroke sequelae. The proportion and intensity of exercises across rehabilitation sessions were structured based on the concept that neuromuscular control depends largely on strengthening muscular contraction and coordination, as illustrated in Figure (1).

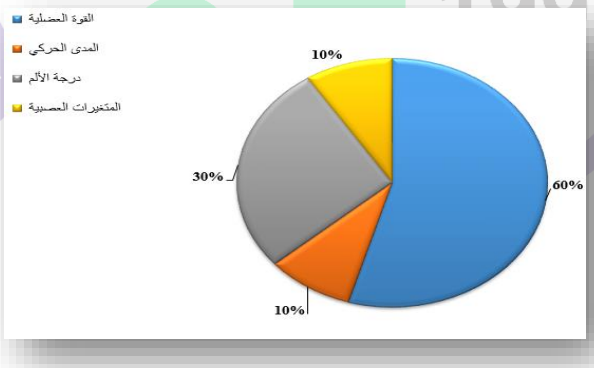

Figure 1. *Distribution of percentages across different neuromuscular control rehabilitation exercises*

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The researcher applied a pilot on the (4) patients extracted in the same sample of this study patients, 2 from each group at Baghdad Teaching Hospital/ Physiotherapy Department on Tuesday (19/11/2024). No notable difficulties were encountered.

The duration of implementing the neuromuscular control rehabilitation exercises in each session ranged from (25.32) to (29.24) minutes. Five sessions were conducted per week on (Sunday, Monday, Tuesday, Wednesday, and Thursday), with (4) exercises in each session. The program continued for (8) consecutive weeks, resulting in a total of (40) rehabilitation sessions, as shown in Appendix (2).

The content of the neuromuscular control rehabilitation exercises, organized according to the three stages of rehabilitation, included the following:

- Exercises involving attempts to move the affected arm toward nearby points without resistance, alternated with movements of the affected leg (5 sessions).
- Exercises involving grasping nearby objects (5 sessions).
- Light-resistance pulling exercises using a spring attached to the bed (5 sessions).
- Light-resistance isometric contraction exercises using an elastic band (level 1), holding for a specified duration according to the patient's ability (5 sessions).
- Light-resistance dynamic contraction exercises using an elastic band (level 1) (5 sessions).
- Light-resistance dynamic contraction exercises using kettlebells and dumbbells weighing (0.5 kg) (5 sessions).
- Static balance and dynamic stability exercises (5 sessions).
- Dynamic balance exercises (5 sessions).

The research experiment began with administering the pre-tests to the participants aged (50–55) years, totaling (11) patients. These tests were conducted at Baghdad Teaching Hospital / Physiotherapy Department at 10:00 a.m. on Wednesday (20/11/2024).

Neuromuscular control rehabilitation exercises were applied to the experimental group during their physiotherapy treatment at Baghdad Teaching Hospital / Physiotherapy Department from Sunday (24/11/2024) to Thursday (16/1/2025). The control group continued receiving the standard rehabilitation program followed at the same hospital.

Post-tests were administered to both research groups on Sunday (19/1/2025), after completing the neuromuscular control rehabilitation program.

After completing the experiment, the researcher statistically analyzed the data using the SPSS software package to extract the percentage, mean, standard deviation, skewness coefficient, and paired-samples t-test values.

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Results

Table 2. *Pre-test results between the two research groups*

Variables and unit of measurement	Group (N)	Mean	SD	Levene	Sig	t	Sig	Difference
General body strength (kg)	Experimental (5)	0.55	0.071	0.048	0.831	0.237	0.818	Not significant
	Control (6)	0.56	0.069					
Berg overall body balance (score)	Experimental (5)	4.8	3.633	0.602	0.458	0.692	0.506	Not significant
	Control (6)	6.17	2.927					

Baseline equivalence was confirmed, as no statistically significant differences were found between the two groups (Sig > 0.05, df = 9).

Table 3. *Pre- and post-test results for each research group*

Variables	Group (N)	Comparison	Mean	SD	t	Sig	Difference
General body strength (kg)	Experimental (5)	Pre	0.55	0.071	26.151	0.000	Significant
		Post	30.28	2.54			
	Control (6)	Pre	0.56	0.069	38.486	0.000	Significant
		Post	24.243	1.563			
Berg overall body balance (score)	Experimental (5)	Pre	4.8	3.633	28.562	0.000	Significant
		Post	54.6	0.894			
	Control (6)	Pre	6.17	2.927	27.129	0.000	Significant
		Post	45.17	3.656			

Differences were statistically significant (Sig < 0.05) at a degree of freedom of (n−1) and a significance level of (0.05).

Table 4. *Post-test results between the two research groups*

Variables and unit of measurement	Group (N)	Mean	SD	t	Sig	Difference
General body strength (kg)	Experimental (5)	30.28	2.54	4.851	0.001	Significant
	Control (6)	24.243	1.563			
Berg overall body balance (score)	Experimental (5)	54.6	0.894	5.585	0.000	Significant
	Control (6)	45.17	3.656			

The differences were statistically significant (Sig < 0.05) at a degree of freedom of (9) and a significance level of (0.05).

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Discussion

A review of the results presented in Table (3) indicates that participants in both the experimental and control groups showed improvements in general body strength and overall balance in the post-tests compared with the pre-tests. However, the results of Table (4) demonstrate that the experimental group outperformed the control group in both general strength and overall body balance, which are key indicators of recovery from stroke sequelae among men aged (50–55) years with temporary hemiplegia.

This researcher stated that this betterment and superiority in the experimental group is due to applying neuromuscular control exercises, which were safe, compatible with patients' capabilities and without extremely difficulty or pressure on the nervous system it). The progression of the exercises was controlled and their contents were varied: repetitions depended on each patient's tolerance indicating that individual differences might be more important. Both sensory–motor stimulation of peripheral nerves and functional movement patterns in variable positions for the muscles involved were included. Most important, the fact that a low level of resistance was used in both isometric and dynamic contractions should be considered safe, but also very useful as part of resuming general strength and balance in people who have experienced stroke.

The improvement observed in the experimental group can be explained by the integration of these factors, which placed patients in rehabilitation situations characterized by simplicity, progression, and frequent repetition. This facilitated the recovery of neural functions related to neuromuscular control and the reorganization of motor programs governing the contraction of muscles in the affected limbs, particularly the arms and legs.

Rehabilitation in patients with hemiplegia need to consider some points, especially during the exercise, a sense of security and should not put pressure on affected nerve or submitting the patient to exercise he is unable to make it (Khadam 2022). Physical therapy for stroke-induced hemiplegia generally includes muscle strengthening and movement exercises to improve the posture of affected extremities (Rudy, 2018). Management modalities will vary based on the features and severity of disease, including motor rehabilitation, physiotherapy, medical treatment and possibly surgery (Al-Hajilan, 2019).

In addition, motor rehabilitation exercises have been demonstrated to promote neural growth and increase the generation of neurotrophic factors necessary for nerve development. Research also suggests the ability of physical activity to promote better cerebral blood flow and increasing cognitive function (Ludyga et al., 2016). It is, therefore, widely regarded that sports rehabilitation as a purposeful and goal-oriented process performed by professionals to increase the functional capacity of the injured body part and subjecting it back to pre-injury conditions with minimal chance of any deformity or dysfunction (Bunwan, 2019).

Physical responses of the body as seen in tissue growth and function are the result of muscle resistance training. Rehabilitation of the injured muscle, on the other hand is not same as training healthy muscles and should be done based on injury type and severity with slow increase in intensity, in a progressive manner without excessive load that can lead to further damage. It is thus imperative that practitioners who are rehabilitating athletes use a safe, scientifically sound approach to resistance application versus one of commercial vanity (Thabit, 2018). Repetition is one of the significant factors that have been regarded as essential elements of rehabilitation exercise load, it enhances neural function and

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promotes neuromuscular control required for restoring natural movement patterns (Jwan, 2023).

Improvements in muscular strength and balance on both sides of the body form the foundation for proper posture and contribute to correcting body alignment, while strength training in different positions enhances balance through repeated exposure and the equalization of dynamic moments (Al-Qatt, 2020; Jack, 2016).

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Conclusions

Neuromuscular control exercises are appropriate for rehabilitation sessions for men aged (50–55) years with temporary hemiplegia.

1. The application of neuromuscular control exercises contributes to restoring general strength following stroke-related impairments in this population.
2. Neuromuscular control exercises help restore overall body balance in patients with temporary hemiplegia after stroke.
3. It is essential to consider the capabilities and severity of injury among men aged (50–55) years with temporary hemiplegia when designing neuromuscular control rehabilitation exercises.
4. Continuous collaboration between academic specialists in sports rehabilitation within colleges of physical education and sports sciences and therapists in rehabilitation departments is necessary to accelerate recovery from stroke sequelae among men aged (50–55) years with temporary hemiplegia.

Appendix 1. *Description of the Handgrip Strength Test*

- **Test objective:** To measure handgrip strength.
- **Equipment and tools:** An electronic dynamometer with a measurement range of (0–150) kg (Figure 2).
- **Test description:** The patient holds the electronic device in the grip of one hand (right or left) and then squeezes the device as forcefully as possible.
- **Instructions and test conditions:**

o The arm holding the device must not touch any external object or the patient's own body.
o Avoid swinging or pendulum movements of the arm during performance.
o Three attempts are performed, and the best attempt is recorded.
o The measurement display must be reset to zero after each attempt.

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- **Recording:** The best value obtained from the three attempts is recorded for the patient.
- **Unit of measurement:** Kilograms (kg).

Figure 2. *Image of the handgrip strength measuring device*

Appendix 2. *Examples of selected rehabilitation exercises*

Rehabilitation session (21):

1. Contraction exercise using a 0.5 kg dumbbell:

- Sitting on a chair at a 90° angle or standing with feet shoulder-width apart.
- Hold the dumbbell in the affected arm directed downward with arms extended at the sides.
- Gradually flex the affected arm at the elbow to the maximum possible contraction.
- Hold for 5 seconds, then slowly return to the starting position.

2. Dynamic contraction using a level (1) elastic band:

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- Stand with feet shoulder-width apart and hold the elastic band handle in the affected hand.
- Gradually flex the affected arm at the shoulder (without bending the elbow) until the band reaches shoulder height while maintaining body stability.
- Hold for 5 seconds, then slowly return to the starting position.

3. Reverse contraction using a 0.5 kg kettlebell:

- Stand with feet shoulder-width apart and hold the kettlebell in the affected hand.
- Gradually raise the affected arm laterally from the shoulder until the kettlebell reaches shoulder height.
- Hold for 5 seconds, then slowly return to the starting position.

4. Elastic band contraction with coordinated arm and leg movements:

- Combine arm exercises with leg movements such as pulling, extending, and contracting (e.g., backward pulling), while stabilizing the non-affected leg.

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Strategic Intelligence and its Relationship to Evaluating the Performance of Physical Education School Principals from the Perspective of Administrative Supervisors in Baghdad Governorate

Israa Jassim Abd [1]. Iqbal Abdul Hussein[2]

[1,2] University of Baghdad, College of Physical Education and Sports Sciences for Women.

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Abstract

The relationship between strategic intelligence and the performance evaluation of school principals specializing in physical education from the perspective of administrative supervisors in Baghdad GovernorateToday, educational leadership is one of the most prominent pillars of the success of educational institutions, due to its effective role in achieving educational goals and raising the efficiency of administrative and educational performance. Among these skills, "strategic intelligence" stands out as a modern concept that combines logical thinking, the ability to predict the future, and working within a clear vision and effective partnership. This research aims to identify the relationship between strategic intelligence and the performance evaluation of school principals specializing in physical education from the perspective of administrative supervisors in Baghdad Governorate, and to determine the level of performance evaluation among school principals specializing in physical education from the perspective of administrative supervisors.

To reveal the nature of the relationship between strategic intelligence and performance evaluation, and to determine which dimensions of strategic intelligence are most closely related to performance evaluation.The researchers adopted the descriptive correlational approach because it was suitable for the nature of the research. The sample included (120) male and female managers who specialize in physical education, in addition to a number of administrative supervisors who evaluated their performance.

For the academic year (2024-2025), the number of which is (90) supervisors from the administrators, and the reasons for the researchers' study were that they represent the problem community in this research themselves, and they are an available sample characterized by ease of communication and achieve the required purposes. The methodological procedures for the research included, from them I chose (67) supervisors at a rate of (83.75%) by the random method for the main application sample, and I also chose (3) supervisors from them at a rate of (3.75%) by the random method for the exploratory experiment sample, and I also chose (10) supervisors from them at a rate of (12.5%) by the random method for the application sample. The data were collected by two approved scales, the first to measure strategic intelligence in its dimensions (organized thinking, foresight

[1] University of Baghdad, College of Physical Education and Sports Sciences for Women
israa.abd2304p@copew.uobaghdad.edu.iq
[2] University of Baghdad, College of Physical Education and Sports Sciences for Women
iqbal@copew.uobaghdad.edu.iq

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and strategic vision, partnership and motivation) and the administrative performance evaluation form prepared by the Ministry of Education and approved for work. Is it the evaluation of department directors?

After statistical processing using Pearson correlation coefficients and significance tests, the results showed a statistically significant positive correlation between strategic intelligence and performance evaluation, indicating that a high level of strategic intelligence among managers contributes to improving their performance level from the perspective of administrative supervisors.

In light of the findings, the study recommended enhancing school principals' strategic intelligence skills through regular training and development programs, and focusing on the future perspective and strategic vision in administrative decision-making, given the direct impact this has on improving institutional performance in schools.

Keywords: Strategic intelligence, performance evaluation, school principals, physical education, administrative supervisors.

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introduction

The educational development movement in Iraq is progressing, and those in charge are keen to ensure it is comprehensive and scientific, integrating all elements and bodies related to the educational process to provide the best educational services. The school is considered a fundamental unit in the educational system, as it bears the responsibility of preparing a generation capable of meeting the demands of life and keeping pace with rapid changes. The school principal is the most prominent leader, undertaking the tasks of planning, organizing, supervising, and evaluating, making their administrative and educational performance a key determinant of the success of the educational process. In light of the contemporary challenges facing educational institutions, strategic intelligence, which is future-oriented and allows the organization to make knowledge-based decisions while considering the organization's future circumstances, is a hallmark of organizational leaders who possess a future vision, foresight, systems thinking, partnership, motivational ability, intuition, and creativity (Hollensen, 2010:158). Strategic intelligence is an integrated system of leadership qualities that are used to address the challenges facing leaders and in the relationships between leaders and their people. (ScuddeR, 2011, pp. 32-40) Intelligence is the ability possessed by a certain level of managers who focus on an information system that ensures the collection and processing of information, enabling them to make strategic decisions that contribute to providing educational services with high efficiency. (Al-Zalimi, 2014, p. 33) It is the ability that describes the leaders of organizations in gathering information about other competing organizations in the field, identifying the internal and external environment and how to deal with it, and the clarity and realism of the strategy adopted. (Amin, 2014, p. 77) Strategic intelligence is a set of procedures and activities used to find, analyze, and evaluate all business information to achieve a specific goal, focusing primarily on issues related to the strategic planning of a business.

(4, Khalidiya Pc, 2019) Strategic intelligence has become one of the most important leadership skills that an educational manager should possess, as it contributes to guiding school work towards achieving goals, efficiently utilizing available resources, and making decisions in changing and complex environments. (Radi, 2020) Evaluating the administrative and educational performance of school managers is a fundamental tool for determining their competence in performing their duties, identifying their strengths and weaknesses, and subsequently developing improvement programs that contribute to enhancing the quality of education. Based on this, the research problem is defined by the following main question: What is the importance of studying the relationship between strategic intelligence and evaluating the administrative performance of school managers specializing in physical education?

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Methodology and Tools

First: Research Methodology and Design

The researchers adopted the descriptive method using survey and correlational approaches, as it is the most suitable for the nature of the research, which aims to uncover the relationship between strategic intelligence and the performance evaluation of school principals specializing in physical education from the perspective of administrative supervisors in Baghdad Governorate. This method is considered the most appropriate for the research problem and objectives. The descriptive method is defined as "the accurate perception of the reciprocal relationships between society, trends, inclinations, desires, and development, as it provides the research with a picture of lived reality, establishes indicators, and constructs future predictions" (Mahjoub, 2000, p. 95).

Second: The Research Population and Sample

The research population consisted of all administrative supervisors working in the education directorates of Baghdad Governorate for the academic year (2024–2025). The research sample was randomly selected, representing approximately (30%) of the original population. The sample consisted of (90) male and female supervisors. The researchers chose to study them because they represent the problem population in this research, and they are a sample that is easily accessible and fulfills the required objectives and methodological procedures of the research. (67) supervisors (74.44%) were randomly selected for the main application sample. (3) supervisors were randomly selected for the pilot study sample, and (10) supervisors were randomly selected for the application sample. The period extended from (July 13, 2025) to (July 27, 2025) in the general directorates in Baghdad, as shown in Table No.(1) .

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.**Table.1** It shows the population and sample distribution numbers and percentages

seq	Education Directorates	The size of the native community	The excluded	Dividing the research sample		
				Sample preparation and application of the scale		Sample of the exploratory experiment
				preparation	The practical	
1	First rusafa Education	13	2	9	1	1
2	Second rusafa Education	20	2	14	3	1
3	Third rusafa Education	10	/	8	2	/
4	First karkh Education	15	/	12	2	1
5	Second Karkh Education	21	3	16	1	/
6	Third Karkh Education	11	3	7	1	/
Total		90	10	67 %44.74	10 %11.11	3
Percentages of the sample from the population		%100	%11,11	%85.55		%3.33

Third: Research tools and data collection methods

The researchers used two main tools to collect data:

1- Strategic Intelligence Scale: Based on relevant literature and theories, the researchers developed the strategic intelligence scale they created.

The researcher, Huda Azzam Muhammad (2023), wrote her master's thesis. To ensure the current scale was tailored to the requirements of her study and its focus on the field of sports, the researchers followed a systematic scientific approach in developing the strategic intelligence scale, guaranteeing its validity and reliability for scientific research purposes. The literature indicates that constructing any scale requires meticulous planning characterized by a systematic sequence.

It takes into account scientific principles that ensure ease of application.

The scale is easy to correct and economical in terms of effort and time (Al-Ubaidi, 2011, p. 250). The scale was modified to suit the requirements and scope of the study. The researchers presented the scale to (11) experts in school administration and teaching methods to determine its suitability and appropriateness for the current study, serving the goal of preparing the scale and taking into account the controls for constructing research instruments. The scale consists of (30) statements distributed across (5) axes, as shown in Appendix No. (1), with five answer alternatives according to the Likert scale (strongly agree, agree, sometimes, disagree, strongly disagree). Scores are given (1, 2, 3, 4, 5) respectively. The

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highest score on the scale was (150) and the lowest score was (30). Face and content validity were verified by presenting it to a group of specialized referees, and the reliability coefficient was (0.91) using Cronbach's alpha equation.

2- Performance evaluation scale for school principals specializing in physical education:

The researchers adopted the performance evaluation form prepared and approved by the Ministry of Education for evaluating the work of school principals by specialized administrative supervisors. This form includes (6) areas: (cognitive area, skills area, values and attitudes area, e-learning area, activities and achievements area, and penalties). Each area includes:

- The cognitive domain, which includes (6) indicators, with each indicator scoring (4) points, and the total score for the domain is.(24)

- The skills domain includes (6) indicators, with each indicator scoring (4) points, and the total score for the domain is.(24)

- The domain of values and attitudes includes (6) indicators, the score for each item is (4) points, and the total score for the domain is.(24)

- The field of e-learning includes (4) indicators, with each indicator scoring (4) and the total score for the field being (16) points.

- The field of education, activities and achievements includes (6) indicators, and the score for each indicator is (2), and the total score for the field is (12) points.

- Penalties: If the manager receives a disciplinary penalty during the evaluation period, points will be deducted according to the type of penalty.

Total marks for the evaluation form (100) marks

Fourth: Field Application Procedures

- ❖Arabic and foreign sources.
- ❖The internet.
- ❖Direct, individual interviews.
- ❖Paper questionnaires to gather expert and specialist opinions.
- ❖Strategic intelligence scale.
- ❖Paper forms for data collection and processing.
- ❖Official and administrative correspondence.
- ❖Field visits to gather information.

Fifth: Equipment and tools used in the research:

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❖One (1) Chinese-made (CGSA) scientific handheld calculator.

❖One (1) Chinese-made (HP) personal electronic calculator.

❖ SPSS version 26 software was used for statistical data processing.

❖One (1) Chinese-made PILO electronic stopwatch.

VI. Statistical Methods Used

The data were analyzed using the following statistical methods:

●Arithmetic mean and standard deviation to describe the data.

● One-sample t-test to compare the arithmetic means with the hypothetical mean.

● Pearson correlation coefficient to measure the relationship between strategic intelligence and performance evaluation.

● Significance test (Sig) to verify the significance of differences and relationships.

Table.2 It shows the statistical features of the strategic intelligence scale

Type of indication	sig	Calculated value of (t)	Hypothetical mean	Error rate of the mean	Standard deviation	Arithmetic mean	N. of paragraphs	Scale name
moral	0.000	12.516	90	1.038	2.587	113.372	30	Strategic intelligence

Table.3 shows that school principals possess a high degree of strategic thinking, exceeding the scale's hypothetical level. This high level of strategic intelligence is a significant indicator of the ability of physical education principals to think long-term, analyze situations, and make appropriate decisions based on clear visions and future goals. Furthermore, this high level of strategic intelligence contributes to:

●Improving the planning and organization of school activities.

●Enhancing the efficiency of administrative and educational performance within the school.

●Strengthening the principal's ability to solve problems and make decisions flexibly and realistically.

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●Building positive working relationships with the teaching and administrative staff, which positively impacts their performance evaluation by administrative supervisors.

Table.3 It shows the statistical features of the job performance evaluation form for school .principals

Type of indication	sig	Calculated value of (t)	Hypothetical mean	Error rate of the mean	Standard deviation	Arithmetic mean	N. of paragraphs	Scale name
moral	000،0	6،79	50	0،82	2،6	58،81	28	Performance evaluation

Table (3) clearly shows a significant difference in performance levels among the sample, meaning that most managers demonstrated similar efficiency in their performance. These results indicate that (school managers specializing in physical education) possess outstanding administrative and technical skills, and perform their duties with a high degree of efficiency and effectiveness. This reflects a good level of educational management, planning, and organization within their schools. The high performance rating is not a coincidence, but rather reflects a positive reality in the level of administrative and leadership practice of these managers.

Table 4It shows the correlational relationships between the research variables

.

School principals evaluate	Strategic intelligence scal	Correlation coefficient	variables
		0.792(*)	Strategic intelligence scal
	0.130 (*)	0.097	School principals evaluate

Table (4) shows the results of the simple Pearson correlation coefficients between the main research variables, namely the Strategic Intelligence Scale and the Performance Evaluation Scale for School Principals Specializing in Physical Education. This indicates a weak, positive correlation between the two variables. This means that the higher the level of strategic intelligence among school principals, the higher their performance is evaluated by administrative supervisors, although the relationship is not very strong. This result supports the main hypothesis, which stated

that there is a correlation between the two variables, and indicates that strategic intelligence contributes, albeit to a limited extent, to improving the administrative and educational performance of principals. While strategic intelligence is an influential factor, it is not the sole determinant of school principals' performance evaluations. Other factors, such as administrative experience, leadership style, institutional support, and the school environment, may also play a role (Al-Kurdi, 1996: 313). Finland (12: 200) considers strategic intelligence a necessary process for facilitating long-term decision-making. Both

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researchers agree with Kruger (2010) that strategic intelligence enhances the capabilities of employees within institutions and facilitates decision-making that benefits the institution. However, the existence of a significant, albeit weak, positive correlation underscores the importance of strategic intelligence as a skill that should be strengthened to improve school management efficiency. This implies that school principals with higher strategic thinking skills tend to perform better in the eyes of administrative supervisors. A principal with strategic intelligence is more capable of planning, decision-making, managing human resources, and directing efforts toward achieving school goals (Dorn, 2007, p. 162), which positively impacts their overall performance and evaluation by supervisors. Those working with him, and since strategic intelligence is linked to the manager's ability to have a holistic vision, realistic analysis, and intelligent handling of administrative situations, a high level of it necessarily leads to an improvement in job performance evaluation, especially in aspects related to planning, leadership, decision-making, and human resource management in the school. Since the school principal is at the top of the pyramid in his field of work, he needs to possess the necessary requirements to make the right decision for a given reason, and he bears great responsibility in managing collaborative work with team members, by encouraging the team towards progress through overall performance, focusing on available elements, and in a way that enables us to use the available capabilities (Rashid & others, 335:2024).

Conclusions

1. The strategic intelligence scale and the performance evaluation scale contributed to determining the level of strategic intelligence and the level of performance evaluation of school principals specializing in physical education from the point of view of the administrative supervisors in Baghdad Governorate.
2. School principals possess a high degree of strategic intelligence from the perspective of administrative supervisors in Baghdad Governorate.
3 . School principals have a high level of performance evaluation from the perspective of administrative supervisors in Baghdad Governorate.
4 . There is a positive correlation between strategic intelligence and performance evaluation. It can be concluded that strategic intelligence is a strong indicator for evaluating the performance of school principals.

Thanks, and gratitude

I extend my sincere thanks, appreciation and gratitude to everyone who contributed to the completion of this research, and helped me with their words, opinions or guidance.

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Appendices
The Strategic Intelligence Scale in its final form

Dear Supervisor..... ,

-1You have before you the Strategic Intelligence Scale, which consists of statements, each with five possible answers (alternatives). Each answer represents your opinion on the statement's content.

-2Your answers are for scientific research purposes only and are strictly confidential.

-3Please do not answer any statement with more than one option in the designated section.
-4Please do not leave out any statement, as this will negatively affect your opinions.

The Researchers

(strategic Intelligence scale)

ت	Ferries	I strongly agree	agree	sometimes	I disagree	I strongly disagree
1	The school principal relies on his skills in interpreting the future directions of the school.					
2	The school principal can see and deal with things that are unclear.					
3	The school principal believes in the importance of anticipating the future to achieve leadership and excellence.					
4	The school principal constantly monitors environmental changes surrounding the school to make future decisions.					
5	The school principal puts forward proposals that would prevent problems from occurring in the school.					
6	The school principal's ability to respond to changes that arise both inside and outside the school					

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7	The school principal works to make good use of available opportunities to achieve the school's goals.
8	The school principal explains the problems by considering their combined causes.
9	The school principal conducts a thorough review of all issues related to the school.
10	The school principal adopts a logical analysis approach to the internal problems he faces at work.
11	The school principal operates within a unified, coherent, and interconnected system within the school.
12	The school principal possesses the ability to make strategic decisions.
13	The school principal adopts new methods for learning and acquiring knowledge at the school.
14	The school principal studies the problems facing the school from several different angles.
15	The school principal relies on a clear vision when making decisions.
16	The school principal possesses a holistic vision through which he defines the work system in the school.
17	The school principal has the ability to transform the vision into a tangible reality that can be implemented within the school's educational mission.
18	The decisions made by the school principal are consistent with his strategic vision for the school.
19	The school principal uses his vision to unify teachers' efforts towards the school's goals.
20	The school principal formulates the school's strategic goals according to a scientific methodology.

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21	The school principal involves teachers in presenting options for decision-making at the school.
22	The school principal welcomes the teachers' new ideas and opinions.
23	The school principal supports teachers who have new proposals to improve the school.
24	The school principal rewards outstanding teachers.
25	The school principal encourages teachers to form work teams among themselves.
26	The school principal has the ability to persuade teachers to effectively carry out their assigned tasks.
27	The school principal believes that strategic alliances with other similar schools help in crisis management.
28	The school principal tries to establish alliances with other schools to benefit from their expertise and experience in educational and administrative work.
29	The school principal believes that partnership provides flexibility in the face of ongoing environmental changes.
30	The school principal believes that the partnership gives the school a greater ability to face competition.

Appendix 2

It lists the academic titles, names, specializations, and places of work of the professors .and experts who were interviewed

Work place	Scientific title	Jurisdiction	name	ت
Al-Mustansiriya Basic Education	professor	Teaching methods	Prof. Dr. Ismail Abd zaid Ashour	1
Al- Muthanna University	professor	Sport managment	Dr. Khaled Aswad Laikh	2

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University of Baghdad	Assistant professor	Teaching methods	Misaa Nadim Ahmed Al- yassin	3
Al-Mustansiriya University	Assistant Doctor	Sport managment	Salam Hantoush Rashid	
University of Baghdad / College of Physical Education and Sports Sciences	Professor dr	Sport management	Hussein Khamis Hussein	5
Al-Mustansiriya University, College of Physical Education and Sports Sciences	professor	Measurement and -evaluation basketball	Dr. Ali Samoum Al-Fartusi	6
Lebanese University of Science and Arts	A.p.D	Sport managment	Fadi Mouhammed Al-Kubi	7
University of Diyala / Physical Education and Sports Sciences	Professor dr	Measurement and evaluation	Bashar Galib Shehab	8
Ibn Al-Haytham College of Pure Sciences	Professor A. dr	Teaching methods	Rana Abd al Majeed Alwan	9
Maysan University	Professor A. dr	Teaching methods	Ebtegaa Mohammed kasim	10
University of Babylon	Professor	Teaching methods	Raghdaa Hamza Safah	11

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Performance evaluation form for school principals

School	Full name
Job title	Date of appointment
specialization	Date of assuming office
Are you participating in the population census?	certificate

Grade awarded	Highest degree	Indications	ت
	4	Knows and understands educational philosophy, policies, and goals.	1
	4	Knows and understands educational regulations, instructions, and legislation.	2
	4	Knows and understands modern teaching methods.	3
	4	Knows and understands school leadership and management styles	4
	4	Knows and understands the social and environmental conditions in which learners live.	5
	4	Knows and understands the process of self-evaluation and external evaluation of the school.	6
0	24	Total	

Grade awarded	Highest degree	Indications	ت

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	4	Develops, implements, and monitors plans to improve school performance and enhance its efficiency.	1
	4	Establishes positive educational relationships built on trust and mutual respect with school staff, students, and their parents.	2
	4	Creates a safe and stimulating school environment that contributes to success and excellence.	3
	4	Deales with challenges, crises, and emergencies quickly and wisely.	4
	4	Consults with school staff and involves them in sharing responsibilities and decision-making.	5
	4	Accurately evaluates school performance and identifies strengths and .areas for improvement	6
0	24	Total	

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Grade awarded	Highest degree	Indications	ت
	4	He adheres to the ethics of the teaching profession and demonstrates patience at all times.	1
	4	He is committed to instilling national and moral values in school staff and students.	2
	4	He accepts diverse opinions and respects cultural and intellectual diversity.	3
	4	He encourages school staff to participate in volunteer activities and to contribute to the school and the community.	4
	4	He engages in ongoing self-assessment and professional development for himself and the school staff.	5
	4	He is committed to ensuring appropriate education for students with special needs or those experiencing psychological or social difficulties, and supports them in developing their abilities and skills	6
	24	Total	

Grade awarded	Highest degree	Indications	ت
	4	He possesses the ability to use electronic programs and applications to manage and archive school documents and records.	1
	4	He possesses the ability to communicate electronically with school staff, supervisors, and parents to ask questions, provide answers, and offer feedback.	2
	4	He possesses the ability to use electronic applications and platforms to create and manage virtual classrooms and present educational content.	3
	4	He monitors the implementation of e-learning by the teaching staff both inside and outside the school and documents this in the visitor log.	4
0	16	Total	

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Grade awarded	Highest degree	Indications	ت
	2	Publishing a scientific research paper or article, authoring a book, or preparing a course syllabi.	1
	2	Voluntarily contributing to awareness campaigns aimed at preventing diseases and epidemics, combating drug abuse and addiction, promoting safety and security, protecting the environment, eradicating illiteracy, addressing family problems, or supporting Iraqi national industry.	2
	2	Participating in ministerial monitoring or inspection committees.	3
	2	Developing a rehabilitation program for learners with special needs, designing an educational activity that enhances learner interaction, or delivering a training lecture that promotes e-learning skills.	4
	2	Giving a lecture at a training course, scientific seminar, or workshop	5
	2	Organizing a scientific competition, cultural festival, art exhibition, sports tournament, theatrical performance, or school trip to a historical, heritage, cultural, scientific, sports, or industrial site.	6
0	12	Total	

Deducted grade	The number	Type of punishment	ت
0		Warning (3 points deducted)	1
0		Reprimand (5 points deducted)	2
0		Salary cut (7 points deducted)	3
0		Reprimand (11 points deducted)	4
0		Salary reduction (13 points deducted)	5
0		Demotion (15 points deducted)	6

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0	0	Total

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Refreance

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The Effect of Lactate Resistance Training on Hemoglobin Concentration Performance Endurance and Some Offensive Skills of Under-21 Football Players

Mohammed Bajai Atia[1] Ali Abdulamir Hussein [2]

[1,2] University of Karbala, College of Physical Education and sport sciences.

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Abstract

Enhancing the functional efficiency of vital components (hemoglobin) to cope with the substantial accumulation of lactate, and improving the efficiency of muscle fibers during high-intensity exertion and pronounced intramuscular lactate buildup—along with increasing these fibers' capacity to generate the required energy through lactate removal and breakdown during high-intensity training—constitutes a key factor in developing performance endurance. Among the most effective exercises that create these conditions are lactate-resistance training methods. The first aims to elevate lactate to maximal levels without excessive accumulation within muscle fibers, while the second seeks to raise intensity with increased accumulation in order to improve blood hemoglobin concentration and enhance performance endurance, which is strongly associated with the muscles' tolerance to lactate levels and accumulation. The research problem lies in the reduced ability to maintain speed during the advanced stages of matches and the weak linkage between high physical effort and the accurate and effective execution of complex offensive skills, which may be attributed to insufficient physiological adaptations resulting from the training methods used. The study aimed to identify the effect of lactate-resistance training on hemoglobin concentration, performance endurance, and certain offensive skills among under-21 football players. The research hypothesis posited that lactate-resistance training would have a significant effect on hemoglobin concentration, performance endurance, and selected offensive skills in under-21 football players. The researchers adopted the experimental approach due to its suitability for addressing the nature of the proposed problem. The research sample consisted of under-21 players from Karbala Football Club. The researchers concluded that the scientifically planned and systematically implemented training program applied to the study sample contributed positively to the development of the study variables.

Keywords: Lactate Resistance Training, Hemoglobin Concentration, Endurance Performance, Offensive Soccer Skills.

[1] University of Karbala, College of Physical Education and sport sciences.
mohamed.b@uokerbala.edu.iq

[2] University of Karbala, College of Physical Education and sport sciences.
ali.abdulamir@uokerbala.edu.iq

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Introduction and Significance of the Study

Football is one of the most widely practiced sports worldwide, characterized by excitement, suspense, and intense competition among players. Performance in football relies heavily on energy production through the anaerobic lactic system. The specific demands of the game place a considerable burden on various functional systems of the body due to increased accumulation of lactate and hydrogen ions within muscle fibers during training and competition. Consequently, players experience muscle pain, a reduction in speed, and may ultimately cease activity when excessive amounts of lactic acid/lactate and hydrogen ions accumulate in the blood.

However, the body possesses regulatory systems that help restore internal homeostasis, including biological buffers—chemical substances that reduce hydrogen ion concentration when it increases (acidosis) and counteract alkalinity when it decreases—thereby maintaining blood pH balance. Among the most important chemical biological buffers is hemoglobin.

With the significant advancements in modern training methods and approaches, and the scientific additions introduced through rigorous research and experimentation, developing the function of biological buffers (hemoglobin) to cope with high lactate accumulation, improving the efficiency of muscle fibers under high-intensity conditions, and enhancing these fibers' capacity to generate energy through lactate removal and breakdown during intense training have become key factors in improving performance endurance. The most important exercises that provide these adaptations are lactate-resistance training methods. The first aims to elevate lactate to maximal levels without excessive accumulation within muscle fibers, while the second seeks to raise intensity with increased accumulation to improve blood hemoglobin concentration and enhance performance endurance, which is strongly associated with increased muscular tolerance to lactate levels and accumulation.

Football has been profoundly influenced by modern sports sciences, as training science has witnessed remarkable development, particularly in lactate-resistance training, which enhances the efficiency and activity of various body systems and organs. This is positively reflected in general and specific abilities, as well as physiological and skill-related capacities, through optimal use of training techniques and methods to achieve positive outcomes. In line with this development, there is a need to design varied and well-regulated training programs based on scientific principles that align with competition demands and players' age categories to achieve the desired objectives in modern football. Hence, the importance of the present study lies in designing lactate-resistance training to develop the investigated variables, as a scientific contribution to training programs adopted by coaches.

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Research Problem

The accumulation of lactic acid is considered one of the physiological factors that negatively affect the continuity of effective performance due to its association with muscular fatigue, decreased performance endurance, and reduced accuracy in executing complex skills, particularly in demanding offensive situations. Although many training programs focus on developing endurance and speed separately, there is a clear deficiency in the scientific application of lactate-resistance training aimed at physiological adaptations related to oxygen transport, such as hemoglobin, and their effect on performance endurance and its direct reflection on the quality of complex offensive skill performance.

Through observing the training reality and competitions of this age group, a decline in the ability to maintain speed during the advanced stages of matches and a weak linkage between high physical effort and the accurate and effective execution of complex offensive skills have been noted. This may be attributed to insufficient physiological adaptations resulting from the training methods employed. Accordingly, the research problem is defined as the need to examine the effect of lactate-resistance training on selected physiological, physical, and skill variables to determine its contribution to improving hemoglobin concentration, performance endurance, and the development of complex offensive skills among under-21 football players, thereby contributing to the design of more efficient training programs aligned with the requirements of modern performance.

Research Objectives

1. To identify the effect of lactate-resistance training on hemoglobin concentration, performance endurance, and selected offensive skills among under-21 football players.

Research Hypothesis

1. Lactate-resistance training has a positive effect on hemoglobin concentration, performance endurance, and selected offensive skills among under-21 football players.

Research Scope

1. **Human Scope:** Under-21 players of Karbala Football Club.
2. **Temporal Scope:** 15/08/2025 – 01/12/2025.
3. **Spatial Scope:** Karbala International Stadium.

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Research Methodology and Field Procedures

Research Methodology

The researchers employed the experimental method due to its suitability for the nature of the problem under investigation. An experimental design with two equivalent groups—experimental and control—was adopted.

Research Population and Sample

The research population is defined as "all individuals, events, or objects that constitute the subject of the research problem" (Mohammed Abdul Fattah Al-Sarafi, 2002, p. 185). The research population consisted of under-21 football players from Karbala Football Club. The researchers selected a sample of 20 players using the comprehensive enumeration method. The sample was randomly divided into two groups: an experimental group and a control group, with each group comprising 10 players.

Homogeneity

The researchers identified the measurements that influence the study variables—namely height, body mass, and training age—due to their relevance to the research variables under investigation. Homogeneity among the sample participants with respect to these measurements was examined using Levene's test.

Table1. Results of Levene's Test for Homogeneity of the Research Groups

Variables	Unit of Measurement	Group	Mean ($\bar{X}$)	SD	df Between Groups	df Within Groups	Levene's Value	Sig. Level	Type of Significance
Height	cm	Control	171.4400	3.77689	1	18	0.128	0.725	Not significant
		Experimental	173.2100	3.65922					
Body mass	kg	Control	64.6900	4.45856	1	18	0.331	0.572	Not significant
		Experimental	63.9000	3.90640					
Training age	months	Control	52.2000	4.62990	1	18	0.257	0.618	Not significant
		Experimental	53.9000	5.31489					

It is evident from Table (1) that the significance levels of Levene's test for homogeneity across all variables were greater than the significance level (0.05), indicating that the two research groups were homogeneous with respect to the extraneous variables.

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Instruments, Devices, and Tools Used in the Study

- Observation.
- Personal interviews.
- Tests and measurements.
- Electronic device for measuring height and body mass.
- Two (2) SONY cameras (Japanese-made).
- One (1) ACER electronic calculator/computer.
- Medical cotton.
- Disinfectant solution.
- Two (2) whistles (Chinese-made).
- Four (4) cones with a height of 30 cm.
- Twenty (20) medical syringes with a capacity of 5 ml.
- Cooling box (cool box).

Field Research Procedures

Determination of Research Variable Measurements

ϖ Blood Hemoglobin Measurement (Hb):

Hemoglobin concentration was measured using a 2 ml blood sample analyzed with a Complete Blood Count (CBC) device.

First: Performance Endurance Test

- Test Name: Circular Performance Test.
- Purpose of the Test: To measure circular performance endurance of the players.
- Test Requirements: Football field, 10 footballs, 6 markers, whistle, stopwatch, timer, and recorder.
- **Performance Description:**
  This test is performed in a circular sequence. The player starts at the midfield line on the right side and performs 30 ball touches (ball control). The player then runs along the touchline while dribbling the ball until reaching the corner area, where a high cross is delivered into the penalty area. The player then runs to the edge of the penalty area facing the goal and shoots five (5) balls at the goal. Subsequently, the player moves to the left touchline to perform a throw-in to a teammate, receives the ball back, and dribbles the ball in a zigzag pattern between plastic markers (cones). Finally, the player sprints for a distance of 30 meters.
- **Scoring:**
  The total time taken to complete the performance is recorded.

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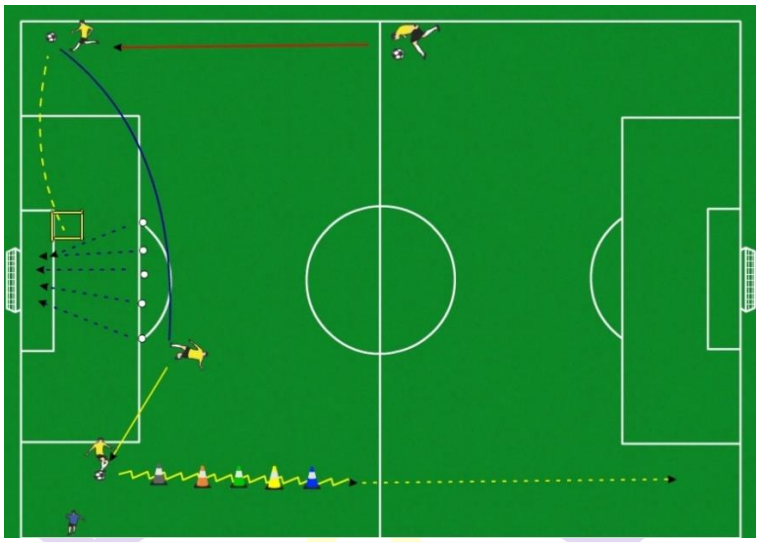

Figure (1) Illustrates the **Circular Performance Endurance Test**.

Second: Dribbling Test

- Test Name: Dribbling the ball between ten (10) markers, back and forth (Saleh Radi, 1998, p. 120).
- Purpose of the Test: To measure dribbling skill.
- Equipment Used: Football, stopwatch, ten (10) markers of appropriate height.
- Test Area: The test area is defined so that the distance between each marker is 1.5 m.
- Performance Description: Upon hearing the starting whistle, the player dribbles the ball between the markers while maintaining proper dribbling technique.
- Number of Attempts: Each player is given one attempt; if the attempt is unsuccessful, a second attempt may be allowed.
- Scoring: The time taken to complete the test back and forth is recorded to the nearest tenth of a second.

Third: Passing Test

- Test Name: Passing test (Raad Hussein Hamza, 1999, p. 14).
- Purpose of the Test: To measure passing accuracy.
- Equipment Used: Ten (10) footballs and a small goal with dimensions (110 cm × 63 cm).
- **Performance Description:**
  A line of 1 m in length is drawn at a distance of 20 m from the small goal. A stationary ball is placed on the starting line, and the player stands behind the line facing the small goal. Upon the signal, the player passes the ball toward the goal. Each player is given five (5) consecutive attempts.
- **Scoring:** The total score is calculated based on the five passes, as follows:
  - Two points for each successful pass that enters the small goal.
  - One point if the ball hits the post or crossbar without entering the goal.

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- Zero points if the ball misses the small goal.
- **Maximum score:** 10 points.

Fourth: Ball Reception Test

- **Test Name:** Ball reception (inside of the foot) test (Hanafi Mahmoud Al-Mukhtar, 1997, p. 63).
- **Purpose of the Test:** To measure the player's ability to control the ball within a defined area in football players.
- **Equipment Used:** Footballs, cones, rope.
- **Performance Description:**
  The player stands inside a circle with a diameter of 2 m. A teammate passes three (3) ground balls into the circle, and the player must receive and control each ball without allowing it to leave the circle.
- **Scoring:** One point is awarded for each successful reception in which the ball remains within the circle.
- **Maximum score:** 3 points.

Pilot Study

A pilot study is defined as a small-scale experiment or preliminary procedure conducted by the researchers to identify the strengths and weaknesses that may accompany the implementation of the main experiment (Nouri Al-Shouk & Rafi' Al-Kubaisi, 2004, p. 77). The objectives of the pilot study were as follows:

- The pilot study was conducted on Saturday, 16/08/2025.
- To determine the extent to which the research sample responds to and interacts with the tests.
- To identify the appropriate time required for administering the tests.
- To verify the adequacy of the assisting research team in conducting the tests.
- To determine the time duration of each test.
- To establish the scientific bases of the tests.
- To identify the time required for the training unit.
- To familiarize with the exercises and their methods of execution.
- To determine the duration and intensity of the exercises.

Scientific Bases of the Tests

- **Test Validity:**
  Validity is one of the essential scientific bases of a good test and refers to "the extent to which the test actually measures the ability, trait, attitude, or readiness it was designed to measure; that is, it measures what it is intended to measure" (Mohammed Jassim Al-Yasiri, 2010, p. 72).
- **Test Reliability:**
  Reliability is the second essential characteristic that researchers must verify, referring to "the degree of accuracy with which the test measures the trait it

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assesses. In other words, a test is considered reliable if it measures the trait accurately and consistently from one occasion to another under similar conditions" (Ahmed Mohammed Abdulrahman, 2010, p. 94).

- **Test Objectivity:**
  Objectivity refers to "freedom from bias or prejudice and the exclusion of the examiner's personal factors, such as opinions, tendencies, or personal inclinations, including any form of bias" (Ali Samoom Al-Fartousi et al., 2015, p. 229).

Pretests

Prior to implementing the training exercises prepared by the researchers, pretests were conducted on Friday, 15/08/2025, for the research sample on the study variables under investigation. The researchers ensured that all temporal and spatial conditions, as well as the procedures for administering the tests, were standardized as much as possible.

Equivalence

The researchers carried out equivalence testing for the research sample based on dependent variables, including hemoglobin concentration, performance endurance and selected complex offensive skills (see Table 2).

Table2. Equivalence of the Two Research Groups

Variables	Group	Mean ($\bar{X}$)	SD	Calculated t-value	Sig. Level	Type of Significance
Hemoglobin before exertion	Control	14.3	1.24	0.151	0.487	Not significant
	Experimental	14.2	1.56			
Hemoglobin after exertion	Control	15.6	2.12	0.086	0.745	Not significant
	Experimental	15.5	2.78			
Performance endurance	Control	67.55	3.54	0.120	0.598	Not significant
	Experimental	67.77	4.23			
Dribbling	Control	19.22	0.57	0.488	0.354	Not significant
	Experimental	19.12	0.23			
Passing	Control	3.50	0.88	0.017	0.932	Not significant
	Experimental	3.00	0.69			
Ball reception	Control	4.00	0.71	1.256	0.134	Not significant

Main Experiment

The researchers designed lactate-resistance training exercises to develop the investigated research variables for the experimental group. This was based on the analysis and review of a large number of specialized scientific sources and references, while taking into account the training level and physical capacity of the research sample.

The training program was implemented as follows:

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- The training units were applied during the special preparation phase.
- Implementation of the exercises began on Sunday, 17/08/2025.
- The training program lasted for eight (8) weeks.
- Three training units were conducted per week, resulting in a total of twenty-four (24) training units.
- The duration of each training unit ranged from 45 to 55 minutes.
- The exercises were applied only in the main part of the training unit.
- The researchers considered the individual differences and performance levels of the players when designing the exercises.
- The training consisted of a combination of physical exercises integrated with ball-based drills, all directed toward lactate-resistance training.
- Training days were Sunday, Tuesday, and Thursday.
- A high-intensity interval training method was used.
- Training intensity ranged between 80% and 90% of the target time for each participant, based on the results of the pretests.
- The implementation of the training program concluded on Thursday, 16/10/2025.

Posttests

Upon completion of the training exercises included in the training program, the researchers re-administered the same tests used in the pretests to both research groups, under the same temporal and spatial conditions and following the same procedures as closely as possible for the research variables under investigation.

Statistical Methods

The researchers used the Statistical Package for the Social Sciences (SPSS) employing the following statistical techniques:

- Arithmetic mean.
- Standard deviation.
- Levene's test.
- t-test for paired samples.
- t-test for independent samples.

Presentation, Analysis, and Discussion of Results

Presentation and Analysis of the Pre- and Posttest Results of Hemoglobin, Performance Endurance, and Offensive Skills for the Two Research Groups and Their Discussion

Presentation and Analysis of the Pre- and Posttest Results of Hemoglobin, Performance Endurance, and Offensive Skills for the Control Group

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Table3. Shows the arithmetic means, standard deviations, mean differences, standard error of the differences, calculated *t*-values, significance levels, and type of statistical significance for the pre- and posttests of the research variables for the control group.

Variables	Test	Mean ($\bar{X}$)	SD	Mean Difference	SE of Difference	Calculated t-value	Sig. Level	Type of Significance
Hemoglobin before exertion	Pretest	14.3	1.24	0.400	0.124	3.225	0.003	Significant
	Posttest	14.7	0.43					
Hemoglobin after exertion	Pretest	15.6	2.12	0.600	0.167	3.592	0.001	Significant
	Posttest	16.2	0.29					
Performance endurance	Pretest	67.55	3.54	10.05	1.612	6.234	0.000	Significant
	Posttest	57.5	2.54					
Dribbling	Pretest	19.22	0.57	1.72	0.322	5.341	0.000	Significant
	Posttest	17.5	0.76					
Passing	Pretest	3.5	0.88	2.500	0.715	3.496	0.002	Significant
	Posttest	6.0	0.96					
Ball reception	Pretest	4.00	0.71	1.00	0.263	3.802	0.001	Significan

Table (3) presents the statistical indicators of the pre- and posttest results for the physical and skill variables of the control group. The results revealed statistically significant differences between the pre- and posttests for the variables of hemoglobin, performance endurance, ball reception, dribbling, and passing. This was clearly demonstrated through the use of the t-test.

The mean values obtained in the pre- and posttests for the variables of performance endurance and dribbling showed lower mean values in the posttests compared with the pretests. This is expected, as these variables are measured inversely by time; that is, a lower mean value indicates a better performance level. In contrast, the results showed that the mean values in the posttests for the passing and ball reception variables were higher than those of the pretests, which is a normal outcome, since the results of these tests depend on an increase in the number of successful repetitions or scores.

Presentation and Analysis of the Pre- and Posttest Results of Hemoglobin, Performance Endurance, and Offensive Skills for the Experimental Group

Table4. Shows the arithmetic means, standard deviations, mean differences, standard error of the differences, calculated *t*-values, significance levels, and type of statistical significance for the pre- and posttests of the research variables for the experimental group.

Variables	Test	Mean ($\bar{X}$)	SD	Mean Difference	SE of Difference	Calculated t-value	Sig. Level	Type of Significance
Hemoglobin before exertion	Pretest	14.2	1.56	1.20	0.154	7.792	0.000	Significant

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	Posttest	15.4	0.35					
Hemoglobin after exertion	Pretest	15.5	2.78	1.10	0.215	5.116	0.000	Significant
	Posttest	16.6	0.27					
Performance endurance	Pretest	67.77	4.23	13.54	1.764	7.676	0.000	Significant
	Posttest	54.23	1.89					
Dribbling	Pretest	19.12	0.23	2.77	0.369	7.507	0.000	Significant
	Posttest	16.33	0.52					
Passing	Pretest	3.00	0.69	5.00	0.532	9.398	0.000	Significant
	Posttest	8.00	0.71					
Ball reception	Pretest	3.50	0.96	5.50	0.489	11.247	0.000	Significant
	Posttest	9.00	0.75					

Table (4) presents the statistical indicators of the pre- and posttest results for the variables of hemoglobin, performance endurance, ball reception, dribbling, and passing for the experimental group. The results revealed statistically significant differences between the pre- and posttests in favor of the posttests, as clearly demonstrated by the use of the t-test. The mean values for performance endurance and dribbling were lower in the posttests than in the pretests, since these variables are inversely measured by time; that is, a lower mean value in the posttest indicates a better performance level. In addition, the results showed statistically significant differences between the pre- and posttests in favor of the posttests for hemoglobin concentration, passing, and ball reception. The mean values of these variables were higher in the posttests than in the pretests, which is a normal and expected outcome, as the results of these tests depend on an increase in the number of successful repetitions or scores.

Presentation and Analysis of the Posttest Results of Hemoglobin, Performance Endurance, and Offensive Skills for the Control and Experimental Groups

Table5. Shows the arithmetic means, standard deviations, calculated *t*-values, significance levels, and type of statistical significance for the posttest comparisons between the control and experimental groups for the research variables.

Variables	Group	Mean ($\bar{X}$)	SD	Calculated t-value	Sig. Level	Type of Significance
Hemoglobin before exertion	Control	14.7	0.43	3.788	0.001	Significant
	Experimental	15.4	0.35			
Hemoglobin after exertion	Control	16.2	0.29	3.029	0.002	Significant
	Experimental	16.6	0.27			
Performance endurance	Control	57.5	2.54	3.099	0.002	Significant
	Experimental	54.23	1.89			
Dribbling	Control	17.5	0.76	3.812	0.001	Significant

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	Experimental	16.33	0.52			
Passing	Control	6.0	0.96	5.025	0.000	Significant
	Experimental	8.0	0.71			
Ball reception	Control	5.0	0.83	10.727	0.000	Significant

Table (5) presents the statistical indicators of the posttest results for the variables of hemoglobin, performance endurance, ball reception, dribbling, and passing for the control and experimental groups. The results revealed statistically significant differences between the posttests of the control and experimental groups for these variables, in favor of the experimental group, as clearly demonstrated by the use of the *t*-test.

The mean values of the experimental group for the variables of dribbling and performance endurance were lower than those of the control group, since these variables are inversely measured by time; that is, the lower the mean value, the better the performance level. In addition, the results showed that the mean values of the experimental group for hemoglobin, passing, and ball reception were higher than those of the control group, which is a normal and expected outcome, as the results of these tests depend on an increase in the number of repetitions or scores.

Discussion

After presenting and analyzing the results of the pre- and postmeasurements of hemoglobin (Hb) concentration before and after exertion for the research sample, it was found that all participants demonstrated improvements in this variable before exertion. The researchers attribute the increase in blood hemoglobin concentration to several contributing factors, including proper nutrition rich in iron and other amino acids that play a role in elevating hemoglobin levels. Although the observed increase was relatively small, even a slight rise in hemoglobin (Hb) leads to an increase in blood oxygen saturation, as one gram of hemoglobin can bind with approximately 1.34 ml of oxygen. An increase during rest indicates an enhancement in the oxygen-carrying capacity of the blood, which represents a positive physiological adaptation. Risan Khuraibat and Ali Turki indicated that amino acids and iron ions are essential components in the formation of red blood cells and hemoglobin molecules, and that iron deficiency in daily nutrition leads to anemia, with the estimated daily iron requirement being approximately 1 mg; therefore, daily dietary intake must contain an adequate amount to meet the body's needs of this important compound (Risan Khuraibat & Ali Turki, 2002, p. 59).

On the other hand, the researchers note that the exercises applied to the experimental group had a clear effect on increasing blood volume. These exercises contributed to an increase in plasma volume and subsequently red blood cell count, which positively influenced cardiac efficiency and enhanced oxygen transport to body systems and muscles.

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The researchers also attribute the improvement in performance endurance to the proposed training exercises, which enhanced the players' ability to sustain performance during play by working at high but submaximal intensity for longer durations and resisting fatigue resulting from exertion. This led to the development of physiological adaptations among the players. This finding is consistent with what was stated by Amr Allah Al-Bassati, who noted that directed physical exercises or efforts lead to functional adaptations in the body's internal systems to achieve a high level of sports performance (Amr Allah Al-Bassati, 1998, p. 3). Furthermore, the exercises prepared by the researchers were carefully selected according to a scientific perspective in terms of intensity and distances that match the specificity of the game. Mohammed Othman (1987) emphasized that when a coach is able to determine the appropriate timing for recovery phases, gradual increases in training load can be achieved within the training rhythm of physical performance (Mohammed Othman, 1987, p. 70).

The results also demonstrated statistically significant differences in offensive skills (dribbling, passing, and ball reception) in the posttests between the experimental and control groups, in favor of the experimental group. The researchers attribute this improvement to the effectiveness of lactate-resistance training applied to the experimental group, as these exercises possess distinctive characteristics and closely resemble real game situations due to their continuous use of the ball. This similarity enhances motivation and encourages players to exert maximum effort during training. Alfred Kunze (1980) emphasized that proper football training requires the ball to be the central focus of training, and that acquiring technical performance and playing ability necessitates precise observation and gradual physical conditioning within integrated technical and tactical training (Alfred Kunze, 1980, p. 22).

Moreover, the nature of the lactate-resistance exercises included in the training program was designed according to precise scientific principles, taking into account training load components such as progression and gradual increase in intensity in a manner suitable for the age group and performance level of the players. Adherence to the principles of sports training science leads to positive outcomes, as the success of training programs is measured by the extent of progress achieved by the athlete in skill, physical, and functional performance, which depends on the level of adaptation achieved through the applied training program. Abu Al-Ala and Ahmed Al-Nasr (1993) indicated that scientifically programmed training based on the principles of progression and gradual overload has positive effects on trainees, and that endurance training, in particular, produces tangible athletic development and creates favorable conditions for tactical understanding according to the type of sport practiced (Abu Al-Ala Ahmed & Nasr Al-Din Sayed, 1993, p. 192).

Offensive skills are considered fundamental skills in football, as players cannot perform their assigned duties without mastering them. The researchers believe that the

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observed development in these skills is attributed to their intensive use within the proposed training exercises, which led to significant improvements. Lactate-resistance training enhanced players' ball feel and passing distance perception, enabling accurate passing under pressure and improving decision-making in confined training areas. Ron Greenwood emphasized that training within limited spaces develops and teaches players passing accuracy (Ron Greenwood et al., 1989, p. 24). Therefore, coaches play a crucial role in guiding players toward mastering passing skills in all their forms.

Furthermore, the development of football, whether in playing styles or tactical approaches, largely depends on players' mastery of basic skills, particularly offensive skills, which require precise timing and high sensitivity of all body parts to maintain ball possession. Ball reception skill involves bringing the ball under control and acting according to the team's tactical needs. The improvement in this skill can be attributed to the integration of skills with correct performance and quick decision-making at the appropriate time within training areas under real competitive pressure during ball possession. Hassan Abdul Jawad (1980) stated that the success of a player in executing any task depends on proper ball reception from any direction (Hassan Abdul Jawad, 1980, pp. 28–29). In addition, the adaptation of the experimental group players to the training program, which employed high-intensity interval training with appropriate intensity levels and suitable rest intervals, led to the development of specific endurance capacities that positively reflected on offensive skill performance.

Enhancing physical capacities is of great importance for football players and represents one of the fundamental characteristics of modern football. The ultimate goal of training is to enable athletes to reach optimal performance levels by creating harmony between their abilities and capacities and the applied training program.

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Conclusions and Recommendations

Conclusions

The researchers concluded the following:

- The scientifically planned and systematically designed training exercises applied to the research sample contributed positively to the development of the study variables (hemoglobin concentration, performance endurance, and complex offensive skills).
- The training exercises significantly enhanced the efficiency of hemoglobin as a biological buffer through increased binding with hydrogen ions.
- Lactate-resistance training had a positive effect on improving performance endurance and selected offensive skills among under-21 football players.

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Recommendations

- Rely on physiological measurements whenever possible, such as hemoglobin concentration, at regular intervals to scientifically monitor the development of athletes' capacities.
- Coaches are encouraged to benefit from these training exercises and incorporate them into their training programs in a manner consistent with preparation phases.
- It is recommended to examine the effects of these training exercises on other research variables in future studies.

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Temporal Changes in Heat Shock Protein Levels (HSP70 and HSP90) at Rest and During the First Hour After a High-Intensity Resistance Exercise Session in Weightlifters

Omar Khalid Yasir[1]

[1] **University of Baghdad, College of Physical Education and Sports Sciences**.

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Abstract

This study was about how heat shock proteins, HSP70 and HSP90 change in the body after a really tough workout and over the next hour in top weightlifters. Heat shock proteins like HSP70 and HSP90 help us figure out how the body deals with stress from exercise.

We worked with 12 weightlifters from Amanat Baghdad Sports Club. They did a resistance workout that included the snatch and clean & jerk exercises at 85–90% of their maximum lift.

We took blood from these weightlifters at four times: before they started the workout right after they finished 30 minutes later and 60 minutes later.

We used a test called ELISA to check the levels of HSP70 and HSP90 in their blood.

The results showed that the levels of HSP70 went up a lot right after the weightlifters finished exercising and stayed high for a while. Heat shock proteins like HSP70 were still high in their blood, after some time. They went from 1.92 ± 0.38 ng/mL before exercise to 2.64 ± 0.45 ng/mL after and peaked at 30 minutes (2.98 ± 0.50 ng/mL) before going down a bit at 60 minutes. HSP90 levels did something. They went up from 2.73 ± 0.47 ng/mL before exercise to 3.35 ± 0.52 ng/mL after peaked at 30 minutes (3.68 ± 0.56 ng/mL) and then went down a bit.

These findings tell us that a single tough workout makes heat shock proteins, like heat shock proteins go up fast in weightlifters.

This increase in heat shock proteins happens after you do your exercise and it peaks within thirty minutes. Then it goes down over the next sixty minutes.

This shows that your body is turning on things to help with stress from exercise like the stress from a workout.

The results also suggest that HSP70 and HSP90 could be things to look at to track how stress your body is, under and to manage your workout loads in people who do strength training like strength athletes who do strength training.

[1] University of Baghdad, College of Physical Education and Sports Sciences
omar.taha@cope.uobaghdad.edu.iq

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Keywords:
Heat shock proteins, HSP70, HSP90 resistance exercise, acute physiological response, weightlifting.

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Introduction

Understanding what happens to the body after exercise is really important for athletes, those who do weightlifting. When athletes train hard their bodies experience stress that needs to be fixed. This involves changes at the level to help the body recover from weightlifting.

Heat Shock Proteins or HSPs are important for protecting the bodys proteins from damage caused by stress from weightlifting. When the body experiences activity like weightlifting it produces more of these Heat Shock Proteins. Two specific types, HSP70 and HSP90 are very responsive to exercise like weightlifting and have been linked to muscle stress from weightlifting.

Research has shown that a single intense workout can change the levels of HSP70 and HSP90 in the body after exercise like weightlifting. This change happens quickly. Is part of the bodys defense mechanism against stress from weightlifting. However most studies have looked at changes that happen after exercise like weightlifting, not away.

Elite weightlifters experience a lot of stress during training for weightlifting. Their bodies need to adapt to the stress of weightlifting. Understanding how HSP70 and HSP90 change after exercise like weightlifting can help us understand how their bodies recover from weightlifting. This knowledge can also help create training plans that are tailored to athletes who do weightlifting.

The goal of this study is to look at how HSP70 and HSP90 change in weightlifters after intense exercise like weightlifting. We want to know how these Heat Shock Proteins change over time and what this means for the bodys recovery from weightlifting.

The study has objectives:

* To find out the levels of HSP70 and HSP90 in elite weightlifters at rest before weightlifting.
* To see how HSP70 and HSP90 change in the hour after exercise like weightlifting.
* To compare the changes in HSP70 and HSP90 at times to understand the pattern of response to weightlifting.
* To understand what these changes mean for the bodys recovery from weightlifting.

We have two hypotheses:

* We think that HSP70 levels will be different at rest before weightlifting after exercise like weightlifting and during the hour after exercise like weightlifting.
* We think that HSP90 levels will also be different at rest before weightlifting after exercise like weightlifting and during the hour after exercise like weightlifting.

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Research Methodology

This study used an approach with a Repeated Measures Design. It is well suited to our research, which aims to track changes in Heat Shock Protein levels, HSP70 and HSP90 in the participants over time. This design helps analyze responses by comparing within the same individual who does weightlifting. This way we minimize the influence of variability and increase precision in interpretation of the data from weightlifting.

We implemented a high-intensity resistance exercise protocol like the one used in weightlifting. This protocol induces a stress response from weightlifting. We took measurements at three time points:

* Resting measurement before exercise like weightlifting.
* After the training session of weightlifting.
* During the hour after exercise like weightlifting.

Research Sample

Our research sample consisted of 12 weightlifters from the Baghdad Municipality Club. They were chosen because they are advanced-level athletes who regularly train for weightlifting. The participants follow high-intensity training regimens consistent with competitions, in weightlifting. This makes them suitable for investigating physiological responses to high training loads.

We verified that our sample was homogeneous in terms of training level and athletic experience. We excluded athletes with muscle injuries or medical conditions that could affect physiological responses to exercise. All participants were informed about the study and their consent was obtained prior to participation.

Table1. Characteristics of the Research Sample in the Variables (Age, Height, Body Mass and Training Age)

Variable	Mean	Standard Deviation	Skewness
Age (years)	22.41	2.13	0.42
Height (cm)	173.58	5.76	-0.31
Body Mass (kg)	84.33	9.14	0.27
Training Age (years)	6.25	1.87	-0.48

Table (1) shows that the skewness values are within the range (±1). This indicates a distribution and homogeneity of the sample in the studied variables.

We analyzed HSP70 and HSP90 levels using laboratory assays. We followed procedures and implemented control measures to regulate influencing variables. This ensured the accuracy and reliability of our results.

Table2. Shapiro–Wilk Test for Normality

Variable	W	Sig.
HSP70 Rest	0.964	0.812
HSP70 0 min	0.951	0.621
HSP70 30 min	0.972	0.903
HSP70 60 min	0.958	0.744

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HSP90 Rest	0.969	0.871
HSP90 0 min	0.954	0.668
HSP90 30 min	0.961	0.791

All p-values are greater, than 0.05. This indicates that our data follow a distribution. It supports the use of statistical analyses in our study.

The data was looked at to see if it followed a pattern. The results in Table 2 showed that all the important values were greater than 0.05 which means the data is normal. So it was decided to use statistical tests that work well with normal data like the Repeated Measures Analysis of Variance.

Research Procedures

The experiment was done in a room at the Baghdad Municipality Club where the temperature and humidity were controlled. All the measurements were done at the time of day for all the people in the study to make sure their bodies were in the same state.

Experimental. Measurement Procedures

The study used a plan to look at how the heat shock protein levels changed after a very hard workout especially in the first hour after exercise.

First: Resting Measurement

Blood samples were taken in the morning at 10:00 a.m. To make sure the time of day did not affect the results. The people in the study had not eaten for 10 hours before the test. The blood samples were taken 48 hours after their workout. They sat still for 10-15 minutes before the blood was taken to make sure their bodies were calm. This was used as a reference point to compare the measurements.

Second: Workout Plan

The people in the study did a workout that included:

* A general warm-up for 10 minutes
* A specific warm-up with weights that were 50-60% of what they could lift
* They did the Snatch and Clean & Jerk exercises with weights that were 85-90% of what they could lift
* They did 3-4 sets of each exercise
* They did 2-3 repetitions in each set
* They rested for 2-3 minutes between sets

The workout was designed to be very hard and to cause a lot of stress on their bodies.

Third: Measurements After Exercise

Blood samples were taken at three times to see how their bodies reacted to the workout:

* After the workout
* 30 minutes after the workout
* 60 minutes after the workout

The people in the study sat still and did not do any other exercise while they were waiting for the measurements. They were not allowed to have any drinks or stimulants.

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Methodological Control

All the measurements were done on the day and in the same conditions. The workouts were done at the time of day for all the people in the study. The same laboratory procedures were used for all the samples to make sure the results were accurate.

Instruments and Laboratory Analyses

Blood samples were taken from the arm. Put into special tubes. The blood was spun around in a machine to separate it. The samples were stored in a cold freezer until they were analyzed.

Analysis of HSP70 and HSP90 Proteins

The levels of HSP70 and HSP90 proteins in the blood were measured using a test called the Enzyme-Linked Immunosorbent Assay.

First: Kit Specifications

HSP70

The kit used was the Human HSP70 ELISA Kit made by Elabscience Biotechnology Co., Ltd.

The kit could detect levels of HSP70 between 0.156 and 10 ng/mL.

HSP90

The kit used was the Human HSP90 ELISA Kit made by Elabscience Biotechnology Co., Ltd.

The kit could detect levels of HSP90 between 0.312 and 20 ng/mL.

Second: Laboratory Analysis Procedures

The samples and the test kits were left at room temperature for a while before the test. The test kits were prepared according to the instructions. The samples were added to the test kits. Left to react for 90 minutes. The test kits were washed to remove any substances. A special solution was added to the test kits to make them change color. The color was measured using a machine.

Third: Quality. Accuracy Assurance

The samples were tested twice to make sure the results were accurate. If the two results were not the same the sample was tested again. A special curve was made to calibrate the test kits. All the samples were tested in the laboratory and, with the same test kits to make sure the results were consistent.

Statistical Analysis

The data was analyzed using a computer program. The average and standard deviation were calculated. The data was checked to see if it followed a pattern. The Repeated Measures Analysis of Variance was used to compare the results at times. If there were any differences further tests were done to find out where the differences were. The level of significance was set at 0.05.

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Results

Here are the results of the HSP70 levels study.
We looked at the HSP70 levels at times.
The times we looked at were when the people were resting, immediately after they exercised, thirty minutes after they exercised and sixty minutes after they exercised.
Time Point Unit Mean SD Change (%)
Rest ng/mL 1.92 0.38 —
Immediately post-exercise ng/mL 2.64 0.45 +37.5%
30 min post-exercise ng/mL 2.98 0.50 +55.2%
60 min post-exercise ng/mL 2.41 0.42 +25.5%
What does this mean for our bodies?
The HSP70 levels were highest thirty minutes after the people exercised. Then they started to go down.
Now lets look at the HSP90 levels.
We did the thing as before.
We looked at the HSP90 levels at times.
Time Point Unit Mean SD Change (%)
Rest ng/mL 2.73 0.47 —
post-exercise ng/mL 3.35 0.52 +22.7%
30 min post-exercise ng/mL 3.68 0.56 +34.8%
60 min post-exercise ng/mL 3.11 0.49 +13.9%
What does this mean for our bodies?
The HSP90 levels were similar to the HSP70 levels. They did not go up as much.
This is what we thought would happen.
We also did some tests to see if the HSP70 and HSP90 levels really changed.
These tests are called repeated measures ANOVA.
For HSP70 we got these results:
Factor F df Sig. Partial η^2
Time 38.72 3 33 0.0001 0.779
For HSP90 we got these results:
Factor F df Sig. Partial η^2
Time 24.15 3 33 0.0001 0.687
Note:
The F-value for repeated measures ANOVA is shown as F.
The degrees of freedom are shown as df.
The significance level is shown as Sig.
The effect size is shown as Partial η^2.
We did some tests to find out which times were different from each other.
These tests are called -hoc Bonferroni comparisons.
For HSP70 we got these results:

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Mean Difference and Sig.
We looked at the results for HSP70. Found some things.
The results for HSP70 are based on the tests we did which're post-hoc Bonferroni comparisons, for HSP70.
Rest vs 0 min -0.72 0.002
Rest vs 30 min -1.06 0.000
Rest vs 60 min -0.49 0.018
0 min vs 30 min -0.34 0.041
0 min vs 60 min 0.57 0.006
For HSP90 we got these results:
Comparison Mean Difference Sig.
Rest vs 0 min -0.62 0.004
Rest vs 30 min -0.95 0.000
Rest vs 60 min -0.38 0.039
0 min vs 30 min -0.33 0.048
0 min vs 60 min 0.57 0.011
We only counted the results that were significant, at $\alpha \leq 0.05$.

Results

Table3. Descriptive Statistics for HSP70 Levels

Time	Unit	Mean	Sd	%Percentage Change
At rest	ng/mL	1.92	0.38	——
Immediately after exercise	ng/mL	2.64	0.45	+37.5%
After 30 minutes	ng/mL	2.98	0.50	+55.2%
After 60 minutes	ng/mL	2.41	0.42	+25.5%

Physiological Interpretation:

The results indicate that **HSP70 levels reached their peak approximately 30 minutes after exercise**, followed by a **gradual decline over time**, suggesting a transient stress response associated with acute physical exertion.

Table 4. Descriptive Statistics for HSP90 Levels

Time	Unit	Mean	Sd	%Percentage Change
At rest	ng/mL	2.73	0.47	—
Immediately after exercise	ng/mL	3.35	0.52	+22.7%
After 30 minutes	ng/mL	3.68	0.56	+34.8%
After 60 minutes	ng/mL	3.11	0.49	+13.9%

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The pattern is similar to that of HSP70, but with a less pronounced increase, which is scientifically plausible.

Table 5. Repeated Measures ANOVA

HSP70	F	Df	Sig.	Partial η^2
Time	38.72	3, 33	0.0001	0.779

HSP90	F	Df	Sig.	Partial η^2
Time	24.15	3, 63	0.0024	0.687

Table6. Bonferroni Post Hoc Comparisons for HSP70

Comparison	**Mean Difference**	Sig.
Rest vs 0 min	-0.72	0.002
Rest vs 30 min	-1.06	0.000
Rest vs 60 min	-0.49	0.018
0 min vs 30 min	-0.34	0.041
0 min vs 60 min	0.57	0.006

Statistically significant at an error level of ≤ (0.05).

Table 7.Bonferroni Post Hoc Comparisons for HSP90

Comparison	**Mean Difference**	Sig.
Rest vs 0 min	-0.62	0.004
Rest vs 30 min	-0.95	0.000
Rest vs 60 min	-0.38	0.039
0 min vs 30 min	-0.33	0.048
0 min vs 60 min	0.57	0.011

Statistically significant at an error level of ≤ (0.05).

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Discussion of Results

The results in Table 3 show that heat shock protein levels, HSP70 go up after you do a really tough weight lifting workout. Heat shock protein levels or HSP70 are higher, after this kind of exercise. levels go up away after exercise peak at 30 minutes and then start to decrease at 60 minutes but still stay above normal levels. This pattern suggests that HSP70 is one of the proteins to respond to stress caused by intense exercise. It helps protect proteins and makes sure they fold properly after mechanical and oxidative stress from intense muscle contractions.

* The peak in HSP70 at 30 minutes post-exercise shows that the bodys protective mechanisms are still active during the recovery phase.
* This is a time when stress-related signals, such as oxygen species are high.
* Recent studies have shown that acute HSP responses happen within the minutes after exercise and peak during the early recovery phase.

Table 4 shows a pattern for HSP90 with levels increasing right after exercise and peaking at 30 minutes before decreasing at 60 minutes. However the increase in HSP90 is lower than that of HSP70. This is because HSP90 plays a role in stabilizing proteins and cellular signaling pathways related to muscular adaptation.

* Overall these findings show that HSP70 and HSP90 have a response to high-intensity resistance exercise in weightlifters.
* The levels of these proteins rise quickly after exercise peak at 30 minutes. Then decrease within the first hour of recovery.
* This highlights the role of these proteins in protecting muscle cells and helping with adaptation to training-induced stress.

The results from Table 5 using repeated measures ANOVA show significant differences in HSP70 and HSP90 levels across different time points. The p-values The levels of HSP70 and HSP90 are 0.0001 for both proteins. The effect sizes are really big.

* This pattern over time suggests that HSP70 and HSP90 are produced quickly after high-intensity exercise.
* They show that the body is turning on mechanisms to protect itself from muscular stress.
* HSP70, which is very sensitive to stress helps to fix damaged proteins and prevent them from clumping

The first hour after exercise is when HSP70 and HSP90 respond, with the highest levels happening around 30 minutes and then they go down slowly.

These findings show that HSP70 and HSP90 are like signals that the body's under acute muscular stress and is adapting, especially in top athletes.

* The big effect sizes really drive home how much time affects the levels of HSP70 and HSP90.
* This shows how important it is to take samples after exercise when we are trying to understand what is happening in the body after exercise.

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Tests using the Bonferroni test confirmed that all the differences between time points, for both HSP70 and HSP90 were statistically significant.

HSP70

* Post-hoc comparisons revealed a difference between rest and 0 minutes post-exercise of -0.72 ng/mL and between rest and 30 minutes post-exercise of -1.06 ng/mL.
* This indicates a peak response at 30 minutes with studies showing robust early induction of HSP70 following intense muscular stress.

HSP90

* A similar temporal pattern was observed, with differences between rest and 0 minutes and rest and 30 minutes.
* However the changes were less pronounced compared to HSP70 reflecting HSP90's role in stabilizing proteins and signaling pathways.

Physiological Interpretation of the Temporal Pattern

* The immediate increase in HSP70 and HSP90 post-exercise reflects the activation of protective mechanisms in skeletal muscle.
* Peak levels at 30 minutes indicate stress-related signaling.
* The gradual decline by 60 minutes reflects stabilization of the environment and the **continuation of physiological adaptation.**

Practical Implications

* These results give us markers for the time after we exercise.
* They help us figure out when to start training or recovery programs.
* The first hour after we exercise is the time to look at how heat shock proteins change in elite athletes.

Conclusions

1- Heat shock proteins, like HSP70 and HSP90 change quickly after high-intensity resistance exercise in weightlifters.
2- HSP70 is more sensitive to stress than HSP90 so it reacts more to exercise.
3- The hour after high-intensity resistance exercise is a time to study how heat shock proteins react.

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Recommendations

1- We should measure HSP70 and HSP90 levels during the hour after high-intensity resistance exercise to see how stress our muscles are under.

2- We should take these measurements during the sixty minutes, after exercise and pay attention to what happens at the thirty-minute mark.

3- We should design recovery and training programs based on how each athletes heat shock proteins react to exercise so we can avoid overtraining. Help them recover better.

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Prediction The Skill Performance of The High Long Serve Based on Some Biomechanical Variables For Junior Badminton Players

Rana Hadi Jabbar[1]

[1] University of Baghdad, College of Physical Education and sport sciences.

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Abstract

Badminton is one of the sports that has witnessed significant development through the great efforts made to expand its spread and to develop it from one level to a better level, relying on the science of biomechanics which studies human movement. Due to the absence of a study that has addressed the biomechanical variables of the long high serve skill in badminton, the researcher decided to address and interpret this study. The importance of the research lies in developing predictive equations for the long high serve skill in badminton based on the biomechanical variables of junior badminton players in order to provide important scientific results for players, coaches, and researchers. The research aims to identify some biomechanical variables of the long high serve skill for junior badminton players, identify the percentage of contribution of some biomechanical variables to the long high serve skill of junior badminton players, and develop predictive equations for the long high serve skill in badminton based on the biomechanical variables of junior badminton players. The researcher adopted the descriptive method using the survey approach on badminton players participating in the 2024–2025 sports season, whose number reached (38) junior players under the age of (16) years. Nine biomechanical variables were measured in addition to the long serve test in badminton. After processing the data, a set of conclusions and recommendations was reached, as the results showed the existence of (9) predictive equations with significant values that can be relied upon in explaining the relationship between biomechanical variables and the skill performance of the long high serve in badminton.

Keywords: Prediction, Biomechanical Variables, Long High Serve Skill in Badminton.

[1] University of Baghdad, College of Physical Education and sport sciences
Rana.H@cope.uobaghdad.edu.iq

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Introduction

One of the sports that has been developed in large part due to the effort it makes to bring Badminton as popular as possible. Since each scientific research is the basis that solves a problem or it also preserves and affects the transfer of what has been accomplished by an athlete from one level to a better level, we find that there are areas in which scientific research plays a major role and contributes to development such as sports area, including badminton games. Realization of this development is based on biomechanics, which examines human movement through in terms of principles, laws and factors shaping the athlete's motion. Another notable determinant of skill performance is the biomechanical variables, which identify an organization's activity and signal scientific research to determine solutions to specific problems.

According to "Motion analysis is one of the main tools through which motor performance can be studied; it is an analytical study of all the individual parts and elements of motion in order to reach a high degree of accuracy, allowing for best improvements and better performance" (Hussein & Shaker, 1998 pp. 41-42). Furthermore, “motion analysis gives the coach and athlete a visual model of the movement, as well as detailed information about errors in order to choose appropriate training methods and means to avoid motor errors, saving time and effort for both coach and athlete” (Abdel-Khaliq, 1999).

The long high serve skill in badminton is regarded as one of the main offensive skills, which, if mastered correctly may be critical to win a game for each team since there are no studies on the biomechanical variables of the long high serve skill in badminton so it is very necessary to investigate and rationalize what factor contributes to this skill performance in badminton and developing equations that would predict it for the coaches by knowing its biomechanical variables.

One of the studies that treatment biomechanical variables, which are the study of Rana Hadi (2013) was conducted on junior players Armenian Club in badminton aged (10-13) years and (12) players. The Findings Results showed that special exercises positively affected some physical variables in the inferential favor of the experimental group. Specific exercises also improved some biomechanical parameters (vertical momentum of the body at maximum height, body angular velocity, striking arm angular velocity, speed of shuttlecock launch and applied force) in the experimental group. In addition, previously mentioned special exercises positively impacted the forehand stroke in badminton for the experimental group. However, there was no significant difference in the variables (trunk angle at contact moment, the angular momentum of striking arm, knee joint angle at contact point moment, knee joint angular velocity, shuttlecock release angle, altitude of hitting points for shuttlekocks and shuttlecock release angle) between groups undergoing special exercises and those who did (Jabbar,2013 pp. 50–110).

In another study by Reem Salam (2009), conducted on (4) players from the Iraqi national men’s tennis team, it found that we find that tangential velocity of the striking arm between ’swing’ and ‘hitting' stages has a significant relationship compared to knee joint angle, height of the body center of gravity at hitting point, ball release angle at hitting point along with ball release speed and angular momentum in relation with level of technical performance in forehand stroke exertions during tennis. The result also showed that mechanical levels of the knee and hip joints in tennis did not reach a sufficient level corresponding to the technical performance level of forehand stroke (Ibrahim, 2009; pp. 58 & 132).

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A study by Habib Ali Taher (2004) on the Iraqi national volleyball team (11) concluded that some biomechanical variables such as knee angle and hip angle at preparation to implement the performance jump serve skill in volleyball, mechanical power variable, an important correlated variable with this angular velocity of the arm. The parameters of launch (angle, velocity, and initial height) proved weakly correlated with mechanical power. We also observed significant relationships with knee angle at preparation for jump serve and hip angle at the same time point, as well as between launch angle and height of center of gravity during ball release. Moreover, strong correlations were noted between the trunk angle and arm + trunk angular velocity, as well as to the launch angle. The trunk angular velocity was a contributor (0.903) for the ball launch, and this factor was raised to (0.999) when mechanical power was imparted to it (Al-Husseini, 2004, pp. 31,50).

The present research is unique in its establishing predictive equations for the long high serve skill obtained from biomechanical variables of junior badminton players, and such important scientific results are expected to be provided for players, coaches and researchers. So, this study identified some biomechanical variables associated with the long high serve skill in junior badminton players, determined the contribution of selected biomechanical variable to percentage long high serve skill and established predictive equations for badminton long-hitting high skills by using biomechanics variables in junior badminton players. The time frame of the study was between 6/10/2024 and 22/1/2025.

Methods and Tools

The researcher used the descriptive approach because it fits the research objectives and the survey method. It is defined as “the study of phenomena among members of a specific population as they are, without the researcher intervening to implement any alterations in the values of these phenomenon or impact on them in any manner” (Abdel-Fattah, 2022, p.218). The research sample, according to the championship regulations prepared by the Iraqi Central Badminton Federation, included (38) junior players under age (16) years among badminton players participating in the 2024–2025 sports season.

The researcher used more than one method of information collection, devices and tools in the form of (Arabic and foreign sources, observation and experimentation, personal interview, a assistive work team, workin on information gateway at international level). The remaining equipment comprised of (10) Yonex badminton rackets, (20) Yonex shuttlecocks, a high-speed camera (Casio) which had the capability to capture images at an interval of about (1000) frames per second, measuring scale (1 m), rubber rope (100 cm), and colored adhesive tapes. The biomechanical factors included elbow angle of the striking arm, the inclination angle of the trunk at hitting, knee joint angle of the supporting leg at hitting, shoulder joint angle, angular velocity of the striking arm/ angular velocity trunk, shuttlecock release speed and shuttlecock release Angle and height. The long serve test in badminton was the test implemented (Al-Bakri, 2000, p. 64).

Subsequently, a pilot study was implemented by the researcher on (5) junior badminton players under (16) years in order to extract the scientific bases of the test for suitability, stability and objectivity despite this test having scientific foundations that have been previously tested in Iraqi environment. The researcher gained content validity by providing the questionnaire forms to experts and specialists in biomechanics and

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badminton so that they were able to identify the most appropriate tests for measuring the long high serve skill in badminton, as well as determining which were considered the most important biomechanical variables contributing to this skill. As explained by Thaer Dawood (2020), "content validity measures how good a test is at representing all the facets or behaviours that make up a certain trait or phenomenon according to whether the test covers only part of the phenomenon or it covers the entire phenomenon" (Al-Qaisi, 2020, p. 25).

The reliability of the long serve test was also calculated in terms of the test–retest method. The reliability of the test was shown to be high, by Pearson's simple correlation coefficient between the values obtained in both measurements; the calculated significance value (Sig = 0.000) turned out smaller than the adapted level of significance (0.05). The objectivity of the test was also determined based on Pearson's simple correlation coefficient between the results obtained by both judges, and high objectivity was demonstrated because the calculated value of significance (Sig = 0.000) of which was lower than adopted significance level ($p>0.05$).

The researcher also using this analytical statistic software program, (IBM SPSS Version 26), the researcher also obtained arithmetic mean and standard deviation, median, skewness coefficient moments method: and Multiple Linear Regression Stepwise methods.

Results

The researcher calculated the values of the arithmetic means, standard deviations, medians, and skewness coefficients for all biomechanical variables and the long serve test in badminton. The results indicated that all skewness coefficient values were less than (+3), which reflects a good distribution of the sample and its homogeneity across all variables, as shown in Table (1).

Table 1. *Arithmetic Means, Standard Deviations, Medians, and Skewness Coefficients for the Biomechanical Variables and the Long Serve Test in Badminton*

No.	Variables	Mean	Median	Std. Deviation	Skewness
1	Elbow Angle of the Striking Arm	114.947	115.500	4.764	-0.255
2	Trunk Inclination Angle at the Moment of Shuttlecock Hit	27.657	28	2.485	0.827
3	Knee Joint Angle of the Supporting Leg at the Moment of Shuttlecock Hit	144.078	144	3.122	0.406
4	Shoulder Joint Angle at the Moment of Shuttlecock Hit	40.894	40.500	1.060	0.794
5	Angular Velocity of the Striking Arm	578.605	578	7.726	0.244
6	Angular Velocity of the Trunk	94.500	95	2.617	-0.076
7	Shuttlecock Release Speed	35.500	35.500	2.617	-0.038

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8	Shuttlecock Release Angle	20.736	20	2.126	0.471
9	Height of the Shuttlecock Hitting Point	2.171	2.160	0.041	0.567
10	Long Serve Test	28.289	29.500	3.109	-1.042

Results of the Predictive Equations for the Long High Serve Skill in Badminton Based on Biomechanical Variables

Using the long high serve skill in badminton as the dependent variable, the researcher applied Multiple Linear Regression using the Stepwise method to calculate the predictive equations, as shown in Table (2).

Table 2. *Results of the Predictive Equations for the Long High Serve Skill in Badminton Based on Biomechanical Variables*

Model	Requirements (Variables)	Multiple Correlation Coefficient	Coefficient of Determination (R^2)	Constant	F Value	Regression Coefficient	t Value	Contribution Percentage
First	Elbow Angle of the Striking Arm	0.523	0.273	9.123	2.608 (Sig = 0.011*)	0.542	2.652 (Sig = 0.010*)	27.35%
Second	Elbow Angle of the Striking Arm	0.643	0.413	13.567	2.850 (Sig = 0.033*)	0.280	2.430 (Sig = 0.203*)	41.344%
	Trunk Inclination Angle at the Moment of Shuttlecock Hit					0.599	1.599 (Sig = 0.020*)	
Third	Elbow Angle of the Striking Arm	0.766	0.586	13.439	4.328 (Sig = 0.033*)	0.849	2.649 (Sig = 0.001*)	58.675%
	Trunk Inclination Angle at the Moment of Shuttlecock Hit					0.131	2.601 (Sig = 0.016*)	
	Knee Joint Angle of the Supporting Leg at the Moment of Shuttlecock Hit					0.738	2.556 (Sig = 0.004*)	
Fourth	Elbow Angle of the Striking Arm	0.785	0.616	14.526	4.081 (Sig = 0.015*)	0.722	3.511 (Sig = 0.003*)	61.622%
	Trunk Inclination Angle at the Moment of Shuttlecock Hit					0.022	1.852 (Sig = 0.015*)	
	Knee Joint Angle of the Supporting Leg at the Moment of Shuttlecock Hit					0.609	2.340 (Sig = 0.026*)	
	Shoulder Joint Angle at the Moment of Shuttlecock Hit					0.517	1.401 (Sig = 0.026*)	
Fifth	Elbow Angle of the Striking Arm	0.792	0.627	15.223	4.326 (Sig = 0.023*)	0.571	2.346 (Sig = 0.011*)	62.726%
	Trunk Inclination Angle at the Moment of Shuttlecock Hit					0.691	2.601 (Sig = 0.004*)	
	Knee Joint Angle of the Supporting Leg at the Moment of Shuttlecock Hit					0.278	2.335 (Sig = 0.014*)	
	Shoulder Joint Angle at the Moment of Shuttlecock Hit					0.612	3.410 (Sig = 0.006*)	
	Angular Velocity of the Striking Arm					0.715	3.281 (Sig = 0.034*)	
Sixth	Elbow Angle of the Striking Arm	0.823	0.677	16.471	4.167 (Sig = 0.022*)	0.522	3.185 (Sig = 0.006*)	67.732%
	Trunk Inclination Angle at the Moment of Shuttlecock Hit					0.492	2.189 (Sig = 0.002*)	
	Knee Joint Angle of the Supporting Leg at the Moment of Shuttlecock Hit					0.712	3.677 (Sig = 0.012*)	
	Shoulder Joint Angle at the Moment of Shuttlecock Hit					0.364	4.120 (Sig = 0.031*)	
	Angular Velocity of the Striking Arm					0.331	3.528 (Sig = 0.026*)	
	Angular Velocity of the Trunk					0.348	4.186 (Sig = 0.011*)	

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	Elbow Angle of the Striking Arm					0.678	3.152 (Sig = 0.020*)	
	Trunk Inclination Angle at the Moment of Shuttlecock Hit					0.348	3.615 (Sig = 0.031*)	
	Knee Joint Angle of the Supporting Leg at the Moment of Shuttlecock Hit					0.164	3.725 (Sig = 0.012*)	
Seventh	Shoulder Joint Angle at the Moment of Shuttlecock Hit	0.841	0.707	17.261	4.215 (Sig = 0.031*)	0.912	4.181 (Sig = 0.017*)	70.728%
	Angular Velocity of the Striking Arm					0.677	3.512 (Sig = 0.005*)	
	Angular Velocity of the Trunk					0.542	2.616 (Sig = 0.002*)	
	Shuttlecock Release Speed					0.564	2.716 (Sig = 0.041*)	
	Elbow Angle of the Striking Arm					0.461	2.705 (Sig = 0.018*)	
	Trunk Inclination Angle at the Moment of Shuttlecock Hit					0.816	3.241 (Sig = 0.003*)	
	Knee Joint Angle of the Supporting Leg at the Moment of Shuttlecock Hit					0.347	3.164 (Sig = 0.011*)	
	Shoulder Joint Angle at the Moment of Shuttlecock Hit					0.268	4.253 (Sig = 0.023*)	
Eighth	Angular Velocity of the Striking Arm	0.876	0.767	18.205	4.562 (Sig = 0.028*)	0.951	4.277 (Sig = 0.018*)	76.737%
	Angular Velocity of the Trunk					0.248	2.613 (Sig = 0.031*)	
	Shuttlecock Release Speed					0.269	2.440 (Sig = 0.019*)	
	Shuttlecock Release Angle					0.367	3.612 (Sig = 0.021*)	
	Elbow Angle of the Striking Arm					0.615	1.687 (Sig = 0.003*)	
	Trunk Inclination Angle at the Moment of Shuttlecock Hit					0.348	3.442 (Sig = 0.026*)	
	Knee Joint Angle of the Supporting Leg at the Moment of Shuttlecock Hit					0.159	2.672 (Sig = 0.031*)	
	Shoulder Joint Angle at the Moment of Shuttlecock Hit					0.624	3.677 (Sig = 0.011*)	
Ninth	Angular Velocity of the Striking Arm	0.942	0.887	20.235	4.891 (Sig = 0.019*)	0.528	4.121 (Sig = 0.002*)	88.736%
	Angular Velocity of the Trunk					0.348	3.691 (Sig = 0.035*)	
	Shuttlecock Release Speed					0.297	3.988 (Sig = 0.034*)	
	Shuttlecock Release Angle					0.728	4.292 (Sig = 0.019*)	
	Height of the Shuttlecock Hitting Point					0.688	4.519 (Sig = 0.006*)	

Results of the Predictive Equations for the Long High Serve Skill in Badminton Based on Biomechanical Variables

The results of the multiple linear regression analysis presented in Table (2) showed that the contribution percentages of the long high serve skill in badminton based on biomechanical variables were as follows:

Variable 1: (Elbow Angle of the Striking Arm)

The multiple correlation coefficient was (0.523) and the determination factor was (0.273). The constant value is reached (9.123), while the calculated F value (2.608) at the significance level of (0.011) indicates statistical significance, because it was less than the adopted significance level (< 0.05). The (t)-value calculated was (2.652) with a

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significance level of (0.010) which is also significant as it is less than (<0.05). Its contribution percentage was (27.35%). Thus, the elbow angle of the hitting arm serves as a predictor for long high serve skill:

Long High Serve = 9.123 + (0.542 × Elbow Angle of the Striking Arm).

Variable 2: (Elbow Angle of the Striking Arm and Trunk Inclination Angle at the Moment of Shuttlecock Hit)

In addition, the multiple correlation coefficient was (0.643) and the coefficient of determination was (0.413). The constant was (13.567), and the value of calculated F was (2.850) with significance level (0.033), which is considered statistically significant since it is less than (< 0.05). The estimated t values for analysis were (2.430, 1.599) with significance levels (0.203, 0.020), respectively, showing that they are statistical significant at (< 0.05). This variable ranked contribution of (41.344%). Accordingly, the predictive equation is:

Long High Serve = 13.567 + (0.280 × Elbow Angle of the Striking Arm) − (0.599 × Trunk Inclination Angle at the Moment of Shuttlecock Hit).

Variable 3: (Elbow Angle of the Striking Arm, Trunk Inclination Angle at the Moment of Shuttlecock Hit, and Knee Joint Angle of the Supporting Leg at the Moment of Shuttlecock Hit)

R squared (0.586), the Multiple correlation coefficient was (0.766). Constant value = (13.439), F calculated value = (4.328) at level of significance, p-value= 0.033 < 0.05 [statistically significant]. The t values calculated were as follows: (2.649, 2.601, 2.556) and the significance levels accomplished were at (0.001, 0.016, 0.004), where those reached are considered statistically significant since they become less than (< 0.05). It reached this variable with a contribution of (58.675%). Accordingly, the predictive equation is:

Long High Serve = 13.439 + (0.849 × Elbow Angle of the Striking Arm) − (0.131 × Trunk Inclination Angle at the Moment of Shuttlecock Hit) − (0.738 × Knee Joint Angle of the Supporting Leg at the Moment of Shuttlecock Hit).

Variable 4: (Elbow Angle of the Striking Arm, Trunk Inclination Angle at the Moment of Shuttlecock Hit, Knee Joint Angle of the Supporting Leg at the Moment of Shuttlecock Hit, and Shoulder Joint Angle at the Moment of Shuttlecock Hit)

And the multiple correlation coefficient was(0.785), and the coeffecient of determination was (0.616). The constant was (14.526), the f value obtained was (4.081) with a significance level of (0.015), statistically significant because it is less than (< 0.05). The t values were calculated at the significance levels of (3.511, 1.852, 2.340, 1.401) with p value (0.003, 0.015, 0.026, 0.026) respectively which is statistically significant (<p< (^[5]). This variable resulted in a contribution percentage (61.622%) Accordingly, the predictive equation is:

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Long High Serve = 14.526 + (0.722 × Elbow Angle of the Striking Arm) − (0.022 × Trunk Inclination Angle at the Moment of Shuttlecock Hit) − (0.609 × Knee Joint Angle of the Supporting Leg at the Moment of Shuttlecock Hit) − (0.517 × Shoulder Joint Angle at the Moment of Shuttlecock Hit).

Variable 5: (Elbow Angle of the Striking Arm, Trunk Inclination Angle at the Moment of Shuttlecock Hit, Knee Joint Angle of the Supporting Leg at the Moment of Shuttlecock Hit, Shoulder Joint Angle at the Moment of Shuttlecock Hit, and Angular Velocity of the Striking Arm)

The multiple correlation coefficient was (0.792) and the coefficient of determination was equal to (0.627). The value of the constant was (15.223), while the calculated F value was (4.326) and at a significance level of (0.023) which indicates that the results are statistically significant because it is less than (< 0.05). The t values calculated were (2.346, 2.601, 2.335, 3.410, 3.281) for significance levels (0.011, 0.004, 0.014, 0.006, and.034), respectively which indicates statistical significance as they lead to being lesser (< 0.05). It had a contribution percentage of (62.726%) variable. Accordingly, the predictive equation is:

Long High Serve = 15.223 + (0.571 × Elbow Angle of the Striking Arm) − (0.691 × Trunk Inclination Angle at the Moment of Shuttlecock Hit) − (0.278 × Knee Joint Angle of the Supporting Leg at the Moment of Shuttlecock Hit) − (0.612 × Shoulder Joint Angle at the Moment of Shuttlecock Hit) − (0.715 × Angular Velocity of the Striking Arm).

Variable 6: (Elbow Angle of the Striking Arm, Trunk Inclination Angle at the Moment of Shuttlecock Hit, Knee Joint Angle of the Supporting Leg at the Moment of Shuttlecock Hit, Shoulder Joint Angle at the Moment of Shuttlecock Hit, Angular Velocity of the Striking Arm, and Angular Velocity of the Trunk)

The multiple correlation coefficient was (0.823) and the coefficient of determination reached (0.677). The constant was (16.471) and the computed F value (4.167) at significance level (.022), denoting statistical significance as it is less than (The contribution percentage of this variable was (67.732%). Accordingly, the predictive equation is:

Long High Serve = 16.471 + (0.522 × Elbow Angle of the Striking Arm) − (0.492 × Trunk Inclination Angle at the Moment of Shuttlecock Hit) − (0.712 × Knee Joint Angle of the Supporting Leg at the Moment of Shuttlecock Hit) − (0.364 × Shoulder Joint Angle at the Moment of Shuttlecock Hit) − (0.331 × Angular Velocity of the Striking Arm) − (0.348 × Angular Velocity of the Trunk).

Variable 7: (Elbow Angle of the Striking Arm, Trunk Inclination Angle at the Moment of Shuttlecock Hit, Knee Joint Angle of the Supporting Leg at the Moment of Shuttlecock Hit, Shoulder Joint Angle at the Moment of Shuttlecock Hit, Angular Velocity of the Striking Arm, Angular Velocity of the Trunk, and Shuttlecock Release Speed)

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Whereas, the multiple correlation coefficient was (0.841) and the coefficient of determination was (0.707). Its constant value (17.261), calculated F value (4.215) at significance level (0.031). The statistically significant because it is less than (< 0.05). The calculated t values were (3.152, 3.615, 3.725, 4.181,3.512,2.616,2.716) at significance levels (0.020,0.031,0.012,0.017,0.005, 0.002, and 0.041), indicating statistical significance since they are lesser than (< 0/05). This variable resulted in a contribution percentage of (70.728%). Accordingly, the predictive equation is:

Long High Serve = 17.261 + (0.678 × Elbow Angle of the Striking Arm) − (0.348 × Trunk Inclination Angle at the Moment of Shuttlecock Hit) − (0.164 × Knee Joint Angle of the Supporting Leg at the Moment of Shuttlecock Hit) − (0.912 × Shoulder Joint Angle at the Moment of Shuttlecock Hit) − (0.677 × Angular Velocity of the Striking Arm) − (0.542 × Angular Velocity of the Trunk) − (0.564 × Shuttlecock Release Speed).

Variable 8: (Elbow Angle of the Striking Arm, Trunk Inclination Angle at the Moment of Shuttlecock Hit, Knee Joint Angle of the Supporting Leg at the Moment of Shuttlecock Hit, Shoulder Joint Angle at the Moment of Shuttlecock Hit, Angular Velocity of the Striking Arm, Angular Velocity of the Trunk, Shuttlecock Release Speed, and Shuttlecock Release Angle)

The multiple correlation coefficient was (0.876) and the coefficient of determination value (0.767). The constant (18.205), the calculated F (4.562) at a p-value (engerrule rtium tuitent 0.028 showed statistical significant since it is less than (< 0.05). The obtained t values were (2.705, 3.241, 3.164, 4.253, 4.277, 2.613, 2.440, 3) at significance levels (0.018 //;0:003 //;0:011 //;0:023 //;0:018//;0:031//;0:019//;021), respectively which was statistically significant as they are less than (<.05). It has a contribution percentage of (76.737%) for this variable. Accordingly, the predictive equation is:

Long High Serve = 18.205 + (0.461 × Elbow Angle of the Striking Arm) − (0.816 × Trunk Inclination Angle at the Moment of Shuttlecock Hit) − (0.347 × Knee Joint Angle of the Supporting Leg at the Moment of Shuttlecock Hit) − (0.268 × Shoulder Joint Angle at the Moment of Shuttlecock Hit) − (0.951 × Angular Velocity of the Striking Arm) − (0.248 × Angular Velocity of the Trunk) − (0.269 × Shuttlecock Release Speed) − (0.367 × Shuttlecock Release Angle).

Variable 9: (Elbow Angle of the Striking Arm, Trunk Inclination Angle at the Moment of Shuttlecock Hit, Knee Joint Angle of the Supporting Leg at the Moment of Shuttlecock Hit, Shoulder Joint Angle at the Moment of Shuttlecock Hit, Angular Velocity of the Striking Arm, Angular Velocity of the Trunk, Shuttlecock Release Speed, Shuttlecock Release Angle, and Height of the Shuttlecock Hitting Point)

The multiple correlation coefficient value was (0.942) and the value of the coefficient of determination was (0.887). The constant value was (20.235), while the F value calculated was (4.891) significant level of significance (0.019), is statistically significant because it is less than (< 0.05). Then the calculated t values were (1.687, 3.442,

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2.672, 3.677, 4.121, 3.691, 3.988, 4.292 and 4.519) at significance level (0.003,0.026;0:031;;011;002;,035;.034 [,019;,006] respectively which indicates that our results statistical is significant since it was under (<:.05). This variable was a contribution rate of (88.736%). Accordingly, the predictive equation is:

Long High Serve = 20.235 + (0.615 × Elbow Angle of the Striking Arm) − (0.348 × Trunk Inclination Angle at the Moment of Shuttlecock Hit) − (0.159 × Knee Joint Angle of the Supporting Leg at the Moment of Shuttlecock Hit) − (0.624 × Shoulder Joint Angle at the Moment of Shuttlecock Hit) − (0.528 × Angular Velocity of the Striking Arm) − (0.348 × Angular Velocity of the Trunk) − (0.297 × Shuttlecock Release Speed) − (0.728 × Shuttlecock Release Angle) − (0.688 × Height of the Shuttlecock Hitting Point).

Discussion

As shown in Table (2), stepwise regression led to inclusion and ranking of all biomechanical variables without discarding any. The contribution percentage of all the variables in relation to long high serve skill in badminton was statistically significant. Nine of these predictive equations also yielded significant values, which the researcher says can be relied upon. All biomechanical variables are the major and important role for all of type in enhance skill performance on long high serve, badminton. The findings that were reached in the research are compatible with what has been stated by Habib Ali Dhaher(2004), citing Wajih Mahjoub (1989) when he said: "The angular velocity of the trunk work at the stage of retracting it backward and then hitting the ball where the movement of the trunk works as a stretched bow from which energy resulting from pushing against the earth is stored, to be converted later into kinetic energy transferred to strike it. This process is also supported by mechanical power which is determined according to an equation that requires the time of elevation and the player's mass besides the vertical ground reaction force applied on the center of gravity" (Al-Husseini, 2004, p. 49).

These results are consistent with Talha Hossam El-Din (1993), who pointed out that "angular velocity is an angular motion of each body segment and it has a significant impact on most skills. The trunk is the largest of body segments, and it is the main player in movements of the body while performing a skill or even ordinary movements (Hossam El-Din, 1993 p. 95). These findings are also consistent with the work of Steven M., Monika Serrano, and Mike Elzinga (2008) that "the movement of the body's center of mass, the back, and angular motion of the trunk are among these parts most directly related to dynamic activity associated with forward thrusting motion delivery" (Steven, Monika & Mike, 2008: pp. 114–124).

In addition, he thinks that the arm is considered an integral part to aim in right way of shuttlecock toward opponent's court. As the rotator, the arm is controlled by angular velocity, which directly correlates to power at the impact with shuttlecock. For the same manner, Daniya Riyadh (2004) shows that "Angular velocity is first related to trunk rotational inertia and second muscular torque acting on it. The higher the rotation radius, the smaller the velocity becomes (force + resistance to rotational movement). This mechanical advantage can then be used to create a large linear velocity of the limb farthest

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from the body (the arm and shoulder during the point of strike) which makes for a high-speed ball when released" (Hamed Al-Najm, 2004, p. 90).

Another argument used by the researcher is that the degree of knee joint angle (the supporting leg) at first contact with a shuttlecock also has great influence in the serve skill. The degree of bending at the knee, which indicates the phase of movement to be taken by the player in order to execute a serve skill will move using flexion and extension movements that can be used as an event preparatory stage for striking. This enables the player to have the appropriate body orientation when hitting the shuttlecock during a long high serve. This clarify what Laith Jabbar (2005) has said that "reason of flexion knee joint in the service strike is to take the greatest speed degree rackets at first and body-moving performance beslissing. One such mechanism is achieved through the flexions in the movement of body joints leading to performance (through the application in knee joints). These flexions are the force action generated by the server due to body pressure over the support point, creating an opposite reaction force in an upward direction" (Al-Mousawi, 2005, p. 40).

The release angle of the shuttlecock, the speed of the shuttlecock and the height at which it is hit all have a significant effect on skill performance of long high serve in badminton according to another researcher. This finding is in agreement with Qasim Hassan et al. (1991) who said that "the distance achievable in throwing events depending on achievement of the release angle and height of the release point" (p. 201). It also agrees with what Habib Ali Dhaher (2004) indicated "the trunk angular velocity contributes by (0.903) on the launch of the ball, and this rate increased to when mechanical power added for this is considered where became (0.999)" (Al-Husseini, 2004:49).

Moreover, the findings are in accordance with that mentioned by Zeina Arkan (2018), who mentioned "The magnitude force is time-dependent during support moments; thus, it is essential to produce a considerable amount of instantaneous force within the least possible period if they significantly contribute to accelerating after ground contact. "The higher the force exerted over minimal time and at high speed, the more the efficiency of neuromuscular responsiveness reflected in producing recommended movement speed" (Hameed, 2018, p. 71).

On the angle of inclination from the trunk at the moment it strikes the shuttlecock, according to this researcher, it must be almost straight, without large deviations since without achieving a straight service it does not strike correctly. It corresponds to the extension of the imaginary line of the trunk concerning the soil. The performer should not lean too far as they are performing in both directions — balance is key. This ensures that the trunk angle does not deviate too much from either a vertical or horizontal axis, which would lower striking accuracy of the shuttlecock. This corresponds to what was confirmed by Mohammed Diaa (2006), on the authority of Abdul Ali Naseef and others (1990),"the technique of this angle must be in a straight line without lateral inclination, because if you adopt more leaning, it leads to loss of balance during the performance of movement. The player should not lean too much forward, backward or sideways instead stay in the middle area between two feet" (Al-Khazaei, 2006, p. 57).

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Conclusions:

Thru presenting and discussing the results, the researcher arrived at (9) predictive equations with significant values that can be relied upon in the relationship between biomechanical variables and the skill performance of the high long serve in badminton, as follows:

Model (1): High long serve = 9.123 + (0.542 × Angle of the hitting arm elbow).

Model (2): The high long serve = 13.567 + (0.280 × angle of the hitting arm elbow) – (0.599 × angle of the torso tilt at the moment of hitting the shuttlecock).

Model (3): The high long serve = 13.439 + (0.849 × angle of the hitting arm elbow) – (0.131 × angle of the torso tilt at the moment of hitting the shuttlecock) – (0.738 × angle of the knee joint supporting at the moment of hitting the shuttlecock).

Model (4): The high long serve = 14.526 + (0.722 × angle of the striking arm elbow) – (0.022 × angle of the trunk tilt at the moment of hitting the shuttlecock) – (0.609 × angle of the knee joint at the moment of hitting the shuttlecock) – (0.517 × angle of the shoulder joint at the moment of hitting the shuttlecock).

Model (5): The long high serve = 15.223 + (0.571 × angle of the hitting arm elbow) – (0.691 × angle of the torso tilt at the moment of hitting the shuttlecock) – (0.278 × angle of the knee joint at the moment of hitting the shuttlecock) – (0.612 × angle of the shoulder joint at the moment of hitting the shuttlecock) – (0.715 × angular velocity of the hitting arm).

Model (6): The high long serve = 16.471 + (0.522 × angle of the hitting arm elbow) – (0.492 × angle of the torso tilt at the moment of hitting the shuttlecock) – (0.712 × angle of the knee joint at the moment of hitting the shuttlecock) – (0.364 × angle of the shoulder joint at the moment of hitting the shuttlecock) – (0.331 × angular velocity of the hitting arm) – (0.348 × angular velocity of the torso).

Model (7): High long serve = 17.261 + (0.678 × Angle of the elbow of the striking arm) – (0.348 × Angle of the trunk tilt at the moment of hitting the shuttlecock) – (0.164 × Angle of the knee joint at the moment of hitting the shuttlecock) – (0.912 × Angle of the shoulder joint at the moment of hitting the shuttlecock) – (0.677 × Angular velocity of the striking arm) – (0.542 × Angular velocity of the trunk) – (0.564 × Velocity of the shuttlecock launch).

Model (8): High long serve = 18.205 + (0.461 × Angle of the hitting arm elbow) – (0.816 × Angle of the trunk tilt at the moment of hitting the shuttle) – (0.347 × Angle of the knee joint at the moment of hitting the shuttle) – (0.268 × Angle of the shoulder joint at the moment of hitting the shuttle) – (0.951 × Angular velocity of the hitting arm) – (0.248 × Angular velocity of the trunk) – (0.269 × Velocity of the shuttle release) – (0.367 × Angle of the shuttle release).

Model (9): High Long Serve = 20.235 + (0.615 × Angle of the Hitting Arm Elbow) – (0.348 × Angle of the Trunk Tilt at the Moment of Hitting the Shuttlecock) – (0.159 × Angle of the Knee Joint at the Moment of Hitting the Shuttlecock) – (0.624 × Angle of the Shoulder Joint at the Moment of Hitting the Shuttlecock) – (0.528 × Angular Velocity of the Hitting Arm) – (0.348 × Angular Velocity of the Trunk) – (0.297 × Speed of the Shuttlecock Launch) – (0.728 × Angle of the Shuttlecock Launch) – (0.688 × Height of the Shuttlecock Hit Point).

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Recommendations

1. The necessity of relying on the biomechanical variables of badminton players. The necessity of relying on the biomechanical variables of badminton players.
2. The necessity of conducting further studies related to other skills in badminton that were not addressed in the current study, in light of the biomechanical variables. The necessity of conducting further studies related to other badminton skills that were not addressed in the current study, with reference to biomechanical variables.
3. The necessity of conducting similar studies on the study variables and at different levels for both genders. The necessity of conducting similar studies on the study variables and at different levels for both genders.

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The Effect of Rehabilitation Exercises on Correcting and Improving Spinal Deformities

Dr. Dhafir Harb Ewajela Al-Ibraheemi[1]
[1,] University of Baghdad, College of Physical Education and Sports Sciences.

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Abstract

The nature of some professions (such as dentistry, barbering, blacksmithing, lathe work, etc.) Demands continuous bending during work, directing to a hunchback that may not be very noticeable initially but will certainly become more apparent in the future and may, in some, Participants result in Persistent mobility impairment. This work nature also often causes Marked pain for those in these professions, negatively Shaping work quality. The researcher used the experimental method, Classified as most suitable for the nature of the research. The study sample Comprised of (12) dentists from the Rusafa district of Baghdad Governorate, representing a representative sample of professions. After Executing rehabilitation exercises, the researcher concluded that continuous work leads to bodily deformities, particularly spinal deformities. Additionally, dental work affects the spine and causes deformities. Rehabilitation exercises are important for professions, especially those whose work Comprises standing for long hours throughout the week.

Keywords: Rehabilitation exercises, corrective exercises, spinal deformities, occupational postural deformities.

[1] University of Baghdad / College of physical education and sports science
Zafer.Atiya@cope.uobaghdad.edu.iq

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Introduction

A lot of countries, especially developed ones, have Employed advanced programs to give attention for working individuals. During their daily work,members are encounterto considerable stress and strain on their bodies consequence of prolonged standing and bending. This strain can lead to various physical disabilities and postural problems, restricting individuals from achieving a natural posture due to postural deviations that disrupt and impede proper movement. Posture is key to Kinetic coherence among bodily segments of the body. As Bye & Others (2017) states, "The shape of the body generally Is dictated by the skeletal system, which is a Complex architect of varying lengths, sizes, and shapes, arranged together in an intricate structure that gives the human body its magnificent appearance and simultaneously helps the individual perform their functions in life." The spine is a fundamental pillar of the human body, possessing characteristics that enable it to bear the body's weight and Transmission it to the lower limbs, as well as support the head, upper limbs, and rib cage. An individual's posture has a clear effect on their ability to communicate with others, and the worse the posture, the greater the effect. Challenge to the stability of the individual's condition. Numerous studies in this field have proven that postural deformities, if not hereditary or pathological, occur as a result of incorrect habits of stillness and movement, which Prompts to the unbalanced use of the muscles responsible for maintaining posture.

The spine Encompasses of a series of vertebrae arranged vertically, totaling 33 vertebrae. Only 24 of these vertebrae are connected by strong, rigid ligaments, allowing them to move (Collinger, Boninger, & Bruns, 2013). The remaining vertebrae are fused together. The spine is articulated by intervertebral discs and articular processes. A series of ligaments and muscles extending longitudinally along the spine help Sustain its correct position. The spine Corroborate the trunk, but this support is not rigid; vertebrae are connected to each other by intervertebral discs, which act as shock absorbers during walking and jumping (Bye, Harvey, Glinsky, Bolsterlee, & Herbert, 2019). Anatomically, the spine has four curves (anterior and posterior), which are visible from the side. These two curves are called primary curves because they are present in the fetus. There are two forward convex curves in the cervical vertebrae and lumbar vertebrae, called secondary curves because they develop after birth. (Jayaraman, Thompson, Rymer, & Hornby, 2013)

Good posture plays a Fundamental role in an individual's life, serving as a positive indicator of health and an excellent marker of healthy habits. These habits Comprise proper sleeping posture, the quality of the bed, and the number of hours of sleep (Abdulrazzaq, 2016), a balanced diet, and correct posture while reading, driving, and watching television, in addition to other daily practices. The nature of one's work places daily stress on posture, especially if the work puts pressure on a specific part of the body for extended periods throughout the day. For example, the nature of dentistry often requires constant bending, particularly for those working mornings in hospitals or health centers and evenings in

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private clinics. This can lead to a hunchback, which may not be immediately apparent but will certainly become more Evident in the future and may, in some cases, Findings in permanent mobility impairment. Furthermore, this type of work frequently causes discomfort for dentists, negatively effecting the quality of their work. The aim of this research is to develop a set of rehabilitative exercises designed to correct body deformities and to identify their effectiveness in correcting certain deformities. The physical constitution of the research sample of dentists.

Many researchers have addressed the topic of postural deformities. The study (Ibraheem & Rasheed, 2021) addressed postural problems in women after childbirth, along with the accompanying problems of weight, lack of movement, and mechanical differences, by designing a device to identify postural problems and then designing a rehabilitation program to correct the postural defect resulting from pregnancy. The two researchers selected a group of new mothers aged (24-32) years, numbering (7) women, with a postpartum period of (48-58) days, in addition to the approval of the specialist doctor. The results showed a clear improvement in all the research variables, especially postural.

In the study (Rifaat and Shayal, 2009), the researchers used the experimental method on (12) injured people. The researchers designed a set of rehabilitation exercises to develop the strength and flexibility of the lower back muscles. The exercises continued to be applied for eight weeks with three rehabilitation sessions per week. The researchers concluded that the rehabilitation exercises for the back muscles are beneficial. The researchers also concluded that there was an improved in the strength and flexibility of the lower back muscles.

As for the study (Ming-Huwi Horng, Horng, & Kuok, 2019), Cobb angle was measured through the sum of the angles of inclination of the upper and lower vertebrae by the law of plane geometry. The study included (32) patients with scoliosis who received treatment in the hospital from 2011 to 2016. Cobb angles were measured in them. The findings of measuring the angle of inclination method and the classical method were compared, and the time taken to measure the two groups was recorded respectively using an electronic timer for comparison.

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Materials and methods

The researcher used the experimental method as it was Relevant for the nature of the research. A Questionnaire was conducted in the Rusafa district of Baghdad Governorate regarding back pain among dentists during their practice. The Questionnaire included 128 dentists who work long hours, both morning and evening. Forty-one of them reported experiencing back Throughout work. When photographs were taken of 90% of these dentists and Examined using the Kenovea software to Quantify spinal deformities based on the difference among these images and typical spinal measurements using Cobb angle, 30% (12 dentists) were found to have curvatures and postural Anatomical variations that were visible in the software but were not apparent to them. However, upon, Further investigation they reported experiencing more back pain than the others. Consequently, the research sample consisted of 12 dentists with an average age of 33.45 years (±3.478), an average height of 169.451 cm (±6.145), and an average of years of service in the same profession. (9.124) years (±4.021), and doctors working in the morning and evening were Filtered with an average of (6.88) working hours, (±1.301).

Spinal Anatomical variation measurements were extracted Consistent with the difference between them and the typical spinal measurements according to the COBB Angle (Suwannarat, Wattanapan, & Wiyanad, 2017). The researcher used photography to photograph the research sample and then used a computer to Pinpoint the specific spinal deformities as follows:

The person stands in a normal, non-tense position with their left shoulder facing the wall and bare from the top down. The researcher then takes a picture of them, and the picture is Converted to the computer and the required measurements are taken using the Kenovea program, which is a program Focusing on the mechanical analysis of athletic movements and the extraction of distances and angles.

First measurement: Quantifying the distance of deviation from the line connecting the beginning of the cervical curve at the first cervical vertebra and the end of the curve at the fifth lumbar vertebra.

Second measurement: Quantifying the angle of curvature and the sum of the angles of superior and posterior concavity of the spine and the forward curvature of the lower vertebrae.

Corrective rehabilitation exercises: After interviewing the research sample and explaining the research objectives and the method for solving its problem, the researcher Demonstrated the details of the rehabilitation program. After Quantifying the days on which the sample members would perform the rehabilitation exercises, it was Corroborates that the steps for Executing the program would be as follows:

Weeks 1 and 2: Number of units used: Three corrective rehabilitation units per week, each lasting 15 minutes. These Incorporate five minutes of warm-up exercises to prepare the body's muscles. The core of this study consists of breathing exercises aimed at

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enhancing strength and flexibility of the chest wall muscles, along with exercises to tighten the muscles working on the spine.

Weeks three and four: Number of units used: Three units per week, 25 minutes each, including some warm-up exercises to Formulate the body's muscles for five minutes. The main part includes breathing exercises followed by special exercises for the back muscles, working to enhance and tighten them.

Weeks five and six: Number of units used: Three corrective and formative rehabilitation units per week, with a time of 30 minutes.

It Comprises performing some warm-up exercises to prepare the body's muscles for five minutes, subsequently succeeded by the main part, breathing exercises, and special exercises that work to tighten the back muscles and stretch the chest cage muscles.

Weeks seven and eight: Number of units used: Three Formative and prescriptive rehabilitation units per week.

The 45-minute program includes five minutes of warm-up exercises to prepare the body's muscles, followed by the main part which includes breathing exercises, and then special exercises for the back and chest muscles using some tools.

Weeks nine and ten: Number of units used: Three corrective and formative rehabilitation units per week.

The 45-minute program includes five minutes of warm-up exercises to prepare the body's muscles, followed by the main part which Is composed of breathing exercises to increase vital ability, and then special exercises for the back and chest muscles with Elevated intensity.

Note: The rehabilitation program focused on the principle of gradual progression, starting with simple muscle-strengthening exercises in the first weeks (15 minutes) and progressing to complex exercises with increased intensity in the last weeks (45 minutes).

The rehabilitation units were Segmented into three days of the week, including the days when there were fewer clients. The choice of days was left to some members of the sample depending on the availability of each of them, provided that three rehabilitation units were performed distributed over the days of the week. The members of the sample were also asked to perform some home exercises, including lying on the ground with complete relaxation for 5 minutes on a flat ground.

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Results

Table 1. Descriptive statistical analysis for the pre- and post-test results

Variable	pre-test		post-test	
	mean	sd	mean	sd
Degree of Cervical Lordosis	7.8692	2.14992	4.2267	0.48970
Hyperkyphosis	14.5375	1.92438	8.5417	0.74524
Lumbar Lordosis	7.4158	1.58468	4.0050	0.78040
Cervical Lordosis Angle	41.2500	3.54516	26.6667	4.07505
Thoracic Kyphosis Angle	30.9167	4.88892	22.3333	1.82574
Lumbar Lordosis Angle	18.9167	2.64432	13.3333	1.66969

Table 2. Differences between the pre-test and post-test for the research sample

Variable	Differences	Sig.	Significance
Degree of Cervical Lordosis	6.035	0.000	Significant
Hyperkyphosis	8.722	0.000	Significant
Lumbar Lordosis	7.350	0.000	Significant
Cervical Lordosis Angle	8.562	0.000	Significant
Thoracic Kyphosis Angle	5.454	0.000	Significant
Lumbar Lordosis Angle	6.881	0.000	Significant

Discussion

From Monitoring the findings above, we find that all significance values (Sig.) are. The results were less than the significant level (0.05), indicating a statistically significant difference between the pre-test and post-test results. The researcher Characteristics these statistically significant differences in the research sample to the researcher's precise scientific Examination in diagnosing the function of the muscles responsible for causing spinal deformities. This Examination targeted these muscles with Centered exercises specific to this area, which is heavily effected by prolonged work. The rehabilitative exercises enhance by the researcher played a significant and important role in relaxing the tense muscles and strengthening the muscles that work to restore the spine to its natural position. Rehabilitative exercises "work to reorganize the function of Specific organs and systems that have been destroyed during work or injury by restoring the automatic function of internal organs and regulating neuromuscular activity to align with the body's functional capacity." Khalil (2008) states that "therapeutic exercises are specific movements for medical conditions with a therapeutic purpose to restore the body to its natural state, utilizing the fundamental principles of motor work that Impacts the response of muscles

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and nerves through selection." The movements and positions are suitable for the body, and the researcher attributes the results achieved to stretching exercises, which are beneficial and necessary to restore the muscle to its normal length (Hameed & Alta, 2019). The rehabilitation exercises that were Implemented to the doctors in the research sample included elements of strength, flexibility and coordination, which helped to rehabilitate the muscles working on the thoracic, cervical and sacral vertebrae. Ghafel, 2020, indicates that "exercises that work to improve muscle strength work at the same time, to a partial extent, to Optimize postural deviations and deformities when strength exercises are accompanied by flexibility exercises in the muscles."

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Conclusions

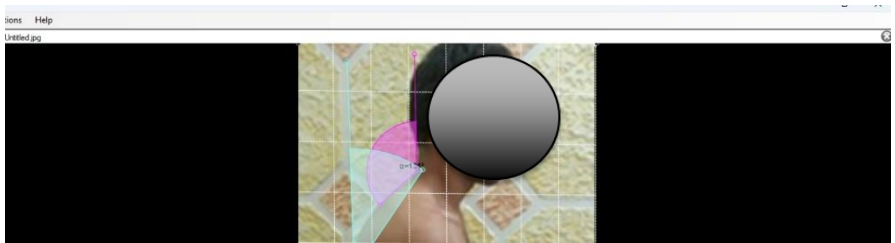
Continuous work can lead to physical deformities,specifically spinal deformities. - Working in a profession like dentistry affects the spine and can cause deformities.

- Corrective and rehabilitative exercises are very crucial for those in professions such as dentists, especially those who work long hours standing throughout the week.

Appendix (1)

Showing the Correct Standing Position and the Procedure for Measuring Spinal Curvatures Using an Inclinometer and the Kinovea Software.

Appendix (2)



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Elucidate Type
s of Rehabilitation Exercises

The researcher Categorized rehabilitation exercises into three main groups targeting the muscles acting on the spine:

Breathing exercises (to Augment vital capacity and expand the chest), including:

- Thoracic expansion exercise: Inhale deeply while raising the arms high to the sides, then exhale slowly while lowering them.
- Deep breathing exercise while lying on your back with your hands on your rib cage and focus on expanding your ribs while inhaling.

Stretching exercises (to treat tight muscles), including:

- Chest muscle stretch: Stand next to a wall and place your forearms on it while twisting your body in the opposite direction to stretch the anterior chest muscles affected by curvature.
- Cat-Cow stretch: To work on the flexibility of the entire spine and reduce kyphosis.

Strengthening exercises (to treat muscle weakness in the back), including:

-Standing "Y-W" exercise: Move your arms to trace the letter Y, then W, to strengthen the erector spinae muscles and the muscles between the shoulder blades. - Back muscle strengthening exercise: Lie on your stomach and raise your chest and arms slightly to strengthen your lower back muscles.

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Appendix (3)
Shows a Model of a Rehabilitation Unit

ت	section	Tim	the details	Notes
1	Preparatory Section	5 minutes	Warm-up and body preparation with walking exercises in place and moving the legs and arms, followed by light exercises such as neck and shoulder rotations.	to prepare the body well.
2	Main Section	10 minutes	We begin with deep breathing exercises to relax the chest muscles and increase Paramount capacity. This is followed by stretching exercises for the chest and back muscles, and strength training exercises for the opposing muscles using body weight or assistive devices such as walls, doors, wooden sticks, and resistance bands.	Pay attention to the adductor muscles, reducing their tension, and the extensor muscles, strengthening them
		20 minutes		
3		10 minutes	Light stretching exercises with relaxation, performed lying on a flat surface or sitting in a chair with the back flat	The focus is on calming down, relaxing, and ensuring the back remains straight

The program units included:

- Number of exercises: 6 to 8 varied exercises per unit.
- Number of sets: 3 sets per exercise.
- Repetitions: Strength exercises: 10-12 repetitions.
Stretching exercises: Hold for 20-30 seconds.
- Rest periods: 30-45 seconds between sets to prevent excessive eye strain.

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The Effect of an Educational Curriculum Based on the Constructivist Model of John Zahorik on Learning the Performance of Shooting Skills in Basketball among Fourth Preparatory Grade Students

Wurood Raheem Abdulnabi[1] Sahar Hur Majeed[2]

[1,2] University of Baghdad, College of Physical Education and Sports Sciences for Women.

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Abstract

The research aimed to design an educational curriculum based on the constructivist model of John Zahorik and to employ it in instructional exercises during practical physical education lessons in basketball. It also sought to identify the effect of this educational curriculum on learning the performance of basketball shooting skills among fourth preparatory grade students. The researchers hypothesized that there would be statistically significant differences between the pre- and post-test results of the experimental and control groups in performing shooting skills — free throw performance, jump shot performance, and lay-up performance — in basketball. Furthermore, they assumed that there would be statistically significant differences between the post-test results of the two groups in the same shooting skills. The experimental method was used, employing a two-group design (experimental and control) involving 30 fourth preparatory grade students for the academic year 2024–2025, representing 26.786% of the total population. The elements of the strategy were incorporated into instructional exercises and applied in practical basketball lessons, with four instructional units assigned to each shooting skill. One lesson was conducted per week, and the implementation continued for 12 weeks. The exercises were carried out during the main part of the lesson, which lasted 30 minutes of the 45-minute basketball class. After completing the experimental procedure, the results were processed using the SPSS statistical software. The most important conclusions and recommendations indicated that applying an educational curriculum based on the John Zahorik constructivist model in practical lessons helps improve students' performance in all shooting skills — free throw, jump shot, and lay-up — with superior results compared to those who learned without it. It is essential to increase the focus on practical applications to better integrate knowledge with performance, and to emphasize hands-on learning while minimizing excessive explanation when employing the elements of the curriculum based on Zahorik's model. Moreover, it is important to consider individual differences in

[1] University of Baghdad, College of Physical Education and Sports Sciences for Women.
Wurud.abd2304p@copew.uobaghdad.edu.iq
[2] University of Baghdad, College of Physical Education and Sports Sciences for Women.
Sahar.h@copew.uobaghdad.edu.iq

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students' responses to the stages of this model in both the instructional and practical aspects of the basketball units. The study further recommends paying greater attention to individual differences when applying this curriculum model and to diversify instructional situations and tasks to achieve the intended educational goals in teaching basketball skill performance.

Keywords: John Zahorik Constructivist Model, Basketball Shooting.

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Introduction

The study of cognitive structure underlying the performance of basketball shooting skills requires more attention when it comes to designing motor programs that would execute these skills. The execution of these skills has to be mastered properly in order to achieve them accurately. This requires researchers to contribute more attention in emphasizing the educational environment that strengthens these processes among students, activates their self-capabilities and promotes their role in cooperative learning. According to the specificities of each skill, modern constructivist models for the performance of learning skills ensure such learning. Thus, it is further confirmed that understanding the learners' characteristics while supporting them for the necessary changes in their learning environment in a manner consistent with these characteristics is important. Hence, this makes a case for academics to perform research that brings new dimensions in preparing students mentally through the understanding of performance of the skills.

"It is maintained that 'the basic knowledge base of the skill cannot be overlooked, so long as the function of such knowledge as a step in the production of a skill is not over-emphasized — whatever this component may add to actual performance applications seems to represent the true essence of such a skill. is to be done swiftly, accurately, effectively and with the least possible effort and lowest possible cost" (Al-Hayek, 2018, p. 144).

In addition, using the processes of inquiry and investigation (identifying problems, forming hypotheses, asking questions, analyzing data and determining conclusion) "contributes to developing and improving their level of organized thinking based on knowledge" (Mustafa, 2019, p. 127)

Motor skill acquisition is similarly considered active learning given the diverse interactive activities on offer which allow students to learn the required skills and knowledge. It is focused on ongoing assessment and feedback, in which the performance of students is evaluated, useful comments are given to them, and advice will improve their qualification and develop motor as well as technical skills (Mohammed 2018: 77–78).

Similarly, constructivist theory primarily emphasizes the assumption that learners continuously construct the knowledge required during learning, whether individually or collaboratively (Al-Juhani, 2018, p. 17).

The researchers hope that knowing how the brain works, and thus providing solutions to achieve efficiency in satisfying students needs when they create need of immediate or future solution. This is linked to a number of skills, like an ability to remember past experiences or perceive current events through those experiences. This is determined by the capabilities available to the student within a general set of logical constraints on what can be achieved when designing motor programs. So, previously formed programs that have been stored and remembered can be reactivated to match the requirements of learning tasks encountered in motor learning units.

So it might be that I want a constructivist learning model, which could potentially enhance the quality of education, fit learners to acquire learn and independently draw knowledge from. This, in turn, has a positive impact on their ability to organize cognitive structures and cope with ongoing changes (Al-Thuwaini, 2023, p. 167).

John Zahorik is another representative of the modern constructivism who introduced clear stages based on main notions characterizing constructivist education. This means generating knowledge through a sequence of steps that forms new knowledge based

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on previous awareness and encourages the learner's mind to ponder. Additionally, it is responsible for transferring the impact of knowledge to such events in life that learners may face and allows learners to describe mental processes (Al-Khafaji et al., 2023, pp. 57–60).

The John Zahorik model focus on the students on learning process and they act as centre point therefore have to learn in real time which should be maximum reachable period according to cognitive capabilities. For this reason, students often seek direct assistance and select relevant points or situations that they think are useful and important in their learning process (Hazza, 2022,p.22).

The John Zahorik model is an example of a modern constructivist approach designed to develop students' cognitive structures and may aid in increasing the cognitive achievement and motivation of learners to think and inquire (Issa & Abu Labdeh, 2016, p. 224).

This also provides a similar pathway of students' self-learning tasks, so that they can be both responsible and more capable to create new ideas during lessons (model by John Zahorik). Constructivism builds on the idea that anything constructed and owned by a learner bears meaning for them, drawing attention to internal cognitive functions and how they are applied toward effective learning (Ahmed, 2021, p. 416).

The practical importance of the research is based on its usefulness to physical education teachers at secondary schools in aiding them with their educational work within a practical lesson setting for fourth-grade preparatory students. Its purpose is to establish a learning environment that focuses on sensory utilization and the construction of students' cognitive structures necessary for fulfilling educational objectives based on skills. In practice, the significance of this constructivist model of John Zahorik is one that aids preparatory-stage students in their own formation of new experiences and reshaping concepts that facilitate utilizing improved programs to develop beneficial learning outcomes through practice and application within school curricula.

This detailed description captures the right research issue. Based on the exploratory qualitative researcher method adopted in the framework of approached studies and based on the academic research work undertaken by researchers within the field of motor learning in a focus study visit to preparatory schools, it was found that there is a clear weakness in performance: "the emerging period (early curve)" "Learning basketball shooting skills headings (free throw- jump shot - lay-up shot) fourth-grade preparatory students. As mentioned before, these skills need performance learning to achieve accuracy. Therefore, researchers concluded that performance knowledge should be concentrated on when utilizing educational exercises practically which expected to teach those three capacities. The intent of this method is to assist and aid students in a group plan of study.

Therefore, the research aims to prepare an educational program in light of constructivist John Zahorik model and apply it in education exercises during practical physical education basketball lessons with determination of the effect of this educational program on learning shooting skills among fourth-grade preparatory students.

The researchers propose study hypothesis that states, 1. There are significant difference between the offensive shooting skills between both experimental group and control group in their pre-test results and post-test results in basketball shooting skills (free throw jump shot & lay-up shot). They also hypothesize that there is a statistically

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significant difference in the post-test results of the experimental and control groups for performance on these basketball shooting skills.

Method and Procedures

The study adopted an experimental approach using a pre-test–post-test design with equivalent experimental and control groups. The research population consisted of fourth-grade preparatory students in the morning study at Al-Mutafawiqeen Secondary School for Boys, within the formations of the Rusafa Second Directorate of Education for the academic year (2024–2025). The total number of students in this population was 112, naturally distributed into three classes. They were selected because they represented the population of the research problem.

From this population, 30 students were selected from two classes using a simple random sampling method, representing 26.786% of the total population. According to the requirements of the study, 10 students were randomly selected from class (A) as a pilot sample, representing 8.929% of the original population. The main sample consisted of students from classes (C) and (D). Based on the experimental design requirements, one class was randomly selected to represent the experimental group, consisting of 15 students from class (C), while 15 students from class (D) represented the control group.

To measure the performance of basketball shooting skills (free throw, jump shot, and lay-up shot), the researchers adopted a performance evaluation form to assess the participants' technical performance in each test without considering accuracy. The performances were video recorded and later evaluated by experts based on technical criteria. The scoring distribution was as follows:

- Preparatory phase: 3 points
- Main phase: 5 points
- Final phase: 2 points

Thus, the total score reflected the technical quality of skill performance.

The researchers carried out practical procedures to incorporate the principles of constructivist theory and the application requirements of the educational program according to the John Zahorik model, integrating them into the educational and practical components of the instructional unit used in the practical basketball lesson. This was implemented through the following procedures:

- Precisely determining the objective of each instructional exercise for each of the three skills.
- Focusing on the cognitive structure to support knowledge of performance, teaching the mind and body simultaneously to produce the required motor behavior according to the correct model of each skill. This was implemented while considering individual differences and the specificity of motor learning in basketball by providing rich informational input within the applied learning environment of the instructional units based on the constructivist John Zahorik model.
- The teacher used expressive body language when explaining the skill performance and its details, activating students' prior knowledge and employing attractive instructional

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illustrations that represented the segmented parts of each of the three skills. Students then applied the exercises of the educational program based on the John Zahorik model, integrating mind and body while comparing their performance with the required model to reach the correct execution of each targeted skill.

- Students engaged in activities simulating real basketball playing situations as well as applied instructional activities based on the John Zahorik constructivist model. These activities enabled students to process presented information through instructional posters using strategies such as discussion, questioning, and discovery, supporting the cognitive structure needed to build motor programs for the three skills. Feedback was provided by the teacher, and students participated in individual or group dialogue about the skill details and training methods. students were prompted to separately analyze and verbalize thinking processes so that peers could learn from their analysis during the application of the instructional exercises. This was followed up with a collaborative group discussion of the instructional exercises.

The Student's Role in Designing the Learning Environment

In this type of motor learning, the student's task included:

1. Activating prior knowledge about the targeted skill in the instructional unit by engaging their senses in receiving new information.
2. Acquiring new information about the skill within a learning environment rich in knowledge of performance, supported by illustrative images of skill phases through instructional posters and interaction with peers in a positive cooperative active-learning atmosphere.
3. Understanding how to apply the targeted skill through discovering the details of its performance.
4. Thinking about the information internally to build knowledge of performance and linking it with previous experiences to construct the motor program of the new skill within the instructional unit.
5. Using the acquired information in the practical performance of the skill by integrating mental and physical processes.

The Teacher's Role in Designing the Learning Environment

The teacher's role included:

1. Guiding students to activate their prior knowledge about the targeted skill in the instructional unit to connect it with new information provided within the designed practical learning environment, enabling students to generate their own experiences regarding the skill through linking cognitive knowledge with practical application.
2. Considering individual differences among students by expanding and diversifying learning activities.
3. Refining students' cognitive structures through continuous feedback during practical performance and helping them organize the sequence of information related to the skill phases.

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4. Encouraging cooperative learning, dialogue, and discussion among students to reach the required knowledge of performance.
5. Providing reinforcement to consolidate and support skill performance and stimulating students' motivation and challenge.

Practical Tasks within the Instructional Units According to the John Zahorik Model

First: Educational Component

The teacher presented the phases and details of the skill using various instructional aids appropriate to students' age level. The skill performance was explained with and without the ball while gradually presenting performance-related information. Students' curiosity and interest in discovering the skill were encouraged through a positive relationship with them. They were also encouraged to move from isolated individual learning situations toward forming healthy cooperative groups. This process activated the elements of the John Zahorik model—activation, acquisition, understanding, and thinking about the information presented through explanation and demonstration—while minimizing explanation time as much as possible.

Second: Practical Component

Students applied knowledge of performance through educational situational exercises, avoiding coercive learning methods. They were allowed to return to the model and discuss freely among themselves. Students were given full opportunity to construct knowledge about the targeted skill performance and continue practicing it with accompanying feedback. Application followed the active learning cycle, utilizing students' understanding and reflection on the information acquired in the instructional unit. Interaction among student groups was increased to reach new knowledge through practical application. The comparison system in motor control was activated by focusing on solving applied educational situations of the skill, stimulating inquiry, emphasizing thinking about skill information, and continuous correction by the teacher, thus practically implementing the elements of the John Zahorik model in skill performance learning in basketball.

Time Plan and Implementation of the Instructional Units

The duration of each instructional unit was 45 minutes, distributed as follows:
1. Preparatory section: Physical activities to prepare the body for performing the targeted skill (10 minutes).
2. Main section: Knowledge and application of the instructional program based on the John Zahorik model (30 minutes), consisting of:
3. Educational component: 5 minutes
4. Practical component: 25 minutes
5. Final section: Relaxation, cooling down, and a small game for motivation and recreation (5 minutes).

Each shooting skill was allocated four instructional units, implemented at a rate of one unit per week on Sundays. The implementation lasted 12 weeks in total. The main section (30

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minutes) of the physical education class (45 minutes total) included 5 minutes for the educational component and 25 minutes for the practical component. Within this period, four exercises were implemented, each lasting approximately 5–6.5 minutes, with short rest intervals distributed between them. The remaining time was allocated to the preparatory (10 minutes) and final (5 minutes) sections, which were managed by the physical education teacher without intervention from the researchers.

Pilot Study

The pilot study aimed to examine the practical aspects of the basketball skill tests and the educational program components. It was conducted on 10 students from the pilot sample on Sunday (22/2/2025). Its objectives were:

1. Ensuring students' acceptance of the skill tests and the instructional exercises based on the John Zahorik model.
2. Training the assisting team on the conditions and procedures for applying the skill tests.
3. Ensuring the suitability of the video camera used to record skill performance tests.
4. Identifying potential obstacles or errors that might occur during the implementation of the instructional units.
5. Confirming the necessity that students be in a complete rest state before performing the three skill tests and conducting a familiarization unit introducing the three skills to the main research sample.

Implementation of the Main Experiment

The experiment began with pre-tests for the three dependent variables applied to the 30 students in the research groups. The three skill tests were video recorded at 9:00 a.m. on Thursday (27/2/2025) at the same school.
The educational program based on the constructivist John Zahorik model was then applied to the experimental group from Sunday (2/3/2025) until Sunday (18/5/2025). Meanwhile, the control group continued learning using the traditional instructional method applied in their regular lessons. Both groups received the same number of lessons and instructional time to learn basketball shooting skills.
The experiment concluded with the post-tests, conducted on Monday (19/5/2025).

Statistical Analysis

After completing the experiment, the results were analyzed using the Statistical Package for the Social Sciences (SPSS) to calculate:

- Percentage (%)
- Arithmetic mean
- Standard deviation
- Levene's Test for homogeneity of variance
- Independent samples t-test
- Paired samples t-test.

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Results

Table 1. Shows The Results Of The Pre-Tests Between The Experimental And Control Groups.

Skill Performance Tests	Group	N	Mean	SD	Levene's Test	Sig.	t-value	Sig.	Difference
Free Throw Performance (Score)	Experimental	15	1.93	1.163	0.018	0.893	0.479	0.636	Not significant
	Control	15	2.13	1.125					
Jump Shot Performance (Score)	Experimental	15	2.07	1.387	0.092	0.764	0.138	0.891	Not significant
	Control	15	2.13	1.246					
Lay-up Shot Performance (Score)	Experimental	15	1.80	1.082	1.206	0.282	0.150	0.882	Not significant
	Control	15	1.73	1.335					

Table 2. Shows the results of the pre-test and post-test comparisons for the experimental and control groups.

Tests	Group	Comparison	Mean	SD	Mean Difference	SD Difference	t-value	Sig.
Free Throw Performance (Score)	Experimental	Pre-test	1.93	1.163	6.333	0.976	25.135	0.000
		Post-test	8.27	0.458				
	Control	Pre-test	2.13	1.125	3.467	1.407	9.539	0.000
		Post-test	5.60	1.183				
Jump Shot Performance (Score)	Experimental	Pre-test	2.07	1.387	6.067	1.710	13.741	0.000
		Post-test	8.13	0.516				
	Control	Pre-test	2.13	1.246	3.533	1.302	10.510	0.000
		Post-test	5.67	1.113				
Lay-up Shot Performance (Score)	Experimental	Pre-test	1.80	1.082	6.533	1.187	21.313	0.000
		Post-test	8.33	0.488				
	Control	Pre-test	1.73	1.335	4.267	2.219	7.447	0.000
		Post-test	6.00	1.309				

Table 3. Shows The Results Of The Post-Tests Between The Experimental And Control Groups

Skill Performance Tests	Group	N	Mean	SD	t-value	Sig.	Difference
Free Throw Performance (Score)	Experimental	15	8.27	0.458	8.141	0.000	Significant
	Control	15	5.60	1.183			
Jump Shot Performance (Score)	Experimental	15	8.13	0.516	7.788	0.000	Significant
	Control	15	5.67	1.113			
Lay-up Shot Performance (Score)	Experimental	15	8.33	0.488	6.468	0.000	Significant
	Control	15	6.00	1.309			

Discussion

A review of the pre- and post-test results presented in Table (2) indicates improvement in the performance of the basketball shooting skills (free throw, jump shot, and lay-up shot) for students in both research groups. The results shown in Table (3) also demonstrate that students in the experimental group outperformed their counterparts in the control group in the improvement of these three dependent variables.

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The researchers attribute this improvement and superiority of the experimental group to the application of the educational program based on the constructivist John Zahorik model, which helped prepare the cognitive structure of students' minds to manage the interaction of a rich flow of knowledge within the learning environment of the instructional unit. This environment was rich in information related to the technical performance of the three shooting skills and required students to activate their memory in order to answer unexpected questions or participate in asking questions about performance details. It also placed students in educational situations that required them to question the type of knowledge support they needed regarding performance.

The program emphasized the development and support of the cognitive structure through all elements that could correct motor skill performance. Consequently, the learning environment required mental processes aimed at organizing and controlling knowledge so that learning would become meaningful. This occurred through the integration of motivational elements in a positive direction that supported the achievement of educational objectives. The instructional program based on the John Zahorik model enhanced students' ability to utilize information within their cognitive structures in the practical context of performance, enabling them to form new concepts related to applicable knowledge. This was achieved through stimulating the brain to receive information and enabling students to interact with and apply this information in practical lessons.

The researchers also attribute these results to the positive effect of the proper implementation of the steps and components of the John Zahorik model in helping students complete the mental processes required to design the motor program. The learning tasks were directed toward the required objective while avoiding distractions or unnecessary movements accompanying performance. This process required students to activate mental imagery of knowledge, encode it, and activate cognitive processes to answer questions related to the educational situations within the instructional exercises of the program.

The active learning environment, which focused on knowledge of performance, also helped regulate the learning environment by controlling and organizing stimuli and adapting them to the students' age level, abilities, and individual differences. The presentation of information within the model, which continued during the practical part of the main section of the instructional unit, required discussion and dialogue among students, in addition to continuous feedback that activated the comparison mechanism in motor control between the performed movement and the desired movement.

Furthermore, the improvement and superiority of the experimental group in the post-test results can also be attributed to the effective application of the steps and components of the John Zahorik model in educational situations. These exercises increased each student's opportunity to practice and apply skills based on knowledge of performance obtained through analyzing performance details and understanding the requirements of the motor task in order to achieve the desired conformity with the model presented in the instructional posters that illustrated the correct performance of the skill.

The effective distribution of student groups in the experimental group and the practical applications of the John Zahorik model contributed to the success of the instructional unit by organizing questions, designing practical educational situations, teaching critical evaluation of skill performance, encouraging deep exploration of performance knowledge, generating sub-questions related to skill performance, developing applications of this knowledge, and sharing knowledge experiences among students. These

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elements were designed according to the abilities of fourth-grade preparatory students, enabling them to achieve mastery through practice and application, which is the foundation of improvement in motor skill learning supported by knowledge of performance.

Additionally, the teacher's use of motivational expressions to enhance students' confidence helped students benefit from the role of cognition in mastering movement. The use of multimedia tools, including videos and instructional posters showing the phases of the skill, and the appropriate presentation of images within the sports hall during the instructional part also supported students' cognitive structures. Repeated demonstrations of each skill component reinforced students' understanding of the sequence of movements required for the skill—from the preparatory phase to the main phase and finally to the concluding phase.

In this regard, it has been stated that "the use of peer and group review strategies has been supported by several theories, including Social Constructivism Theory, which assumes that knowledge is socially constructed and that integrating students into a knowledge community leads to collaborative engagement and the construction of new information through social interactions, thereby deepening each learner's understanding" (Choi et al., 2014, p. 233).

Moreover, it has been noted that "motor learning of a skill cannot occur without organized knowledge about performance that relies on the brain's interpretation of stimuli through cognitive processes responsible for forming motor programs in memory according to the learner's abilities and capacities" (Al-Bayati, 2023, p. 18).

Similarly, the discovery of knowledge through the application of the John Zahorik model places students in learning situations that encourage collaboration with other learners to understand, activate, and apply knowledge, thereby strengthening relationships among learners in such situations (Al-Hamdani, 2020, p. 255).

Furthermore, "students spend most of their time paying attention and listening to the teacher's explanations and instructions; however, the steps of the John Zahorik constructivist model help organize the benefit of all information in a structured manner that facilitates interpretation and enables students to accomplish the tasks assigned to them during the lesson" (Mohammed, 2021, p. 4695).

Constructivist education is also considered an instructional approach in which the learner faces a problem and attempts to solve it by discovering concepts and principles independently and interacting with the learning situation. The learner continuously seeks knowledge and is interested in the coherence of cognitive structures and their elements because new learning becomes integrated with the learner's existing cognitive structures, making it more retainable and retrievable and better able to meet the learner's needs (Muqabla & Al-Atoum, 2023, p. 356).

As for the improvement observed in the basketball skill performance of the control group, the researchers attribute it to the effectiveness of the traditional instructional method used in the lesson. This method provided detailed information that supported students' knowledge of the lesson content and contributed to building a cognitive structure that helped them understand the requirements of practical performance. However, their performance level did not reach that of their counterparts in the experimental group.

It has also been indicated that "learning through the application of the John Zahorik model strengthens the connections within the learner's cognitive structure, enabling

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creative responses to questions during the lesson and effective translation of knowledge into skill performance" (Carmen et al., 2017, p. 66).

In addition, "repetition is one of the fundamental characteristics of motor skill learning, as learners must practice movements repeatedly in order to improve performance and strengthen motor memory" (Bhanu, 2015, p. 146).

Finally, learners must develop the ability to self-evaluate their skill performance independently, as self-evaluation helps identify areas that require improvement and development to enhance performance (Al-Aboudi, 2019, p. 77).

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Conclusions

1. The application of the educational program based on the constructivist John Zahorik model in practical lessons contributes to improving the performance of basketball shooting skills (free throw, jump shot, and lay-up shot) among students who learn through this model, outperforming their peers who learn through traditional methods.
2. Greater emphasis should be placed on practical applications that utilize knowledge of performance, with a focus on actual performance and minimizing lengthy explanations when implementing the components of the educational program based on the John Zahorik model, while considering individual differences in students' responses to the steps of the model within both the instructional and practical components of basketball instructional units.
3. It is important to give increased attention to individual differences when applying the educational program based on the John Zahorik model, and to diversify and vary educational situations and tasks in a way that supports the achievement of the instructional objectives related to teaching basketball skill performance.

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Effectiveness of counseling sessions based on psychological stability integrated with relaxation exercises in regulating sleep for youth football players

Dr. Ahmed Thare Hani [1], Dr. Mohannad Talib Abd[2], Layth Farhan Faraj [3]

[1,2,3] University of Baghdad, College of Physical Education and Sports Sciences

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Abstract:

Football is among the team sports that require psychological preparation, so the players can be able to control their emotions and adapt their behave to the circumstances and their psychological state. In this context the psychological factor very important to determine the quality of performance on the field, it can even be the difference between success and failure for players with similar physical and skill levels. A lot of young football players suffer from sleep disorders because of the psychological pressures that come with training and competition, which affects negatively their physical and mental performance. even with the importance of sleep as un important factor in promoting recovery and improving athletic performance, few studies have addressed the impact of psychological interventions like stabilization exercises, on improving sleep quality in this age group. So, the importance of stabilization programs as an effective means of improving sleep quality and promoting emotional balance to the athletes. Psychological stabilization includes a set of training techniques such as progressive muscle relaxation, meditation, and breathing exercises, which have been proven to contribute to reducing anxiety and improving sleep quality. The research aims to prepare guidance sessions based on psychological stabilization combined with relaxation exercises in regulating sleep for young football players, and to identify the effect of guidance sessions based on psychological stabilization combined with relaxation exercises in regulating sleep for young football players. This study adopted the quasi-experimental design method as it is suitable for the nature of the research, where a psychological training program (psychological stabilization exercises) was applied to a group of young football players, with pre- and post-measurement of the level of sleep. The study sample included (20) young football players, aged between (14-16) years, who train regularly at the Police Sports Club. The sample was selected purposively (not randomly) to meet the study criteria. The results showed a significant increase in total sleep time after the application of the psychological training program, with an average of +30.47 minutes (Cohen's d = 3.37), indicating a very significant effect of the program. Studies point to that

[1] University of Baghdad, College of Physical Education and Sports Sciences.
ahmed.hani@cope.uobaghdad.edu.iq
[2] University of Baghdad, College of Physical Education and Sports Sciences
mohannad.t@cope.uobaghdad.edu.iq
[3] University of Baghdad, College of Physical Education and Sports Sciences
laith.f@cope.uobaghdad.edu.iq

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meditation and breathing exercises incentivize the parasympathetic nervous system and reduce excessive nervous activity, all of this makes it easier to fall asleep and increasing sleep duration. Depending on this, the researchers reached conclusions, including that the players showed improved sleep duration and the proportion of deep sleep stages, that supporting their physical and psychological recovery. the results give strength to the hypothesis that non-pharmacological psychological training can be a sustainable option for improving athletic performance by enhancing sleep. Other conclusions include adopting psychological stabilization training programs as part of the training plans for young athletes, especially during periods of increased competitive pressure, putting mindfulness techniques into training sessions, Couse of their direct impact on sleep, attention, and mental performance.

Keywords: Counseling sessions, psychological stability, relaxation exercises, sleep regulation**.**

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Introduction:

youth stage in football is the most important developmental periods that forms the basis of player's future athletic career. In this stage, fast development happening in physical, technical, tactical, psychological, and social Factors. at this stage young players face multiple pressures, like the intensive training, the competition pressure, the expectations of coaches and management, and the developmental changes associated with adolescence, which can impact negatively on their psychological balance and emotional stability. Sleep is one of basic component in the physical recovery process and neuropsychological regulation. It helps to rebuilding muscle tissue, hormone regulation, and improved focus, attention, and making decisions on the field. The recent literature in sports psychology confirm that sleep disorders are directly connected to increased levels of anxiety and stress, and weakness of psychological stability, which affects players' technical and tactical performance, especially between youth athletes. This is the importance of psychological counseling programs that helps psychological stability by developing emotional coping skills, stress managing, and self-confidence. using relaxation exercises (like progressive muscle relaxation, deep breathing, and calming visualization) as tools to improve sleep quality and reduce physiological arousal before sleep**.** The mixing of psychological stability-focused counseling sessions with relaxation exercises can be a scientifically effective to sleep regulating for young football players, positively affecting their physical, psychological, and their performance**.** Sleep is a vital element that directly affects athletic performance, especially for young athletes who are going through physical and psychological fast development. Studies pointed that sleep disturbances can lead to a bad physical performance, weak concentration, and an increased risk of injuries in athletes (Walsh et al., 2021)**.**

The young football players are considered the most susceptible to sleep problems because of the psychological pressures that come with training and competition, in additionally hormonal and neurological changes at this age. Since football is a sport that requires development and modernization, studying sports psychology is one of the most important modern trends in developing this game (Hani, Khudhair, and Jasim, 2022)**.**

In this context, the psychological aspect is a crucial factor in determining the quality of performance on the field, and it can even be the difference between success and failure, even for players with similar physical and skill levels (Thare Hani, Talib Abd, and Saad Ibrahim, 2025)**.**

Football is among the team sports that require psychological preparation, enabling players to control their emotions and adapt their behavior according to circumstances and their psychological state (Hani et al., 2022)**.**

In this context, the importance of psychological stabilization programs has emerged as an effective means of improving sleep quality and promoting emotional balance in athletes. Psychological stabilization includes a range of training techniques such as progressive muscle relaxation, meditation, and breathing exercises, which have been proven to contribute to reducing anxiety and improving sleep quality (Kudlackova, Eccles, and Dieffenbach, 2013). Sports psychology literature also confirms that improving psychological stability contributes to reducing insomnia and improving self-efficacy in sleep (Scott et al., 2021)**.**

Exploring the effect of psychological stability exercises on sleep levels among young football players aims to develop support programs that contribute to improving mental

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health and athletic performance**.** Guidance programs aim to cultivate new, flexible, and modifiable behavioral patterns through diverse methods that equip individuals with new skills, concepts, information, attitudes, and values to help them change and modify their behavior (Hani 2021)**.**

Many young football players suffer from sleep disorders due to the psychological pressures associated with training and competition, negatively impacting their physical and mental performance. Despite the importance of sleep as a crucial factor in promoting recovery and improving athletic performance, few studies have addressed the impact of psychological interventions, such as psychological stability exercises, on improving sleep quality in this age group. This leads to the following main research question:

Theoretical Significance:

- Increase the scientific literature in the field of sports psychology by mixing psychological stability and sleep quality for young football players.
- Clarifying the relationship between psychological counseling sessions and relaxation exercises for improving mental health and athletic sleep.
- Supporting modern ideas of mixing psychological preparation with physical and technical training.

Practical Significance:

- Providing a practical counseling program that can be used by young age coaches and psychologists in sports clubs.
- improving sleep quality for young players, which positively impacts focus, attention, and decision-making speed on the field.
- Reducing levels of stress and anxiety that associated with competitions, to enhancing emotional stability and behavioral discipline.

Educational and Health Significance:

- Supporting the mental health for young players during a sensitive and changeable period.
- considering sleep as a basic factor in athletic performance, not just a biological need.
- building a psychologically balanced player with skills in regulating emotions and stress.

Future research implications:

- Opening the door for more studies dealing with psychological variables related to sleep, such as competitive anxiety, psychological resilience, or psychological immunity.
- Making a model that can be applied to other sports.

research goals:

- Developing a counseling session based on psychological stability combined with relaxation exercises to regulate sleep among young football players.
- Identify the impact of psychological stability counseling sessions combined with relaxation exercises on sleep regulation among young football players.

Methodology and research design:

The researchers adopted the experimental method with a single pre-test/post-test design, as it was suitable for the nature of the research in revealing the effectiveness of counseling sessions based on psychological stability combined with relaxation exercises in regulating sleep among young football players.

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Participants:

The study sample consisted of (20) junior football players, aged (14–16) years, who regularly train at the Police Sports Club. The participants were selected purposively (not randomly) to fit the study criteria.

A psychological stability-based exercise program was implemented over four weeks, with three sessions per week, each lasting between 30–45 minutes. The program included a set of psychological exercises:

- Deep breathing and diaphragmatic breathing exercises.
- Progressive muscle relaxation.
- Guided imagery.
- Mindfulness techniques.

Tools:

1 .Sleep:

Sleep was tracked using the ŌURA Smart Ring (2nd Generation), which measures movement, heart rate, heart rate variability, respiratory rate, body temperature, and other parameters to determine sleep stages. Players wore the rings every day, except on match days. Data was automatically transferred to an app via Bluetooth.

Measured Sleep Variables:

- Total Sleep Time.
- Wake Time.
- (REM) Rapid Eye Movement Sleep.
- Deep Sleep.
- Light Sleep.
- Percentage of movement during sleep.
- Onset Time.

2 .Training program for psychological stabilization:

The program was designed according to sports psychology literature and relaxation programs applied in sports, especially for young football players specific needs. and reviewed by expert academics to ensure about its validity and suitability.

3. form of personal question:

the information collected about players, such as age, playing years, weekly training hours, and any old medical or psychological conditions affecting sleep.

Procedures:

First: Pre-tests

- Sleep indicators measured by using the sleep tracking device/ research sleep variables (total sleep, deep sleep, REM sleep, light sleep, movement during sleep, sleep onset time, and percentage of movement during sleep).
- standardized the measurement conditions (sleep time, training hours, and avoidance of stimulants before bedtime).
- Data recorded for one week to made accurate averages for the pre-test.

Second: Counseling session (Duration: 4 weeks)

The program applied for (4) weeks, with (4) sessions per week, totaling (16) training sessions, each lasting approximately (60) minutes, supervised by the two researchers.

Program aims:

- Reduce physiological arousal before sleep.
- Support psychological stability and emotional regulation.

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❖ Train athletes in stress management skills.
❖ Improved sleep quality and quantity.

weeks 1 and 2:
Focus on maintaining a steady breathing rhythm (4 seconds inhale – 4 seconds hold – 6 seconds exhale).
Positive visualization of the playing field environment, the color green, the kit and successfully executing a skill.
Enhancement the ability of mentally focus for longer periods.
Week 4 (Peak Phase – Complete Control)
Week 4 the program's climax
Established the Progressive muscle relaxation for 30 minutes.
Deepened the Mindfulness meditation to 15 minutes in most sessions.
Increased positive visualization that related to success in matches.
focus on full control of inhalation and exhalation (increased capacity of respiratory).
Weeks 3 and 4:
At the end of each session, imaging a success situation (a successful pass, a successful shot, a successful defensive tackle).
Enhancement of emotional control before sleep.
Players are instructed to practice the exercises 30 minutes before bedtime.

Third: Experimental Control

To ensure the validity of the results, the following measures were taken:
Physical training times were fixed throughout the program.
Stimulants were prohibited after 6:00 PM.
Sleep times were standardized as much as possible.
Players' adherence to home exercise routines was monitored.

Fourth: Post-Program Measurements

After the fourth week, all sleep variables were remeasured under the same conditions and procedures used in the pre-program for seven consecutive days. The data were then statistically analyzed using:
The paired samples t-test.
Spearman's correlation coefficient.
Cohen's d-value.
Procedural Conclusion: The program progressed from:

- Introduction to techniques
- Consolidation
- Deepening
- Reaching the stage of complete control
- This facilitated a structured transition from knowledge acquisition to stable practice, which explains the significant improvement in players' sleep indicators after the program's completion.

Statistical Analysis:

- The mean and standard deviation were calculated for all variables.
- Analysis of variance (ANOVA) was used to compare different days, with Bonferroni's test used to determine post-hoc differences.
- Cohen's d-test was used to determine the effect size.

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- Relationships between variables were analyzed using Spearman's rank correlation coefficient.
- Statistical significance was considered to be at $p < 0.05$.

Results:

Table (1) shows differences between pre- and post-measurements.

Cohen's d	p-value	t (Student)	SD after	Mean after	SD before	Mean before	Variable
3.37	0.000	15.09	26.55	425.34	28.80	394.86	**Total Sleep Time**
-1.65	0.000	-7.38	10.17	49.05	9.68	57.34	**Wake Time**
1.66	0.000	7.43	13.69	98.14	12.31	89.60	**(REM)**
2.25	0.000	10.06	11.81	81.81	11.12	69.69	**Deep Sleep**
-1.24	0.000	-5.56	18.54	169.09	17.27	179.40	**Light Sleep**
-1.33	0.000	-5.94	6.13	12.48	5.11	15.22	**Movement during sleep**
-2.10	0.000	-9.38	0.97	21.71	1.07	22.89	**Onset Time**

Discussion:

Table (1) presents the descriptive statistics and the paired-samples t-test between the pre- and post-test measurements of sleep variables among junior football players. The results showed statistically significant differences at the 0.05 level in all variables, favoring the post-test, thus confirming the effectiveness of the guidance program integrated with relaxation exercises in improving sleep indicators.

First: Total Sleep

The mean sleep duration increased from 394.86 minutes before the program to 425.34 minutes afterward, with a t-value of 15.09 and a significance level of 0.000, resulting in a very high effect size (Cohen's d = 3.37).

This is point to a big improvement in total sleep duration, which is a key indicator of physical recovery and neurological regulation improvement. This is reflecting the success of program in reducing cognitive and emotional stress, which had been hindering sufficient sleep.

Second: Wake time during the night

numbers decreased from 57.34 minutes to 49.05 minutes, with a t-value of (t = -7.38) and a large effect size of (d = -1.65).

This is point to decrease in sleeping interrupted, that's mean an improvement in deeply sleep continuity. This can be explained by a decrease in physiological arousal because of the relaxation exercises helped calm the nervous system.

Third: rapid eye movement sleep (REM)

numbers increased from 89.60 minutes to 98.14 minutes, with a t-value of (t = 7.43) and a large effect size of (d = 1.66).

The (REM) increasing is an important positive indicator, that regulate cognitive processes and motor memory, which is very important for young football players in consolidating tactical and technical skills.

Fourth: deep sleep

numbers increased from 69.69 to 81.81 minutes, with a t-value of (t = 10.06) and a very large effect size (d = 2.25).

the deep sleep is an important for muscles recovery and growth hormone level, indicating improved physical recovery, which is a direct reflected of reducing stress and improving psychological stability.

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Fifth: light sleep
numbers decreased from 179.40 to 169.09 minutes, with a t-value of (t = -5.56) and a big effect size (d = -1.24).
The decrease in light sleep is a positive indicator, this transition towards too deep sleep and REM, which enhancing overall sleep quality.
Sixth: Movement during sleep
movement during sleep decreased from 15.22 to 12.48, with a t-value of (t = -5.94) and an effect size of (d = -1.33).
this decrease is an indicator of improved physical and emotional relaxation.
Seventh: Sleep Onset Time
decreased the time that required to fall asleep from 22.89 minutes to 21.71 minutes, with a t-value of (t = -9.38) and a big effect size (d = -2.10).
this means an improvement in the speed of falling asleep, this is a result for decreased in excessive mental activity before sleep, which is the most important goal of the counseling season.
a statistically significant differences with large effect sizes for all variables, which is mean improvement was high practical value. thanks to the program that addressed:

- The cognitive aspect (pre-sleep anxiety).
- The emotional aspect (stress and anxiety).
- The physiological aspect (neural excitability).

Furthermore, the high Cohen's d-values—which significantly exceeded 0.80 for all variables—indicate a strong practical effect of the program, and not merely a statistical significance resulting from the sample size.
the results confirm that combining of counseling sessions for psychological stability with relaxation exercises is an effective to improving the quality of sleep for young football players, and positively impacts their physical readiness, focus, and skill performance.

table (2) variable differences between the pre- and post-measurements

Max Difference	Min Difference	SD Difference	Mean Difference	Variable
+48.66	+13.93	9.03	+30.47	**Total Sleep**
+3.60	-14.87	5.02	-8.29	**Wake Time**
+15.99	-0.60	5.14	+8.54	**REM**
+29.26	+3.11	5.39	+12.12	**Deep Sleep**
+6.20	-24.18	8.30	-10.32	**Light Sleep**
+1.24	-6.04	2.07	-2.74	**Movement during sleep**
-0.18	-2.62	0.56	-1.17	**Sleep Onset Time**

in table (2) the mean differences between the pre- and post-test measurements and the standard deviations of these differences with the lowest and highest differences for sleep variable. This table important because it shows the sample changes, not just its statistical significance.
First: Total Sleep
mean difference was (+30.47) minutes, with a standard deviation of (9.03), and the change is between (+13.93) and (+48.66) minutes.
almost all players have a significant increase in total sleep, and minimum improvement of more than 13 minutes. as a general and stable effect of the program on total sleep duration, not just for a small number of players.
Second: Wake Time

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mean difference was (-8.29) minutes, with a variance between (-14.87) and (+3.60). Although the average indicates an overall improvement (reduced wakefulness), the positive upper limit mean that a small number of players did not improve in the same way, they my effects by individual factors like personal anxiety or lifestyle outside of training.
In general, nighttime fragmentation for the sample reduced.
Third: rapid eye movement sleep (REM)
difference was +8.54 minutes, ranging from -0.60 to +15.99.
which is indicates an improvement in this sleep stage for most players, with one or two cases showing no significant improvement (small negative value).
the program effectively enhancing sleep associated with cognitive processing and motor learning.
Fourth: deep sleep
the highest qualitative improvement, with an average difference of +12.12 minutes, ranging from +3.11 to +29.26. It is noteworthy that all values were positive, indicating that every participant experienced an improvement in deep sleep without exception.
This is a strong indicator of the effectiveness of relaxation exercises in promoting physical recovery and reducing physiological arousal.
Fifth: light sleep
Decreased by an average of (-10.32) minutes, with a variation between (-24.18) and .(6.20+)
This indicates a shift of some sleep time from light to deeper stages (DEEP and REM), a positive development in the quality structure of sleep.
However, the presence of a positive difference among some players indicates individual variation in response to the program.
Sixth: Movement during sleep
Decreased by an average of (-2.74), ranging between (-6.04) and.(1.24+)
This indicates an improvement in physical stability during sleep and a reduction in nocturnal movement anxiety, with limited individual variation.
Seventh: sleep onset time
The average difference was -1.17 minutes, with variations ranging from -2.62 to -0.18 minutes, all of which were negative.
This means that all players fell asleep more quickly after the program was implemented, with no adverse effects. This is a strong indicator of the success of the cognitive-relaxation aspect in reducing pre-sleep mental activity.
Thus, the data on individual differences indicate that the improvement was:
Comprehensive in both deep sleep and sleep onset time (improvement in all individuals).
Majority in the remaining variables, with limited individual variation.
Clearly practical value in terms of the number of perceived minutes in each phase.
The greatest improvements were observed in:
Total sleep, Deep sleep, REM sleep.
the program affected in the quantity, quality and internal structure of sleep, which is the primary goal of any structured psychophysiological activity.
this small variation among players can be explained by individual differences in baseline anxiety levels, home adherence to instructions, and daily habits outside the training environment. so, the results of Table (2) match it in Table (1), and confirm that the program combined with relaxation exercises made a real positive change at the individual level, and general statistical level.

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Therefore:

- All variables showed statistically significant differences in favor of the post-test.
- The greatest improvement was recorded in total sleep time and deep sleep.
- The smallest difference was found in the ONSET, but it was still significant (temporally).

table (3) sleep variables Spearman's correlations (after the program)

ONSET	Movement during sleep	LIGHT	DEEP	REM	Wake Time	Total Sleep	variable
-0.147	-0.325	0.289	-0.053	-0.409	-0.072	1.000	Total Sleep
-0.265	-0.042	0.436	-0.054	0.129	1.000	-0.072	Wake Time
-0.114	-0.086	-0.020	-0.080	1.000	0.129	-0.409	REM
0.405	0.299	-0.072	1.000	-0.080	-0.054	-0.053	Deep Sleep
-0.214	-0.159	1.000	-0.072	-0.020	0.436	0.289	Light Sleep
0.298	1.000	-0.159	0.299	-0.086	-0.042	-0.325	Movement during sleep
1.000	0.298	-0.214	0.405	-0.114	-0.265	-0.147	Sleep Onset Time

table (3) Spearman's correlation between sleep variables in the post-test, to discover the relationship between sleep components after working with program mixed with relaxation exercises. this analysis shows the structural consistency of sleep after the improvement.

First: Total Sleep and its Relationship to Other Variables

An average negative correlation showed between total sleep and (REM) (-0.409), and negative correlation with movement during sleep (-0.325), but the correlation with light sleep (0.289) was positive.

The negative correlation with REM sleep can be explained by the fact that an increase in total sleep does not necessarily mean a proportional increase in all sleep stages, as the increase may be distributed across different stages. The negative correlation with Movement during sleep indicates that the longer the total sleep duration, the less nocturnal movement occurs, which is a positive indicator of physical stability.

Second: Wake duration

A moderate positive correlation was found between wake time duration and light sleep (0.436), indicating that increased nighttime fragmentation is associated with a higher proportion of light sleep, which is physiologically logical, as light sleep is more prone to fragmentation.

A weak negative correlation was also found with sleep onset time (-0.265), suggesting that players who fall asleep faster may experience fewer awakenings during the night, although the relationship is not strong.

Third: Deep sleep (DEEP)

Deep sleep showed a moderate positive correlation with both sleep onset time (0.405) and sleep movement.(0.299)

The positive correlation with sleep onset time may seem unexpected, but it can be explained by the fact that some players who take slightly longer to fall asleep may later transition to more stable deep sleep, especially after a decrease in cumulative anxiety.

Its relationship with sleep movement may reflect a normal regulatory interaction within the sleep structure and is not necessarily a negative indicator, especially if the movement is within normal limits.

Fourth: rapid eye movement sleep (REM)

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REM was negatively correlated with total sleep (-0.409) and weakly correlated with the other variables, suggesting that the REM stage became relatively independent after the program, meaning it was no longer associated with clear disturbances in the other components of sleep. This indicates an improvement in the internal organization of sleep cycles.

Fifth: Sleep onset time (ONSET) showed a moderate positive correlation with deep sleep (0.405), a positive correlation with sleep movement (0.298), and a negative correlation with light sleep.(0.214-)

This indicates that the internal structure of sleep has become more organized, such that the improvement does not depend on a single factor but rather on an integrated interaction between the different stages.

The correlation coefficients indicate that:

The relationships between the variables have become more normalized after the program.

There are no random or conflicting correlations with very high values, indicating a balanced sleep structure.

Some moderate correlations (approximately ±0.40) reflect functional interdependence between sleep components, not a disorder.

Furthermore, the use of Spearman's rank correlation coefficient enhances the accuracy of the analysis given the small sample size and the non-parametric data nature. Therefore, the results of Table (3) support the conclusion that the program not only improved the variables separately, but also contributed to reorganizing the internal structure of sleep-in young players, reflecting a better state of psychological and physiological stability.

Therefore:

- A moderate negative correlation exists between REM and total sleep: meaning that as REM sleep increases, the proportions of other sleep stages decrease.
- A positive correlation exists between deep and (ONSET) sleep, indicating that those who go to bed late may compensate with deep sleep.
- A weak negative correlation exists between Movement during sleep and total sleep, reflecting that increased movement reduces total sleep.

From the three tables, we can draw the following useful conclusions:

1 .Total Sleep Duration: The results showed a significant increase in total sleep time after implementing the psychological training program, with an average increase of +30.47 minutes (Cohen's d = 3.37), indicating a very significant effect of the program. Studies indicate that meditation and breathing exercises stimulate the parasympathetic nervous system and reduce excessive nervous activity, thus facilitating the onset of sleep and increasing its duration (Tang et al., 2007).

2 .Rapid Eye Movement (REM) and Deep Sleep (DEEP): Significant increases were observed in both REM sleep (+8.54 minutes) and deep sleep (+12.12 minutes).

these critical stages for supporting mental and physical recovery.

(REM sleep) is responsible for cognitive processing and memory,

(Deep sleep) helps muscle repair and hormonal balance.

3 .reduced wake time and movement during sleep:

reducing in wake time and movement during sleep point to improved sleep quality and stability. Progressive muscle relaxation exercises and mindfulness techniques calm sensory

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centers and reduce anxiety, decreasing the number of awakenings during sleep (Morin et al., 2006).

4 .Reduced sleep onset time: Sleep onset time decreased by 1.17 minutes, a statistically significant improvement. meditation and guided imagery help to shut down racing thoughts and accelerate the process of falling asleep.

5. Correlation Analysis (Spearman)

•A negative relationship between total sleep time and sleep-wake/movement time: this means that any improvement in one aspect positively impacts sleep quality.

•A moderate correlation between ONSET and DEEP, indicating that improved sleep onset is accompanied by deeper sleep. This is an indicator of the integrated effectiveness of the psychological training program.

After applying the program, post-test results showed a decrease in psychological stress indicators, indicating that the program effectively achieved its objectives (Abdulhussein and Hani 2023).

Conclusions:

1 .Psychological stability counseling sessions, combined with relaxation exercises, improved sleep regulation among young football players.

2 . Players showed improvement in sleep duration and the proportion of deep sleep stages, supporting their physical and psychological recovery.

3 . non-pharmacological psychological training can be a sustainable option for improving athletic performance by enhancing sleep.

4. A positive relationship between the level of psychological stability and the quality of sleep among athletes.

5. reducing emotional arousal before sleep is a key in improving sleep depth and regularity.

6 .Integrating cognitive (counseling) techniques with physiological (relaxation) techniques is an effective approach in sports psychology programs.

7 .Paying attention to sleep as a psychophysiological variable contributes to increasing the overall readiness of athletes.

8. Psychological programs based on relaxation techniques (breathing, meditation, mindfulness) have proven effective in improving quantitative and qualitative sleep indicators.

Recommendations:

1 .Adopt a program of guidance sessions integrated with relaxation exercises within the training plans for all age groups in sports clubs.

2 .Appoint or utilize a sports psychologist to monitor the psychological well-being of young athletes on a regular basis.

3 .Integrate education on the importance of sleep into the educational programs for athletes and their parents.

4 .Conduct periodic measurements of sleep levels and psychological stability to monitor progress and prevent disorders.

5 .Conduct similar studies on different age groups or other sports to verify the generalizability of the results.

6 .Investigate other psychological variables related to sleep, such as competitive anxiety, psychological resilience, and psychological immunity.

7 .Use sleep tracking devices, such as the Ōura ring, periodically to monitor sleep improvement and intervene when disorders are detected.

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8 .Conduct future studies with larger samples and different age groups to generalize the findings.
9. Investigate the interaction between sleep quality and skill or physical performance during matches.

Personal Questionnaire
This questionnaire is intended to collect basic demographic and background information about the participants. Please answer the following questions accurately:
Age:
17 ☐ 16 ☐ 15 ☐ 14 ☐ 13 ☐
Years of playing experience in volleyball:
☐Less than 1 year ☐ 1–2 years ☐ 3–4 years ☐ More than 4 years
Number of training hours per week:
☐Less than 4 hours ☐ 4–6 hours ☐ 7–9 hours ☐ 10 hours or more
Do you suffer from any current or previous medical or psychological conditions that may affect your sleep?
☐Yes ☐ No
If yes, please specify_____ :
Counseling sessions based on psychological stability
Psychological Stability Training Sessions
Duration: 4 weeks
Frequency: 4 sessions per week
Session Length: 30–45 minutes
Target Audience: Junior Football Players

Week 1: Preparation and Mindful Breathing

Objective: To calm the nervous system, increase awareness of body and breath, and prepare psychologically.
Session 1:

- Introductory Overview (5 minutes): What is psychological stability and why is it needed in sports?
- Deep abdominal breathing exercises (15 minutes)
- (4-7-8) breathing: Inhale for 4 seconds, hold for 7, exhale for 8
- Initial muscle relaxation (10 minutes)
- Closing discussion: The player's feelings after the exercise (5 minutes)

Session 2:

•Abdominal breathing exercises + "counting breaths" exercise (20 minutes)
•Facial and shoulder relaxation exercises (10 minutes)
•Silent relaxation session (5 minutes)
Session 3:
•Breathing + progressive muscle tension and relaxation (30 minutes)
•Reviewing the body's response (5 minutes)
Session 4:
•Procedures: Open discussion: When do you sleep? Why don't you sleep well?
•Clarifying the role of sleep in performance.
•Simple breathing exercise.

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•Full muscle relaxation: foot → leg → abdomen → arm → face.
•Managing pre-match anxiety.

Week 2: Muscle relaxation, positive visualization, and understanding stress

Objective: To regulate the physiological response and focus attention on mental images
Relaxation

Session 1:
•Progressive full-body muscle relaxation (25 minutes)
•Starting from the feet to the face
•Accompanying breathing exercises (5 minutes)
•Simple positive self-talk (5 minutes)

Session 2:
•Relaxation + Guided Imagery
•Visualize a safe place (15 minutes)
•Visualize a successful athletic performance (10 minutes)
•Silent rest (5 minutes)

Session 3:
•Progressive muscle relaxation + breathing (20 minutes)
•Candlelight meditation or color breathing (10 minutes)
•Review with the players (5 minutes)

Session 4:
•Training situations that cause tension
•Shoulder and neck muscle relaxation
•Full muscle relaxation: feet → legs → abdomen → arms → face
•Managing pre-match anxiety

Week 3: Mindfulness and Emotional Regulation

Goal: To enhance present-day attention, reduce anxiety, and improve self-talk

Session 1:
•Exercise Body Scan (20 minutes)
•Observing thoughts without judgment (10 minutes)
•Meditation breathing exercises (5 minutes)

Session 2:
•Focusing on sounds and breath (20 minutes)
•Writing down and mentally releasing disturbing thoughts (10 minutes)

Session 3:
•Mindful Walking (15 minutes)
•Mindful presence exercise: 5-4-3-2-1 for the senses (10 minutes)

Session 4:
•Examples of negative thoughts before bed.
•Transforming them into positive statements.
•Teaching the "Stop-Breathe-Thought" technique.
•Visualizing a relaxing place.
•Full muscle relaxation: feet → legs → abdomen → arms → face.
•Managing pre-game anxiety.

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Week 4: Integration and Reinforcement with Emotional Release and Self-Confidence

Objective: To reinforce skills and apply them in stressful sports situations, emotional release, and self-confidence.

Session 1:

•A session combining breathing, relaxation, and visualization. (30 minutes)
•Sports Meditation (Visualizing success in a game) (10 minutes)

Session Two:

•Simulating a stressful situation and using stabilization techniques (30 minutes)
•Discussing how to cope with stress (5–10 minutes)

Session Three:

•Reviewing all exercises (20 minutes)
•Developing an individualized plan for each player to apply what they have learned (10 minutes)
•Self-assessment of feelings and performance (5 minutes)

Session Four:

•Writing down what bothers the player.
•Symbolically closing the paper.
•Linking confidence to restful sleep.
•Visualizing a successful performance.
•Full muscle relaxation: foot → leg → abdomen → arm → face.
•Managing pre-game anxiety.

Implementation Notes:

•Sessions should be conducted in a quiet and comfortable place away from noise.
•Calming background music can be used during meditation exercises.
•Supervision by a sports psychologist or a coach trained in these techniques is preferred.
•Notes should be recorded after each session regarding the players' interaction.

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Relaxation Exercises Used:

- Deep Breathing: Focuses on deep and slow abdominal breathing to help calm the nervous system, reduce stress, and increase oxygen levels in the body, it is recommended to take a few breaths (e.g., inhale for 4 seconds, exhale for 6 seconds).
- Progressive muscle relaxation: This involves tensing the body's muscles one group at a time (e.g., feet, legs, abdomen, arms, shoulders) and then relaxing them completely. This exercise helps reduce both mental and physical tension and increases awareness of the bodies that are tense.
- Mindfulness meditation (mental focus): A short session in which the player focuses on the present moment, such as observing their breathing or bodily sensations without judgment. This exercise enhances mental focus and reduces distracting thoughts.
- Positive visualization related to competitions: Mentally visualizing a victory or positive moments on the field (such as executing a successful shot or receiving the ball with focus) helps boost self-confidence and strengthen a positive mental state before and during matches.

Monthly program schedule: Below are details of the four sessions per week, including the exercise components and their durations. The following table shows the exercises for each session in the first week as an example, with some sessions gradually increasing in subsequent weeks:

Week 1 (Defining and moderately repeating exercises): The focus is on the players understanding each technique and performing it at a calm pace.

First week Exercise sessions

Session 4	Session 3	Session 2	Session 1	Exercise
5minutes	5minutes	5minutes	5minutes	Deep breathing
25minutes	20minutes	20minutes	20minutes	Progressive muscle relaxation
15minutes	15minutes	15minutes	10minutes	Mindfulness meditation
10minutes	10minutes	5minutes	5minutes	Positive visualization
5minutes	5minutes	5minutes	5minutes	Short break

During the first week, the sessions focus on deep breathing and basic muscle relaxation exercises. For example, in the first session (45 minutes), allocate 5 minutes for deep breathing, 20 minutes for muscle relaxation, 10 minutes for meditation, and 5 minutes for positive visualization, such as feeling warmth in the chest area and feeling your heart beating slowly and regularly, with a short break that increases by a few minutes in subsequent sessions (for example, 15 minutes for meditation in the second and third sessions) to increase habituation.

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Week 2 (Slight Increase in Duration and Focus)

In the second week, the duration of some exercises is increased to enhance focus. Additional sessions may include positional exercises or increased intensity of muscle relaxation.

Exercise Sessions During Week 2

Session 4	Session 3	Session 2	Session 1	Exercise
5minutes	5minutes	5minutes	5minutes	Deep breathing
25minutes	25minutes	25minutes	25minutes	Progressive muscle relaxation
15minutes	15minutes	10minutes	10minutes	Mindfulness meditation
10minutes	10minutes	10minutes	5minutes	Positive visualization
5minutes	5minutes	5minutes	5minutes	Short break

The muscle relaxation period is increased to 25 minutes to cover additional muscle groups, and meditation and visualization are gradually increased in some sessions. For example, a session might consist of 3-5 minutes of breathing, 25 minutes of muscle relaxation (feeling warmer and more relaxed in the body's muscles while maintaining inhalation and exhalation), 15 minutes of meditation, and 10 minutes of visualization (55 minutes total). This helps the athlete deepen their focus and relaxation under slightly longer conditions.

Week 3 (Deepening the Experience Under Mild Stressors):

The exercise practice is deepened, and small stimuli (such as playing calming music or gentle sound effects) may be added to simulate gradual stress. Mental focus and stress management time are increased. Example of times:

Third week Exercise sessions

Session 4	Session 3	Session 2	Session 1	Exercise
5minutes	5minutes	5minutes	5minutes	Deep breathing
30minutes	30minutes	25minutes	25minutes	Progressive muscle relaxation
15minutes	15minutes	15minutes	15minutes	Mindfulness meditation
5minutes	5minutes	10minutes	5minutes	Positive visualization
5minutes	5minutes	5minutes	5minutes	Short break

This week, the sessions focus on breath control, meditation, and maintaining a steady breathing pattern, while increasing muscle relaxation time in sessions 3 and 4 to 30 minutes. More details can be added to positive visualization (such as imagining a favorite color on each side, the green field, your clothes, and everything else) during the second session. Most sessions total approximately 60 minutes, which helps train the players to be more patient and maintain mental focus for longer periods.

Week 4 (Peak Training and Application: Complete Control)

Week 4 is the culmination of the program, where the player's ability to fully control stress is developed. During this week, all techniques are practiced for the longest possible duration, with a focus on fully stimulating visualization of success in matches. Example schedule:

Fourth week exercise sessions

Session 4	Session 3	Session 2	Session 1	Exercise
5minutes	5minutes	5minutes	5minutes	Deep breathing
30minutes	30minutes	30minutes	30minutes	Progressive muscle relaxation
15minutes	15minutes	15minutes	5minutes	Mindfulness meditation
5minutes	10minutes	5minutes	5minutes	Positive visualization

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5minutes	5minutes	5minutes	5minutes	Short break

In this final week, all sessions last 60 minutes. Breathing exercises focus on increasing the volume of the players' inhalations and exhalations, and muscle relaxation is practiced for a fixed 30 minutes. Mindfulness meditation for 15 minutes to rises deep concentration. after each session, short, repetitive positive visualization (e.g., visualizing a successful pass or a powerful shot) is encouraged to support confidence.

The program has been moves step by step: it starts with simple skills, then moves slowly to deeper techniques and longer practice. After one month of regular training, the player becomes able to handle his stress better, sleeps more regularly, and stays focused during matches more than before.

The player meditates for 15 minutes to reach deep focus. After each session, he pictures a successful moment in his mind—like a clean pass or a strong shot—and repeats that image to build up his confidence.

Overall, this program ensures a gradual progression from a simple introduction to techniques towards their sustained and advanced application. The players are expected to demonstrate significant progress in their ability to manage stress, regulate sleep, and increase their focus during matches by the end of the month of regular application.

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The Effect of Educational Exercises Based on the Kemp Model on Learning the Forehand and Backhand Skills in Lawn Tennis Among Students

Dhabyaa Jafer Hawash [1], **Aghader Hadi Jasim**[2]

[1,2] University of Baghdad, College of Physical Education and Sports Sciences

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Abstract

The study aimed to design educational exercises based on the Kemp Model to facilitate the learning of forehand and backhand strokes in tennis among students, as well as to identify the effect of these exercises on learning the two skills. To achieve this aim, the researcher employed an experimental method using a pre- and post-test design with equivalent experimental and control groups, as it suited the research problem and objectives. The research population consisted of third-year morning students at the College of Physical Education and Sports Sciences, University of Baghdad, for the academic year 2025–2026, totaling 245 students distributed across seven sections (A, B, C, D, E, W, Y). The third-year students were selected because they study tennis within their curriculum. The sample was chosen randomly by selecting two sections to represent the experimental and control groups and then 25 students from each section were randomly selected: Section C (25 students) and Section W (25 students) making a total sample of 50 students representing 20.40% of the population. The sample was divided into two groups: an experimental group (Section C) which learned the forehand and backhand strokes using the Kemp Model and a control group (Section W) which learned using the traditional method followed by the instructor (command style) according to the prescribed physical education curriculum. Appropriate statistical treatments were applied and the results showed that educational exercises based on the Kemp Model had a positive effect on learning the forehand and backhand strokes. Furthermore these exercises provided opportunities for cooperative learning through the use of instructional aids as well as increased motivation excitement and competition among students which facilitated the learning process. The researcher recommends adopting the Kemp Model in teaching forehand and backhand strokes in tennis as it supports the effective implementation and achievement of educational objectives.

Keyword: Kemp Model, Forehand Strokes, Backhand Strokes.

[1] University of Baghdad, College of Physical Education and Sports Sciences.
deyaa.jaafar1104a@cope.uobaghdad.edu.iq
[2] University of Baghdad, College of Physical Education and Sports Sciences.
aghadeer.jassim1004@cope.uobaghdad.edu.iq

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Introduction

In recent decades, the educational process has seen a remarkable shift toward the adoption of modern instructional design models that seek to organize the elements of the learning situation in a scientific manner, based on clear psychological, pedagogical, and cognitive principles. Education becomes a systematic process which goes beyond the traditional concept of transferring information, or demonstrating skills by identifying objectives, assessing learners' characteristics and selecting instructional activities, to establishing teaching strategies and using continuous assessment techniques from different types and methods to confirm that the required goal has been achieved (Obeid et al., 2025: Majeed et al.,2026).

The Kumb model makes it the most extensive among the existing models in instructional design as it follows a cyclical structure enabling practitioners to start from wherever they need based on how your situation looks and emphasizing integration of objectives, content activities, resources, and assessment. This model also emphasizes the analysis of characteristics and needs of learners before designing a teaching program which makes it ideal for application in physical education, where students have diverse health-related capabilities (Al-Aboudi, 2025; Hassan and Abdulkareem, 2026).

Tennis is an individual sport that requires a high degree of accuracy, neuromuscular coordination and immediate second decision-making as well as technical mastery of the basic skills. The forehand and backhand strokes are the basic elements of technical performance in tennis, being the main weapons players use to build their offense and defense as well as dictate flow of a game. Acquiring these two abilities necessitates a clear grasp of optimizing the physical elements in technical terms during the stroke (preparatory, main and follow-through), timing, balance, directional control and speed of ball (Abdulkareem et al., 2025: Hawash and Halil, 2022).

Yet the truth of teaching tennis in much of education is that it relies on timeless theories about how to teach skills, using mostly verbal methods for demonstrating correct form, but without a structured instructional design sensitive to individual differences or specific, measurable behavioral objectives. This results in high drop out, lack of proper skill mastery, an evident learning speed difference between students and decreased motivation and engagement level (Abdulhussein et al., 2026; Abbas, 2025).

The importance of this research refers to the use of contemporary teaching design models, wherein the Kumb model is designed for repetitive motor learning exercises according to scientific stages that facilitate skill acquisition and achieve a high level of performance. Accordingly, this study was conducted to investigate the effect of instructional exercises designed according to the Kumb model on students' learning of the forehand and backhand strokes in tennis.

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Based on the researcher's experience and observations of teaching practices—as a tennis instructor herself— it became evident that most tennis instructors still rely on traditional teaching methods, which emphasize the teacher's role over that of the learner. This reduces the effectiveness of learning and weakens students' participation in building motor skills, which negatively impacts their mastery of basic skills.

There is also a clear disparity in students' performance levels for the forehand and backhand strokes, as well as a delay in mastering proper technique and the occurrence of recurring technical errors resulting from the absence of a systematic instructional plan that takes into account the skill progression and its motor components. This indicates a gap between the teaching methods used and the requirements for effective motor learning.

The Kumb model is considered one of the comprehensive models in instructional design that focuses on analyzing learner characteristics, precisely defining objectives, organizing content, and selecting appropriate activities and instructional materials, while incorporating formative assessment. However, the application of this model in physical education classes—particularly in teaching tennis skills—remains limited, which calls for an assessment of its effectiveness in improving skill acquisition.

Accordingly, the research problem is defined as answering the following question: Do instructional drills designed according to the Kumb model have a significant impact on students' learning of the forehand and backhand strokes in tennis, compared to the traditional method?

Therefore, the objectives of this study were:

- To develop instructional drills based on the Kump model for teaching students the forehand and backhand strokes in tennis.
- To examine the impact of instructional drills based on the Kump model on students' learning of the forehand and backhand strokes in tennis.

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Material and Method

The researchers employed an experimental approach, utilizing a design with two equivalent experimental and control groups and pre- and post-tests to suit the research problem and objectives. The study population was defined as third-year students in the morning program at the College of Physical Education and Sports Sciences, University of Baghdad, for the academic years 2025, totaling 245 students distributed across seven sections (A, B, C, D, E, F, and G). The study population was limited to third-year students because this level includes instruction in tennis. The research sample was selected by random drawing among the sections to determine the groups (experimental and control).

The researcher then selected 25 students from each section by random drawing as follows:

Section C (25 students) and Section W (25 students), for a total of 50 students, representing 20.40% of the total, they were divided into two groups: a control group and an experimental group. The experimental group (Section C) learned the forehand and backhand strokes in tennis according to the Kemp method, while the control group (Section F) learned using the method taught by the teacher (the American method) and in accordance with the prescribed physical education curriculum.

Research Tools

The researchers used the following equipment and tools: 12 plastic markers of varying heights, tennis balls, 2 whistles, 5 rolls of colored tape, a 20-meter fabric measuring tape, 25 tennis rackets, and 2 “Diamond” electronic stopwatches.

The research tests consisted of:

1. Testing the accuracy of the forehand stroke in tennis from multiple zones (Karim Abdul Zahra Al-Khafaji, 2019, 116–119).
2. Accuracy of the backhand stroke in tennis from multiple zones (Karim Abdul Zahra Al-Khafaji, 2019, 116–119).

The piloting study was performed by the researchers on five students on Sunday, October 19, 2025 at 10:00 a.m. in the tennis court area of College of Physical Education and Sports Sciences building at Al-Turath University. The pilot study met its objectives goals (time taken for test completion, verification of validity of research instruments used in the pilot study and identifying any errors and challenges which arose during the course of the pilot study).

After a brief explanation of the instructions and steps required for performing and administering each test, along with all necessary requirements and materials used in the tests, the researchers executed the pre-test on Monday 20 October 2025 on the research sample. Afterward, the researchers conducted the equivalence test for the research sample, as shown in Table (1).

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Table 1. *Equivalence of the Research Groups in the Pre-Test*

Test	Experimental Group (Mean)	SD	Control Group (Mean)	SD	T-value	Sig	Significance
Forehand Stroke	3.25	1.16	3.46	1.36	0.545	0.524	Not Significant
Backhand Stroke	3.75	1.20	3.65	1.49	0.460	0.574	Not Significant

The researchers then developed a set of exercises targeting the skills under study based on the Kamb model, These exercises were administered to the experimental group on October 25, 2025, at a rate of two instructional units per week (on Saturdays and Mondays). The total number of instructional units was 16, spread over 8 weeks. The curriculum was divided into three sections:

1- Warm-up Section: 7 minutes in duration, designed to prepare the body's muscles and joints, and includes:

a- A general warm-up lasting 4 minutes.

b- A ball-specific warm-up lasting 3 minutes, tailored to the skill.

2- Main Section: 33 minutes in duration, during which body positioning for skill execution is explained, along with a set of specific exercises based on the Kemb model. It is divided into:

a- The instructional component, lasting 4 minutes, during which the correct execution of each skill is explained.

B. The practical component, lasting 29 minutes, involves applying the specific exercises according to the Kump model.

3. Concluding Section: Lasting 5 minutes, this section includes repetitions of the skill in its various parts and as a whole.

The instructor conducted the instructional sessions under the supervision of the two researchers. As for the control group, the instructor administered the exercises specific to the prescribed curriculum, allocating the same amount of time as that allotted to the experimental group. The post-test was then administered on Sunday, December 21, 2025, for both the experimental and control groups, using the same test administered in the pre-test under the same conditions and under the supervision of the researcher and the assistant team. The researchers used SPSS to obtain the research results.

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Results

Table 2. *Means, Standard Deviations, and T-Values for the Pre- and Post-Tests of the Experimental Group*

Test	Pre-Test (Mean)	SD	Post-Test (Mean)	SD	T-value	Sig	Significance
Forehand Stroke	3.25	1.16	6.15	1.93	8.277	0.000	Significant
Backhand Stroke	3.75	1.20	5.52	1.96	7.868	0.000	Significant

Table 3. *Means, Standard Deviations, and T-Values for the Pre- and Post-Tests of the Control Group*

Test	Pre-Test (Mean)	SD	Post-Test (Mean)	SD	T-value	Sig	Significance
Forehand Stroke	3.46	1.36	4.40	1.79	6.256	0.000	Significant
Backhand Stroke	3.65	1.49	4.93	1.14	5.230	0.000	Significant

Table 4. *Means, Standard Deviations, and T-Values for the Post-Tests of the Experimental and Control Groups*

Test	Experimental Group (Mean)	SD	Control Group (Mean)	SD	T-value	Sig	Significance
Forehand Stroke	6.15	1.93	4.40	1.79	7.738	0.000	Significant
Backhand Stroke	5.52	1.96	4.93	1.14	6.704	0.000	Significant

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Discussion

Table 2 shows that there are statistically significant differences between the pre-test and post-test scores, with the post-test scores being higher for the experimental group in the research tests. The researcher attributes these differences to the positive impact of the instructional exercises designed according to the Kumb model, which were applied to the members of the experimental group; these exercises contributed to facilitating the learning of the forehand and backhand skills and acquiring them in an organized and integrated manner. This is attributed to the diversity and logical sequence in the presentation of the content, as well as their departure from the traditional routine, which created an engaging and motivating learning environment (Hassan and Abdulkareem, 2025).

Furthermore, the incorporation of progressive hands-on activities and continuous feedback within the model's steps enhanced students' understanding of the technical nuances of performance and helped correct errors as they arose, which positively impacted their mastery of both skills. This led to an increase in students' motivation to actively participate in the instructional units and perform the exercises with enthusiasm and energy, which helped achieve a noticeable improvement in their technical performance compared to the control group, as "the use of engaging exercises in training is an important factor in improving the student's technical, physical, and psychological level (Mohammed Jamil Abdul-Qadir, 1993).

Furthermore, the exercises were designed according to the Kumb model to suit the students' level, as they were designed based on scientific and pedagogical principles that take into account the nature of motor learning, by focusing on the motor aspects of the skill and the sequence of its technical stages in an organized manner, which contributed to improving students' understanding of correct performance and linking the technical stages together. This approach had a positive impact on skill performance, resulting in noticeable development and improvement in the technical aspects of the forehand and backhand strokes in tennis, as "an exercise is a motor performance defined by time and repetition; learning can only occur through it, and it leads to skill development, and all learning aims for rapid progress in both physical and mental aspects and an increase in technical motor learning" (Mahmoud Daoud Al-Rabie, 2011).

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The instructional unit also provided a sufficient and appropriate amount of learning through practical exercises, as it included educational games that helped increase students' motivation to learn the skill, in addition to being enjoyable and easy to perform, which reduced fatigue, boredom, and reluctance to participate. This had a positive impact on the students' level of concentration and understanding and helped reinforce their grasp of the correct motor pathways for the skills, which ultimately led to the achievement of proper technical performance "When a skill reaches a stable stage or when the technique is difficult, the movement cannot be performed unless the player is fully aware of the skill so as to execute it correctly" (Wajih Mahjoub, 1985).

Table 4 shows that there are statistically significant differences between the post-test results of the experimental and control groups, with the experimental group performing better on the research tests. The researcher attributes this superiority among the experimental group members to the difference in the curriculum used between the two groups, as the experimental group's curriculum proved highly effective in developing students' technical performance levels through the diverse and organized exercises included within the instructional units, designed to suit the students' age level and their physical and mental abilities, which contributed to enhancing their capacity for comprehension and understanding and positively reflected on the improvement of technical performance in the skills under study, because "when curricula are implemented effectively, the player's overall performance improves significantly " (Mohammed Mahmoud Al-Hila, 1999, 65).

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These modules helped present the educational material in greater detail and with greater accuracy, while strengthening the connection between new information and the players' prior experiences. The teacher's role was also more effective as a facilitator, guide, and leader of the educational process, creating a positive and motivating learning environment for students. Exercises based on the Kemp model helped make learning more engaging and dynamic, and the variety and innovation of practical exercises further enhanced students' skill-based learning.

In addition, the exercises were engaging, enjoyable, and varied in terms of equipment, directions, and performance—both static and dynamic—which encouraged students to actively engage with the exercises by making repeated attempts with energy and enthusiasm. This had a positive impact on skill acquisition, as "the fundamental and essential rule in skill learning is to focus on the number of practice attempts and their variety" (Moston & Muska, 1981; Abdulghani et al., 2025).

The instructional exercises based on the Kumb model and their content an impact on the differences between the two groups, as they served as aids that facilitated the transfer of educational material to the player and provided him with direct experiences through the sensation of motor performance and a sense of skill, thereby boosting his self-confidence.

This motivated him to continue performing and exert greater effort during the instructional unit, which helped accelerate the learning process, because "one of the fundamental principles that must be taken into account during the educational process is the availability of assistive tools and devices that accelerate learning by fostering a sense of competence and self-confidence in the development and improvement of motor and skill-based performance" (Diaa Al-Khayyat and Nofal Muhammad Al-Hayali, 2001: Jabbar et al., 2025).

Furthermore, the exercises performed by the students during the instructional units were highly beneficial, as the way they were carried out supported the players' motor, mental, and psychological development, which helped improve their motor and physical abilities. This had a more positive impact on them than on the control group, resulting in a clear effect, as "games and exercises help both genders discover their potential and develop their physical, motor, and cognitive abilities while participating in and applying these games and exercises" (Walid Ahmed Al-Masri, 1999: Star, 2019).

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Conclusions

The researchers concluded that instructional exercises based on the Kumb model have a positive impact on students' learning of the forehand and backhand strokes in tennis, and that instructional exercises based on the Kumb model provided students with the opportunity for collaborative learning through the instructional methods used; furthermore, the excitement, enthusiasm, and competition among students facilitated the learning process for the forehand and backhand strokes in tennis.

Recommendations

The researchers recommend adopting the Kumb model for teaching students the forehand and backhand strokes in tennis, as this model facilitates the implementation and achievement of established instructional objectives. They also suggest conducting a study similar to the present one on other skills and activities, as well as across different age groups.

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Standardization of the Orientation to Regular Physical Activity Scale in obese women aged (30-35 years)

Doha Hadi Amin [1], Naima Zidane Khalaf [2]

[1] University of Baghdad, College of Physical Education and Sport Sciences.
[2] University of Baghdad, College of Physical Education and Sport Sciences for women.

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Abstract

The study aimed to codify the scale of orientation towards regular physical activity among obese women in the age group (30-35 years), in order to provide a scientific measurement tool that helps trainers in community gyms to design awareness and educational programs that enhance the continuity of physical activity. The researchers adopted the descriptive survey method, and the research population included women between the ages of 30 and 35 who are not overweight. Since the population size was not accurately determined, Cochran's formula was used to determine the sample size, which amounted to 400 trainees. The sample was divided into an exploratory sample (10 trainees) and a control sample (190 trainees) that were randomly selected. The scale consisted of 22 statements, and was applied during the period from October 5 to December 1, 2024. The data was analyzed using SPSS software to extract Z-scores and T-scores and determine standardized levels. The results showed that the scale has good psychometric properties, making it a reliable tool for assessing the orientation towards regular physical activity. The researchers recommended encouraging continuity in physical activity by designing various training plans and using motivational strategies such as group challenges and symbolic rewards to enhance exercise adherence among women in this age group.

Keywords: Physical Activity Orientation Scale, Obese Women, Standardization, Regular Physical Activity, Age 30–35 Years.

[1] University of Baghdad, College of Physical Education and Sport Sciences.
duha.h@cope.uobaghdad.edu.iq
[2] University of Baghdad, College of Physical Education and Sport Sciences for women.
naeem@copew.uobaghada.edu.iq

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Introduction

Obesity is a complex public health concern that continues to increase worldwide, especially among women aged 30–35 years. Sedentary lifestyles, unhealthy diet, and psychosocial stressors are linked to the rising prevalence of overweight and obesity among this demographic (WHO, 2022). Meanwhile, urbanization and adoption of modern technologies in Iraq have exacerbated physical inactivity and caloric consumption rates (Zhang et al., 2021; Abdulkareem et al., 2024).

Physical inactivity is one of the most significant contributors to weight gain and a broad range of obesity-associated comorbidities, including cardiovascular diseases, type 2 diabetes, and specific cancers (Haardörfer et al., 2014). Apart from assisting in the maintenance of body weight, regular physical activity is also associated with better metabolic and psychosocial health (Tucker et al., 2013). Most importantly, factors related to work, family and society often prevent these women aged 30–35 years from exercising regularly (Al-Eisa & Al-Sobayel 2012; Muttib et al., 2024).

Gaining an understanding of this population's attitudes around physical activity will also inform interventions. Using psychometric tools, it can also help clarify differences in attitudes, motivations and barriers to exercise. These instruments must undergo standardization for the assessment of reliability and validity in various cultural settings, facilitating identification of individuals at risk to which effective programs can be appropriately directed (Garber et al., 2011).

Previous works have shown that such culturally appropriate assessment tools are useful to encourage physical activity among women. Validated questionnaires have been of particular value in enabling the identification of psychosocial determinants of exercise habits (Katzmarzyk et al., 2003). Actually, behavior-change theory–based intervention approaches that consider individual preferences have shown to be more effective than those paying less or no attention to individual preferences in increasing physical activity (Friedenreich et al., 2015).

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There is a lack of standardized instrument to assess habitual physical activity orientation among women in Iraq, particularly among non-obese group. Such a gulf hampers the capacity to develop effective strategies for enhancing exercise adherence and improving health outcomes. Therefore this study impacts is to normalized Orientation to Regular Physical Activity Scale into obese women between 30–35 years age group that helps them identifying where they fall in their approach towards physical activity. This is intended to facilitate the development of tailored, culturally sensitive interventions that consider the specific barriers faced by this population.

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Materials and Methods

Research Design

A descriptive survey design was used for the standardization of Orientation to Regular Physical Activity Scale in overweight women aged 30–35 years. This descriptive method is especially applicable in measuring attitudes, behaviors, and perceptions of a given population and allows for the results to be interpreted as a snapshot of the current state of that specific phenomenon (Creswell & Creswell, 2018).

Target Population

The target population was overweight women aged 30–35 years living in Baghdad/Iraq. The population was treated as infinite for sampling purposes due to a lack of precise data on the total number of people with these characteristics.

Sample Size Determination

To determine an appropriate sample size, Cochran's formula was utilized, which is suitable for large or infinite populations and is calculated as follows:

Where:

$$n_0 = \frac{Z^2 \cdot p \cdot (1-p)}{e^2}$$

- n0 = required sample size
- Z= Z-score corresponding to the desired confidence level (1.96 for 95% confidence)
- p = estimated proportion of the population possessing the attribute (0.5 used for maximum variability)
- e= desired level of precision (0.05)

$$n_0 = \frac{(1.96)^2 \cdot 0.5 \cdot (1-0.5)}{(0.05)^2} = \frac{3.8416 \cdot 0.25}{0.0025} = 384.16$$

This led to a calculated sample size of around 385 participants after rounding. However, in order to increase the robustness of the results a larger sample size of 400 participants was used. This method follows recommendations to maintain adequate statistical power in survey research (Lwanga & Lemeshow, 1991).

The selection was by stratified random sampling in order to accommodate all the diversity of gymnasiums, even all the city of Baghdad. Measuring variation across population subgroups enhances generalizability of results via this method (Etikan & Bala, 2017).

The total sample of 400 participants was divided as follows:

Pilot Study Sample: 10 participants (2.5%) were selected to assess the clarity and reliability of the questionnaire.

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Main Study Sample: 190 participants (47.5%) were utilized for the standardization and validation of the scale.

Table 1. *Shows the distribution of the research population, samples, and percentages*

No.	Sample	Number	Percentage
1	Research population	400	100%
2	Exploratory sample	10	2.5%
3	Standardization sample	190	47.5%

The remaining participants were reserved for potential follow-up studies or to compensate for non-responses.

Research Instruments

The following instruments were used to collect data:

- Orientation to Regular Physical Activity Scale: A 22-item questionnaire designed to determine participants' attitude's and behaviours regarding regular physical activity.
- Demographic Information Sheet: Collected data on Age, weight, height and other relevant information.
- Observation Checklist: Used during gym sessions to verify self-reported data against true behavior.

Expert judgment was used to determine the content validity of the questionnaire amongst physical education and psychology experts.

The equipment and materials used include the following: Electronic calculators for data analysis, Ballpoint pens for manual data recording according to manual entries provided by subjects, Stopwatches for timing physical activities, Computers equipped with SPSS software for statistical analysis.

Data Collection Procedure

Significant time frames include data collection from August 3, 2024, to January 26, 2025. Individual gymnasiums in Baghdad approached participants to establish pre-agreed informed consent describing the purpose and processes of the study. After granting consent, the questionnaire was completed in a controlled manner by the researchers that could clarify all doubts.

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Data Analysis

Statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS) version 26. Means and standard deviations were calculated as descriptive statistics. The reliability and validity for the scale were used inferential statistics (t-tests, z-scores). Normative scores were established to classify the orientation of participants toward physical activity and this was done as part of the standardization process.

Results

Table 2. *The raw scores, frequencies, z-score and t-value of the regular physical activity scale*

Raw scores	Repeats	Z-score	T-score
74	6	-2.14836-	28.52
77	4	-1.85735-	31.43
78	9	-1.76035-	32.4
79	7	-1.66335-	33.37
81	10	-1.46934-	35.31
82	12	-1.37234-	36.28
83	7	-1.27534-	37.25
84	7	-1.17833-	38.22
85	8	-1.08133-	39.19
86	9	-.98433-	40.16
87	8	-.88732-	41.13
88	9	-.79032-	42.1
89	11	-.69332-	43.07
90	10	-.59631-	44.04
91	7	-.49931-	45.01
92	9	-.40231-	45.98
93	8	-.30530-	46.95
94	8	-.20830-	47.92
95	7	-.11130-	48.89
96	6	-.01430-	49.86
97	5	0.08271	50.83
98	3	0.17971	51.8
99	5	0.27671	52.77
101	2	0.47072	54.71
102	2	0.56772	55.68

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103	1	0.66473		56.65	
107	2	1.05274		60.53	
108	1	1.14974		61.5	
109	4	1.24674		62.47	
110	3	1.34375		63.44	
Avg.*	190	M.*	96.14	S.D.*	10.3

* Avg. = Average, M. = Mean, S.D.= Standard deviation

Table 3. *Shows the raw scores, standardized levels and their significance in the regular physical activity scale*

No.	Raw Scores	Standardized Scores T	Levels	Number of Repeats	Percentage
1	79-74	33.37 -28.52	Very Low	26	13.68%
2	85-80	39.19 -35.31	Low	44	23.16%
3	91-86	45.01 -40.16	Moderate	54	28.42%
4	97-92	50.83 -45.98	Good	43	22.63%
5	103-98	56.65 -51.80	Very Good	13	6.84%
6	110-104	63.44 -60.53	Excellent	10	5.26%
7		Avg.		190	100.00%

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Discussion

Meaning that most of the participants have a moderate or just sufficiently low levels of positive attitudes to exercise regularly. The researchers attributing this to what they described as a mix of positive attitudes about exercise overall, but low actual commitment in behavior. Such a shortfall may be due to structural and psychosocial barriers, such as limited free time, family responsibilities and lack of enabling environments that promote lifelong engagement in physical activity.

The earlier literature has also seen such limitations. According to Ogden et al. (2011), time and caregivers are two of the major barriers to regular physical activity among women, accompanied by a belief that they should be doing more but then spend an increasing amount of time inactive. Likewise, it has been reported that although this pattern of positive attitudes is among the best predictors of adoption physical activity maintenance (as stated in Allawi 1994), so-called environmental and societal supports are found to be key players in transferring intentions into long-lasting behaviours (Abdulkareem et al., 2025).

These findings are consistent with previous research where a main reason given for women to exercise, at least get involved with PA is the aspiration to receive optimal body weight and improving their physiological roles in daily life experience (for example energy expenditure). Physical activity is one of the most important factors for improving physical fitness levels and functional capacity, representing an effective preventive measure against obesity-related chronic diseases (Abdulkareem & Hameed, 2017; Al-Ajlouni, 2011).

Also, there are indications that the extent of physical activity (PA) in women is strongly associated with health outcomes. Multiple studies demonstrate that even moderate-intensity physical exercise performed for 30 minutes/day elicits significant benefits such as cardiovascular health, muscle strength, body weight regulation, appetite control, improved quality of sleep and less risk of non-communicable diseases (WHO, 2022; Warburton & Bredin, 2017; Lee et al., 2012).

According to WHO, adults should do at least 150–300 minutes of moderate-intensity aerobic physical activity, 75–150 minutes of vigorous-intensity aerobic physical activity throughout the week (WHO, 2020). Splitting it into sessions lasting at least 10 minutes each has also proved effective (Piercy et al., 2018).

Furthermore, more women are seeking fitness center membership than men for weight loss and disease control. Such a trend highlights the critical need for public health approaches and interventions to create an enabling environment that considers the specific barriers faced by women (Lian & Atiyah, 2024).

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Regular and structured physical activity, according to (Houri 2016), is conducive not only to improving physical health but also to the psychology well-being. Exercise may satisfy psychological needs such as self-esteem, achievement and emotional stability, while it can effectively act to calm within the frame of managing stress and emotional tension (Ali & Jameel, 2020).

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Conclusions

the moderate level of orientation registered by the participants highlights that knowledge and attitude need to be complemented with environmental and motivational support measures to promote continued participation in physical activities among women, especially those who are mildly obese.

Recommendations

suggesting better implementing more regular physical activity in women with mild obesity. Implementing measures to improve awareness of the health benefits of exercising, as well as creating opportunities for women and girls to exercise in female-friendly settings should be priorities. Scheduling barriers associated with parenthood and employment can be alleviated by time-efficient exercise alternatives (home or time short exercise programs). Additionally, it has been suggested that incorporating physical exercise education into health care professional services and promoting social support through community-based programs, may promote motivation and adherence to exercise engagement. policy makers include creating environments and incentives that facilitate active living. Finally, the concept of including movement where typical sedentary activities are being done using digital devices throughout your day may lead to new keys for sustainably participating in physical activity.

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The Effect of Weight Training on The Push Index and Achievement of the 400m Freestyle Over 20 Years

Firas Jaseb Khalaf [1], Moayad Jasem Abbas [2], Ehab Dakhel Hussein [3]

[1,2,3] University of Baghdad, College of Physical Education and sport sciences.

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Abstract

The study aimed to prepare exercises for men's 400-meter freestyle runners and to identify the mechanical variables of the thrust index, and the achievement of the research sample, and to identify the effect of weightlifting exercises on the thrust index and the achievement of the men's (400m) freestyle runner between the test (pre-post-test) of the research sample. The researcher hypothesized that statistically significant differences would exist between the pre- and post-tests in favor of the post-test for both the kinematic variable (propulsive index) and performance achievement in the research group. The research population consisted of track and field athletes specializing in the 400-meter event in Maysan Governorate during the 2023 sports season, totaling five (5) runners who competed in championships organized by the Iraqi Athletics Federation. The researcher recommended the use of weighted training exercises due to their effective role in developing muscular strength and subsequently improving athletic performance. The study also recommended utilizing the findings and generalizing them to speed runners, particularly those specializing in the 200-meter event, across all age categories. The researcher concluded that the designed training program using weighted exercises had a significant positive effect on both the propulsive index and performance achievement.

Keywords: Weighted Exercises, Propulsive Index, Performance, 400 m Running.

[1] University of Baghdad, College of Physical Education and sport sciences.
firas.harbi2204p@coope.uobaghdad.edu.iq
[2] University of Baghdad, College of Physical Education and sport sciences.
moaid.salman@cope.uobaghdad.edu.iq
[3] University of Baghdad, College of Physical Education and sport sciences.
Ihab.Yousif@cope.uobaghdad.edu.iq

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Introduction

Scientific progress in the modern era has become a major concern for researchers and specialists aiming to achieve the highest levels of performance across various fields of life. Despite continuous development, further scientific research is still required to uncover new facts and identify the most effective methods and techniques for improving athletic performance in sports activities. Achieving high performance in sports requires optimizing time and effort while ensuring correct movement pathways that correspond to the specific demands of the practiced event. Therefore, specialists and researchers in the field of sports science have placed considerable emphasis on solving problems that face athletic performance and promoting the advancement of sports through scientifically controlling the components of training load, including intensity, volume, and rest. The activities of the sprint race, including (400 meters), have their own physical characteristics that should be enjoyed by short-distance runners, that the development of these characteristics must be done in accordance with the requirements of the achieved achievement, and that the mechanical variables have a role in improving the achievement, through which an important role emerges in achieving the optimal start and reaching the maximum speed, during the stages of the technical performance of the men's 400 m freestyle event. Thus, the importance of research is evident in studying the effect of weight training on the development of some kinematic variables (thrust index) by working on the development of these variables and the reflection of the development of these variables on achievement.

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Research Methodology

Depending on the background of the research, being one of the Iraqi champions in this event, he noticed the stability of the level of achievement among our runners in the local championships, as the researcher sees the reason for this decrease in the level to the absence of some of the pillars on which the development of physical and mechanical abilities is based, as he developed the idea of solving these problems, and after presenting this idea to the supervisors, the research concluded by using weight exercises to develop the development of the push and achievement index of the 400m freestyle

Research Population and Sample

The research population consists of (15) players from Iraq for the men's 400m freestyle event, and the researcher selected his research sample from Missan Governorate for the Iraqi clubs by the (5) players in the deliberate way, which ranged from (20-26) years, and accordingly, the sample constituted (33%), The homogeneity of the study sample was done in the measurements of height, weight, chronological age and training age, and as shown in Table (1), the sample did not apply a similar training curriculum, and no other research was applied during this period.

Table 1. ***Shows the Homogeneity of the Research Sample in Anthropometric Measurements and Training Age***

Variables	N	Mean	Standard Deviation	Skewness Coefficient
Height (cm)	5	178.80	5.586	-0.727
Weight (kg)	5	71.80	12.377	-0.501
Age (years)	5	25.20	3.899	0.805
Training age (months)	5	10.60	2.191	0.846

Tests Used in the Study

1- Test 250m Bearing Speed

400 m Running Test

Purpose: **To measure** speed endurance **performance.**

Equipment: Standard athletics track (400 m) Three stopwatches Recording forms Two whistles

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Performance Description:

The athlete assumes the starting position behind the starting line. Upon hearing the whistle signal from the race organizer, the athlete begins running at maximum possible speed until reaching the finish line.

Recording Method: Time is recorded from the starting signal until crossing the finish line. The final result is calculated as the average time of the three timekeepers, recorded to the nearest **0.01 second**.

2. 350 m Running Test

Purpose: To measure **specific endurance performance**.

Equipment: Athletics track (400 m) Three stopwatches Whistles Recording sheets

Performance Description: The athlete starts from a high-start position and runs at maximum speed until completing the specified distance.

Recording Method: Time is recorded in seconds and fractions of seconds, calculated as the average of the three recorded times to the nearest **0.01 second**.

Pilot Study

A pilot experiment was conducted on **Tuesday, June 11, 2024**, during which the 400 m running test was filmed using video cameras for biomechanical analysis. The race distance was divided into equal segments of **100 meters**, and each segment was further divided into two equal sections of **50 meters**. Cones or markers were placed at each 50-meter point. The camera was positioned perpendicular to the midpoint of the 100-meter distance to ensure accurate capture of movement variables. The purpose of dividing the distance into smaller segments was to measure biomechanical changes in stride characteristics during running. After reviewing the pilot recordings, the researcher observed that filming from the midpoint of 100 meters did not provide sufficient clarity for motion analysis. Therefore, the distance was divided into **50-meter segments** to improve measurement accuracy. Following the completion of the training program designed by the researcher using **weighted exercises according to target time**, post-tests were conducted between: **September 3, 2024 – September 5, 2024**The testing sequence was identical to the pre-test conditions and conducted under the same environmental and procedural conditions for all participants.

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Table 2. *shows the details of the training curriculum*

Variable	Description
Number of weeks	8
Training units per week	3
Total training units	24
Duration of main part of session	30–40 minutes
Weekly training time	90–120 minutes
Monthly training time	360 minutes
Total program duration	2,880 minutes
Average exercises per session	8–12 exercises
Total exercises in program	72 exercises

Results

In order to be able to identify the difference in the results of the pre- and post-tests of the members of the experimental research group in some kinematic variables, the researcher used a t-test for a single sample with a pre- and post-test, as shown in Table (3).

Table 3. *shows the arithmetic medians, standard deviations and the calculated value (t) of the pre-post-tests of the variable (thrust index m/s) for the research sample.*

Player	Unit	Pre-test Mean (M)	Pre-test SD	Post-test Mean (M)	Post-test SD	Mean Difference	SD Difference	Standard Error of Mean Difference	t-value	Error Level	Significance
Player 1	m/s	0.0113	0.00301	0.0075	0.0017	0.00375	0.00719	0.00180	2.087	0.054	Significant
Player 2	m/s	0.0288	0.00328	0.0156	0.00223	0.01313	0.00873	0.00218	6.012	0.000	Significant
Player 3	m/s	0.0250	0.00316	0.0137	0.00221	0.01125	0.00806	0.00202	5.582	0.000	Significant
Player 4	m/s	0.0206	0.0053	0.0144	0.0034	0.00625	0.01408	0.00352	1.775	0.096	Significant
Player 5	m/s	0.0175	0.00403	0.0113	0.00221	0.00625	0.01258	0.00315	1.987	0.066	Significant

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Table 4. *shows the arithmetic means, standard deviations and the calculated value (t) of the pre-post-test tests (250 m speed tolerance, 350 m performance tolerance, 400 m achievement)*

Variable	Unit	Pre-test Mean (M)	Pre-test SD	Post-test Mean (M)	Post-test SD	Mean Difference	SD Difference	Standard Error of Mean Difference	t-value	Error Level	Significance
250 m	m/s	28.32	1.401	28.14	1.399	0.208	0.06648	0.02973	6.996	0.002	Significant
350 m	m/s	44.00	1.079	43.94	1.023	0.146	0.1078	0.04823	3.027	0.000	Significant
400 m	m/s	49.60	0.9063	49.41	0.8704	0.194	0.06309	0.02821	6.876	0.002	Significant

Discussion

The impulse index of the first player (2.087) the second player (6.012) the third player (5.582) the fourth player (1.775) the fifth player (1.987) while the real morale of the sample members for the first player was (0.054) the second player (0.00) the third player (0.00) the fourth player (0.096) and the fifth player was .066) at a significance level less than or equal to (0.05) and a degree of freedom (4) and since the value of the significance of the calculated differences is less than the level of (0.05), then there are significant differences between the pre- and post-tests in the variable of foot thrust and in favor of the post-test. The development in this variable is the result of the exercises used, which were prepared to develop special force endurance, speed endurance and performance endurance, as it had an effective effect on stimulating the central nervous system, which in turn developed neural signals and created a kind of arousal in the muscle groups working positively, and in turn, it results in high stimulation of the muscle fibers working with maximum energy to accomplish the required work by exerting instantaneous explosive force calculated in a very short time. From the point of view of athletic training, the exercises used as resistance exercises are added to the body and in the direction of physical development, as it is stated (Kurz., 2001, p. 18) that "these exercises, which were applied during the main training period, worked to reduce the time of arousal and with the development of temporal and spatial timings according to the motor properties."

This is proven by the results of the differences in the above table, as it is clear from Table (3) that the calculated t-value for the (250 meters) test was (6.996) while the real significance of the (250 meters) test was (.002) at a lower significance level equal to (0.05) and a degree of freedom (4), and since the significance value of the calculated differences is less than the level of (Therefore, there are significant differences between the pre- and post-tests in the speed endurance variable of the 250-meter test and in favor of the post-test due to the use of weightlifting exercises according to the target time, which requires exerting the force of rapid muscle contractions for a period of time continuously during running, which developed the ability of the muscles to exert force effectively and quickly, and this was evident through the appearance of significant differences in the level of speed

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endurance in the post-test, it gives an indication of the development and exertion of instantaneous force. The speed required to overcome inertia when starting from stability and the development of explosive power and fast strength of both men due to their exposure to the vocabulary of heavy exercise according to the target time, which has been indicated by many sources that weight training enhances and increases the ability of muscular work, as determining the intensity of running is effective in training and exerting the required force to obtain the appropriate speed endurance, in which the development of strength for the muscles working in running was emphasized and the use of weights added to the upper limbs was emphasized. and the lower and torso during the performance of the exercises by exploiting the target intensity, and this is in agreement with what (Nabila et al.) came to say that "the speed of the strength of the muscles of the legs and their exercises is related to the special exercises that develop the reactions of these muscles in a way that is reflected in the development of the speed, endurance of speed and their production" (Abdurrahman, 1986, p. 25). Significance (0.05) and degree of freedom (5) Since the significance value of the calculated differences is less than the level of (0.05), so there are significant differences between the pre- and post-tests and the post-test was in favor of the post-test in the speed endurance variable, and the reason for this is the effectiveness of the exercises according to the target time of the distance according to its new training context in targeting the ability to endure speed in all its forms of near-maximum load intensity according to the target time indicators, taking advantage of the resistance by using weight added to the body to increase the resistance on the muscles, by relying on Rapid strength training for more or less of the race distance for the purpose of developing the available strength and continuity of the work of the working muscles to ensure the development of the ability to endurance the exerted force and endurance of speed, which positively affected the adaptation of the body's systems in their resistance, as he pointed out (Abdullah, 1984, page 112) that "enduring speed means the struggle against fatigue and its resistance while exerting continuous muscular effort that requires showing increasing speed and energy production." The adaptation of the muscle groups working in the resistance of fatigue and endurance to such tests because they originally relied on distances that are less or greater than the distance of the race, which gave a positive effect in the level of speed endurance: "The most important elements on which the development of the level of speed endurance depends are the endurance capacity, intensity of the distances traveled, and the training methods" (Nassif Q., 1990, p. 257). In the achievement of the (400 meters) event among the sample members, and that the significant differences of the results values after being statistically processed showed the value of (t) calculated by (6.876) and at a significance level less than or equal to (0.05) at the degree of freedom (4) and the significance of this test was (0.002) and since the significance is less than the significance level (0.05), then there are significant differences and this development is a logical result of the moral results of the physical abilities of endurance of forces, endurance of speed and endurance of special performance that have been discussed before, as the focus of the work In the implementation according

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to the correct scientific foundations, as the training was concentrated in the distances of the least and greater than the race distance, relying on the weighting exercises and then extracting the target time for that distance, it was influential in the development of strength endurance, speed endurance, special endurance and achievement, as training according to the target time, led to the improvement of the endurance of the special runner and at a faster pace than the rhythm of the race, and there had to be repetitions of the special speed training and the special speed endurance with high intensity with the application of the times. The researcher sought through the exercises used to develop speed and endurance of the special speed and improve the sense of the correct rhythm of the steps and by continuing it, so a suitable rest period must be allocated between repetitions so that the runner can maintain the desired rhythm in running during these exercises, and the researcher believes that the exercises he used have achieved an effect on the achievement of the 400 m run, and this indicates that there has been even a slight adjustment in the research sample. In addition, the mechanism and activity of the muscles and the nervous system have improved, and the coordination between them has become good, and this has been shown through the coordination of movements between the parts of the body when continuing to run during the race distance by doing a quick start or increasing the speed that depends on the The ability of the muscle to relax and elasticity is an important factor to achieve high speed according to the conditions of good performance, so these results were in line with the development of the special speed of the sample members, which used the speed endurance and endurance training of the race according to the target time, and this indicates a clear indication of the development of speed endurance and endurance of the special speed The performance of this competition, which has been emphasized through the training curriculum of this competition, has helped to develop these abilities as a result and their speed rates, as practicing exercises that aim to develop speed and special speed endurance makes the athlete possess the effective characteristics of running speed and technical performance for him and helps in the development of harmonic movements of the working joints, which can lead to improving the speed rate, as it can be the right choice for the most exercises. It is appropriate for the type of event to make a transition in the impact of the training to the main movement later." (Adel, 2004, p. 12) Therefore, there were significant differences between the pre- and post-tests and they were in favor of the numerical tests, as the researcher attributes this development to the previous results showed that the weightlifting exercises according to the target time to which the sample members were exposed was effective in the development of speed endurance, special endurance and achievement, as the training according to the target time and strictly determined led to the improvement of the runner's endurance to a faster rhythm than the rhythm of the race, and there had to be repetitions of the training Special speed and special speed endurance with the aim of developing these special abilities, as the goal of the training is to develop speed and endurance of speed and learn to sense the right rhythm

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Conclusions

Based on the results obtained in this study, the researcher concluded the following:

1. The experimental training program using weighted exercises had a clear and significant effect on improving the **propulsive index** in 400 m runners.
2. The experimental method using weighting had a clear and effective effect on the development of the 400 m men's achievement.

Recommendations

Based on the findings of the present study, the researcher recommends the following:

1. Conducting analytical studies of a larger number of contributing mechanical variables, conducting pre- and post-tests, designing new training curricula and comparing the results.
2. Conducting analytical studies using a larger number of fast cameras distributed over all parts of the race and in the bows and using 3D analysis to arrive at facts about the small parts of the movement.
3. ϖ The researcher uses weightlifting exercises for relatively long periods to achieve the desired goal.
4. Conducting such research on different age groups to reduce the time difference between distance segments for other running events.

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Appendices

Special Preparation Stage
The stage of developing special endurance according to the target time and some biomechanical variables
Week : First Venue: Maysan Olympic Stadium
Training Module: The First
Training objective: Develop special endurance on pulse : (140 180)
Date:- 2024 / 5 / ؟؟؟؟؟

Day	Exercises	Intensity	Repetitions	Work Time	Rest Between Repetitions	Number of Sets	Rest Between Sets
Saturday	70 m Run	100% of the player's maximum intensity	5	Maximum time for the distance	Work to rest	1	3–5 min
	120 m Run	95% of the player's maximum intensity	3	Maximum time for the distance	Work to rest	1	3–5 min
	150 m Run	90% of the player's maximum intensity	2	Maximum time for the distance	Work to rest	1	—
Monday	200 m Run	95% of the player's maximum intensity	3	Maximum time for the distance	Work to rest	1	3–5 min
	300 m Run	90% of the player's maximum intensity	1	Maximum time for the distance	—	1	3–5 min
	450 m Run	85% of the player's maximum intensity	1	Maximum time for the distance	—	1	—

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Wednesday	250 m Run	90% of the player's maximum intensity	2	Maximum time for the distance	Work to rest	2	3–5 min
	300 m Run	90% of the player's maximum intensity	1	Maximum time for the distance	—	1	3–5 min
	450 m Run	85% of the player's maximum intensity	1	Maximum time for the distance	Work to rest	1	—

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Effectiveness of special exercises on anaerobic lactic capacity transitional speed and agility for advanced futsal players

Khulood Jumaah Qasim [1] , Tiba Saleem Abdulmajeed [2]

[1, 2] University of Baghdad, College of Physical Education and sport sciences.

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Abstract

The research aims to identify the effectiveness of special exercises on the anaerobic lactic power index, transitional speed, and agility of advanced futsal players. The experimental method was used, and a group was designed for pre- and post-testing. The research population consists of 14 advanced players from Al-Masafi Club. The main section (first part), from Jan 16, to Mar 18, 2026 the training sessions were held. The sessions lasted for 8 weeks, comprising 20 training sessions, each lasting no more than 35 minutes. The interval training method was used. The calculated t-values were 2.331 (p=0.045) for anaerobic capacity; 6.658 (p=0.000) for transitional speed; and 3.257 (p=0.008) for agility. This research indicated that the specialized interval training workouts greatly increased the ability of expert futsal players to produce anaerobic lactic acid These exercises also improved speed and agility in transitions which shows that they are beneficial for the quick multidirectional performance that is needed in tactical phases in the game The research suggests that experienced futsal players should include these specialized interval training activities in their training routines since they help improve physical skills It also stresses the need for making training activities that fit with energy production systems and an emphasis on the anaerobic lactic acid system, because that's what the game needs particularly during high-intensity bursts of play that are common in futsal matches

Keywords: Specific exercises, anaerobic lactic acid production capacity, transition speed, agility.

[1] University of Baghdad, College of Physical Education and sport sciences.
khuloud.j@cope.uobaghdad.edu.iq
[2] University of Baghdad, College of Physical Education and sport sciences.
teba.saleem1204b@cope.uobaghdad.edu.iq

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Introduction

The training process is deeply linked to various specialized sports sciences, and this process achieves an ideal level in the functioning of internal systems that serve athletic performance, from physical fitness to technical skill. Development in all these aspects occurs when training curricula are built on scientific foundations that rely on the physiology of the athlete's internal systems and employ appropriate training methods to mimic the prevailing energy system.

Futsal has witnessed a remarkable evolution in its physical and physiological performance requirements. Reliance on anaerobic energy systems has become a crucial element in determining high performance levels, especially in the fast-paced and intense nature of the game. Despite numerous studies addressing the development of physical abilities in team sports, there is a limited number of studies focusing on employing specific exercises based on anaerobic energy systems to enhance physical performance in futsal.

This necessitates further research in this area. Futsal is a sport that relies heavily on the second energy production system due to the small playing area, unlimited substitutions, fast-paced technical performance, continuous attacking and defensive movements, and the small number of players. This anaerobic system is essential for players and cannot be developed without high-intensity training sessions that reach their maximum for limited periods, with adequate rest periods between sessions.

It requires a good working relationship with trained players and necessitates training periods spanning several seasons, especially if the training combines physical and technical aspects. This is because the anaerobic (lactic) development of the skill level must serve the technical performance in matches. The anaerobic lactic system works to delay fatigue in the working muscles. For this reason, the Laws of Futsal allow for unlimited substitutions between players. Yasser, in his study, confirmed that interval training in futsal contributes to delaying the onset of fatigue for a longer period and allows for better control over training variables such as performance time, repetitions, and a slower heart rate. (Al-Baqal, 2002).

Zuhair states, "Using interval training is the best method in football because the player's movement involves running with or without the ball as quickly as possible." (Al-Khashab, 1999).

A coach with extensive experience and a scientific approach is always looking for new methods across specialized training and exercises that combine the physiology of the body's systems with physical abilities. Each physical ability is categorized within its respective energy system, emphasizing that energy systems work together but in specific proportions.

A football player must possess several physical abilities. to complement their technical and tactical skills and fulfill their duties during matches. Among the most important of these abilities are speed, as the game demands it significantly, and agility,

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which integrates several physical capabilities. The more a player possesses these abilities, the more distinguished they will be during matches.

This is what the coach achieves by designing exercises with an intensity and difficulty similar to those of matches, repeating them during short and medium training sessions, and varying the training loads to achieve physical and technical development and, subsequently, physiological adaptation of the body's systems and muscles.

Youssef asserts in his study that properly regulating training load will lead to improved functioning of the body's systems and organs and to the development of physical attributes to achieve peak athletic performance. (Kammash, 1999). Amer states in his study that "the coach must understand the relationship between the intensity and volume of the load to increase the athlete's ability to adapt." (Amrallah, 1998).

Mohammed emphasizes the importance of increasing training load step by step and over time periods that allow for physiological adaptation. These periods range from weeks to months. (Allawi, 2000).

Rissan affirms that "one of the most important requirements for developing physical attributes is to put pressure on the energy system that controls the attribute, because all energy systems contribute to achieving performance when developed." (Kharebet, 2016). In Amin's study it was noted that a player becomes more active when controlling the ball or preparing to receive it unlike a player who is further away from the ball who is less active and slower.

The importance of this study lies in the development of specific exercises based on energy systems as well as their integration with players' physical abilities and technical performance This connection between research variables delays muscle fatigue during matches, helping players maintain optimal performance for longer periods.

The research problem lies in the fact that some futsal coaches rely on tactical aspects in their training plans during the competition period and this excessive reliance negatively affects the use of specific exercises that rely on physiological principles related to energy systems especially the anaerobic lactic system and this affects the development of physical abilities that are effective in this game.

Therefore, this study aims to answer the following question: How effective are specific exercises in developing anaerobic lactic endurance, speed, and agility in futsal players? Special training exercises were developed for first-division futsal players at AlMasafi Club to assess their anaerobic endurance speed agility and to determine the effectiveness of these exercises on the studied variables. The study included first-division players from AlMasafi Club participating in the 2025-2026 professional league season during the period from Jan 16 to Mar 18 - 2026 The training sessions were held in the indoor sports hall at AlShabab Sports Club in the Palestine Street area of Baghdad.

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Methods

The research employed an experimental approach; the research group (one group) underwent pre- and post-tests to obtain results that confirmed the research objectives and hypotheses. The original study population was defined as players from professional futsal league clubs participating in the 2025-2026 season. The research sample was selected purposively representing Al Masafi Club and its 14 players amounting 9.77% of the study population.

Table 1. *Descriptive Statistics of the Research Variables*

Variables	Measurement Unit	Mean	Median	Standard Deviation	Skewness
Anaerobic Power	Watt	22.88	23.29	3.97	0.28
Speed (Linear Speed)	Second	4.38	4.39	0.16	0.37
Agility	Second	21.58	21.69	0.63	0.467

The field research procedures included several tests: the anaerobic (lactic) capacity test (Morrow et al., 2015) the 60-second stride test (Al-Hadithi, 2014) the 20-meter standing run test (Al-Dulaimi, 2019) and the Barrow agility test.

A set of tools was used to implement the exercises and the supporting team conducted the specified tests for the research sample in the indoor hall of the Youth Sports Club on Tuesday January 13 2026 at 4:00 PM. The support team implemented the specific exercises designed by the researchers and trainer on the research sample (the experimental group). These exercises were applied in the first part of the main training modules beginning on Friday January 16 2026 and continuing until Wednesday March 18 2026.

The modules were structured over eight weeks comprising 20 training sessions each lasting no more than 35 minutes. The training method employed interval training and a 2:1 training load variability approach. Following completion of the specific exercises post-tests were conducted on the research sample in the indoor hall of the Youth Club on March 18 2026 at 4:00 PM for 40 minutes. The researchers used the SPSS statistical package for data analysis.

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Result

Displaying the results of the pre- and post-tests for anaerobic lactic power, transitional speed, and agility:

Table 2. *Mean Differences, Standard Deviation of Differences, Standard Error, and t-Test Values for the Studied Variables*

Variables	Mean Difference	SD of Differences	Standard Error	Calculated t-value	Sig. (p-value)	Significance
Anaerobic Power	1.949	2.644	0.836	2.331	0.045	Significant
Linear Speed	0.119	0.062	0.017	6.658	0.000	Significant
Agility	0.297	0.316	0.091	3.257	0.008	Significant

Note: Results are considered statistically significant when $p < 0.05$ at a degree of freedom (df) = 13.

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Discussion

The results from the tables above show that the research sample developed anaerobic capacity transitional speed and agility. The presence of statistically significant differences suggests that the specific exercises implemented during training sessions were systematically designed to enhance anaerobic capacity speed and agility. This improvement is attributed to the development of muscle resistance to fatigue and enhanced neuromuscular coordination. The specific exercises were varied and repeated multiple times over two months with varying intensity volume and rest periods between repetitions. Furthermore interval training was highly suitable for the training environment with simulated match conditions during training sessions.

The presence of motor programs in the brain contributed to better performance during official matches. Training aids were used to prevent boredom during implementation (Khadem & Ahmed, 2022). Some studies confirm that anaerobic capacity depends on the player's ability to resist fatigue due to increased oxygen debt which leads to lactic acid buildup. The faster and more continuous the movements the less oxygen is available for energy production thus necessitating the use of the second energy production system (Al-Mawla, 2017; Curby, 2024).

Al-Sabati explained that during conditioned training in terms of the number of touches specific areas and linking speed drills to skill performance in various situations while emphasizing the speed of skill execution players acquire a high level of play. (Amrallah, 2016).

Tariq in his study emphasizes that interval training in football when applied at appropriate intensity levels significantly influences skill-related variables anaerobic capacity and the fatigue index of players particularly when training programs are standardized and based on functional indicators to determine training loads and rest periods. (Mohammed, 2016).

Al-Rabdhi in his study affirms that varying exercises within a single sport avoids mental confusion and increases the desire to train. Furthermore gaining experience in varying performance leads to acquiring diverse physical qualities and abilities." (Al-Rabdi, 2010).

Bahaa Al-Din states that "training regularly for weeks will lead to physiological adaptation and the player's physical and functional abilities will develop contributing to the player's ability to endure the specific (anaerobic-lactic system)." (Salama, 2000; Mushtaq, 2023).

Muhammad's study also mentions that a successful coach plans their training program to cultivate this specific style, which requires physical activity that focuses more on developing the energy system and muscle groups to achieve the desired goals (Allawi, 2000).

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Fares' study indicated that the implemented exercises increased the motivation and enthusiasm of the female players while performing their specific exercises. (Asleawa, 2020).

Rashid emphasizes that "the coach's encouragement is one of the factors that influence the player's physiological, technical, and skill-based response, and this influence is very important because external motivation leads to team gains and cohesion" (Hamad, 2009).

Interval training allows the athlete to achieve the highest training load with the least amount of fatigue. This enables the athlete to perform technical movements repeatedly over extended periods, provided the development of physical abilities is balanced. Since agility is a set of physical capabilities, Hamdoun stated that "during training, the player should not move away from the ball while performing various exercises, as this causes neuromuscular stress on the player, which contributes to the development of their physical abilities and skills" (Al-Hayali, 2016).

Fares' study indicated that improvement in players' performance, particularly in speed and high accuracy in developing basic skills, resulted from the use of these new and effective special exercises, which were scientifically and systematically designed. These exercises emphasized correct performance and helped players develop quick decision-making during skill execution. (Yousif, 2016).

Al-Bashtawi asserts that "running in different directions, performing movements similar to the technique, and repeating them at an appropriate speed contribute to achieving the motor pathway in the neuromuscular system, which leads to the development of speed and agility." (Al-Bashtawi, 2006).

Mohammed's study indicates that the performance and repetition of the technical skill over long training periods led to improvements in coordination, as observed in the sample, which consisted of advanced high-level players. (Al-Madaghema, 2008).

Schmidt's study confirms that the systematic and purposeful repetition of specific exercises contributes to the development of skill performance and enhances the ability to apply the skill efficiently in competitive situations (Schmidt, 2011).

The physiological adaptations resulting from anaerobic training include improved function of enzymes responsible for rapid energy production, leading to increased muscle power (Amanh, 2018).

Finally, some recent studies have confirmed that amino acid supplements are effective in developing the physical abilities of female futsal players when incorporated into daily training for a limited period and in controlled amounts (Qasim, 2026).

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Conclusion

1. The specialized exercises used in interval training significantly improved the anaerobic lactic capacity of advanced futsal players.
2. The specialized exercises significantly improved transitional speed and agility reflecting their suitability to the demands of rapid multidirectional performance that mimics tactical plays in futsal.
3. The application of specialized exercises within a structured interval training framework contributes to the comprehensive development of certain physical abilities relevant to futsal performance.
4. The study results indicate that designing exercises in accordance with the requirements of anaerobic energy systems enhances the physical response efficiency of players.

Recommendations

1. Adding particular interval training activities to futsal training regimens is very important since they help improve physical abilities.
2. Because of the nature of the game training activities must be developed to work with energy production systems with a concentration on the anaerobic lactic system.
3. To improve your transitional speed and agility you need to do particular training activities that are like real game scenarios.
4. The training load (intensity volume and rest) should be set up in a scientific way to make sure that the body can respond in the right way.
5. Use extra training tools and aids to boost players' enthusiasm and the quality of their performance during practice sessions.

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Analysis of the defensive performance effectiveness of the Iraqi national team goalkeepers compared to the goalkeepers of the Iranian national team in the 2024 AFC Futsal Championship

Mustafa Adel Ghadeer[1], Ali Sadeq Dhiab[2], Ali Saad Abdulhameed[3]

1 University of Baghdad, College of Physical Education and Sports Sciences

2,3 University of Baghdad, College of Physical Education and Sports Sciences

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Abstract

The aim of the study was to analyze the effectiveness of the defensive performance of the goalkeepers of the Iraqi national futsal team and to compare it with that of the goalkeepers of the Iranian national team during the AFC Futsal Asian Cup 2024. The researcher employed the descriptive method using analytical and comparative approaches, based on observation and analysis of the matches played by both the Iraqi and Iranian national teams during the tournament, with a total of ten (10) matches analyzed. The researcher utilized the electronic application Sports Stats Recorder to analyze defensive performance and employed a data extraction form to record the data obtained through the analysis application. Upon completion of the match analysis and data collection, the researcher organized and tabulated the final results for statistical processing. The analysis began on Tuesday, October 1, 2024, and the total duration of the analysis and comparison process was twenty (20) days. The results indicated that the effectiveness values of the defensive performance of the Iraqi national team goalkeepers were higher than those of their Iranian counterparts.

Keywords:
Defensive performance, Sports Stats Recorder, PICCO.

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Introduction

The Futsal game is one of the best and competitive team sports that has been growing year after year, especially in Iraq where importance of this game grows, because there are many aspects have encouraged in being more architectural as professional club name (Professional lab). Futsal players have higher capabilities, even the number of goals is more than outdoor football. These are all aspects that have helped the game grow. Moreover, sport clubs and futsal players invest extremely in qualifying teams for the first places at championships. This growth and creativity have not been at random, but rather through surveillance, study and research where sports-related sciences were endowed by researchers, coaches and experts that used modern scientific techniques tools in various disciplines of science to elevate performance for athletic participants in order to have competitive success.

The goalkeeper In futsal the necessity of having a good goal keeper is very important, as the role of goalkeeper is crucial in gaining successful results and success. The use of performance analysis systems-technical (SPAT) and applications in recent years has enhanced the collection of numerical data, which is related to key events throughout matches. As a result, game analysts, coaches and scientists regularly use these systems and applications for extracting information about the player´s performance in training and matches to optimize player abilities or to correct errors which appeared during competition.

Applied technology for monitoring on technical performance analysis in futsal is a very valuable tool to measure players' skill performance efficacy, including goalkeepers', during training and games. Performance analysis is a very important tool to aid in the development of goalkeepers, by continuously monitoring performance during a match, especially related to the prevention of goals being scored.

This research was based on the researchers' following up to Arab, Asian and African championship as well as Iraqi Futsal professional league. It was observed that electronic applications and technical programs for Performance Analysis Technology are not used at the Iraqi league, or ever the Iraqi national teams. Consequently, the researchers considered that by means of a computer application for mobile devices, it would be possible to collect numerical data making demands on players' technical performances in general and goalkeepers in particular, to supply coaches with reliable information about different domains for such a position, whether during training matches or friendly as competitive games. This would also aid in assessing the efficiency of goalkeepers' defensive ability by saving shots aimed at the gate and therefore assisting that positive results resulting from winning matches. Additionally, the research aims to compare defensive performance effectiveness of Iraqi national team goalkeepers with that of Iranian

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national team goalkeepers in their played matches by both teams (five matches for each), to know who were those goalkeepers achieved higher values and undertook what reasons.

The research question was informed by the experience of the researchers as a former futsal goalkeeper, current futsal goalkeeper coach and technical analyst in the Iraqi Futsal Professional League. Based on observation of the Iraqi league and Arab, Asian, and African championships, in addition to interviewing with Dr. Ali Saad Abdul Hamid (the second supervisor), who is a certified sports analyst/observer and personal contact with Dr. Wissam Najib Asliwa, Director of the Coaching Development and Education Department at the IFA an Accredited FIFA coaching instructor it was concluded that there are no specific data or information within Iraqi Football Association (Iraq Futsal committee) on effectiveness of performance both general team as whole not specifically to goalkeeper department like this study. Furthermore there is variation of the defensive support of goalkeepers between the Iraqi national team and against teams as some teams have keepers with clear defensive roles. Every coach has their own training philosophy, one that we as researchers adhere to is the idea that what happens in training should carry over into competition and what happens in competition should be replicated during training.

The study is important in its use of a special electronic application to analyze the defensive performance in calculating effectiveness values of Iraqi national team goalkeepers, then compare these with their Iranian national team counterparts to find out who are best performers and why. This allows coaches identifying strengths that should be enhanced and weaknesses to be remedied or avoided, so that data processing is used in a relevant manner for the planning of proper training units according to accurate quantitative benchmarks.

Enshrined with regards to the performance analysis: The study was conducted by Mahmad (2000) as he sought determining the correlation between performance and level of technical skills among players in some Baghdad clubs and various provinces. The results of the study indicated that the Baghdad clubs were superior in dribbling skills when compared with provincial ones, except for Al-Najaf club; its players showed good relative superiority for this skill.

The study by Keshk (2017) aimed to identify the level of tactical thinking among youth football players in clubs of Sulaymaniyah province. The results revealed variation in the scores obtained by youth players on the applied offensive tactical thinking scale, with some players showing relative superiority, although their scores did not exceed the hypothetical average of the scale.

The research of Abdul Hamid (2016) in order to identify the factors affecting weak tactical performance in football participants has shown that one of the major

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obstacles of the successful performance was evidence obtained on managerial instability, financial support, and lack of proper training bases needed for high-level team play.

In the study of Asliwa (2010): The role of Iraqi goalkeepers in some technical and tactical aspects, their aimed to identify some technical and tactics abilities of Iraq national team represented in three championships: "AFC Asian Cup 2007, Gulf Cup 19 FIFA Confederations Cup 2009", was one of the outcomes reached is showing Iraq goalkeepers as elite guards regarding controlling balls when they encounter it through catch, clear, deflect also under stress from opposition passes and attacks.

Accordingly, the importance of this research becomes evident through analyzing the defensive performance effectiveness of Iraqi national team futsal goalkeepers and comparing it with that of Iranian national team goalkeepers in the AFC Futsal Asian Cup 2024, in order to determine which goalkeepers achieved higher values of defensive performance effectiveness.

Methods and Tools:

The researchers employed the descriptive approach using analytical and comparative methods due to its suitability to the nature of the research problem and in order to achieve the objectives of the study.

The sample of the study included the goalkeepers who formed national team players, which were taking part in AFC Futsal Asian Cup 2024, that is, (32) Goalkeepers. The Sample Study sample was deliberately selected and it includes 4 keepers, (2 GK's from the Iraqi National team and two other keepers Hotelperson to the Iranian national team in the AFC Futsal Asian Cup 2024. Furthermore, (4) goalkeepers were used for a pilot study and another (4) goalkeepers selected to test the reliability of the application. Therefore, they were left out of the study and their numbers sum to (18) goalkeepers form 56.25% of the total population.

Table 1. Homogeneity of the sample in the variables of height, body mass, age, and training age

No.	Variables	Mean	Median	Standard Deviation	Skewness
1	Height (cm)	184.25	184.50	0.95	0.85
2	Body Mass (kg)	81.75	81.50	1.70	0.75
3	Age (years)	29.50	29	3	0.37
4	Training Age (years)	11.50	13	4.72	-1.19

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The researchers used a number of means, devices, and tools in the study, including Arabic and foreign sources, the Internet, personal interviews, a data recording form (Appendix 1), and the equipment used in the research: two HP laptop computers, two Samsung tablet devices, an electronic application for skill performance analysis (Sports Stats Recorder), and another electronic application for skill performance analysis (PICCO) for comparison purposes.

The dependent variables of this study were chosen to characterize the futsal goalkeeper's defense skills; catching, deflecting by hand and clearing by foot. These indices were submitted to a board of experts and specialists from whom we elicited their opinions for the purpose of establishing face validity. Drawing on the experience of the researchers involved in futsal as a former goalkeeper with Baghdad Futsal Club, a goalkeeping coach and technical analyst in Iraqi Futsal Professional League/ Secondly, with the guidance of the second supervisor who is an official certified quantitative and qualitative analyst at the Iraqi Football Association Dr Ali Saad Abdul Hamid; A special questionnaire was developed to explore the results of performance skill at goalkeepers level which extracted numerical data from an electronic application (Sport Stats Recorder). All the variables were then re-readmitted to a panel of experts and specialists in order to establish their scientific criterion (See Appendix 2).

The first pilot study the researchers carried out on a sample (n = 9) outside the main research sample, but belonging to the same population of research. This was conducted through watching the match of South Korea and Kyrgyzstan, analyzing the skill performance of goalkeepers and computing their defensive effectiveness to evaluate whether or not the Sports Stats Recorder application could be employed for skill performance analysis.

The second pilot was run on Sunday (29/9/2024) again a sample from outside the main research but within the same population. This included watching the match of 'Vietnam vs. Myanmar', observing the defending action of goalkeepers, calculating the efficacy level regarding their defence action and checking if they were reliable or not as conducting comparison of comparing results from two defensive performance analysis applications (Sports Stats Recorder and PICCO) amongst team members for reliability determination.

The researchers confirmed the scientific basis for the study by applying face (judges) validity test having displayed research variables to a sample of experts and specialists as well as by computing validity coefficient based on Chi-square (χ^2). Self-validity was also computed, which is a type of validity that uses reliability coefficient:

Self-validity = $\sqrt{}$ (Reliability coefficient × 2).

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The self-acceptance factor had the highest autonomy value, 0.96.

Table 2. Face validity (judges' validity) of the electronic application and defensive performance variables for futsal goalkeepers

Defensive Performance Variables	Agree	Disagree	χ^2	Result
Sports Stats Recorder	33	–	33	Accepted
Catching the ball	33	–	33	Accepted
Deflecting the ball by hand	33	–	33	Accepted
Clearing the ball by foot	33	–	33	Accepted

Significant at the 0.05 level; number of experts = 33; tabulated χ^2 value = 3.84; degrees of freedom = 1.

Reliability was established by means of equivalent-forms. Consequently, they used electronic application (PICCO), which is akin to electronic application (Sports Stats Recorder) in measuring and registering defensive variables. Validity was estimated by computing the correlation (Pearson) between each of the two tools, as presented in table.

Table 3. Pearson simple correlation coefficient (reliability using the equivalent-forms method)

Electronic Application	Correlation Coefficient (Pearson)	Sig
Sports Stats Recorder	0.93	0.000
PICCO		

Significant at the 0.05 level.

Table 4. Differences between the two analysis applications

No.	Sports Stats Recorder	PICCO
1	Operates offline	Operates online (requires internet)
2	Supports the Arabic language	Does not support the Arabic language
3	Records all technical variables	Records all technical variables

The researchers identified the differences between the two applications (Sports Stats Recorder and PICCO), which led them to adopt the Sports Stats Recorder electronic application for use in this study.

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Experimental Procedures:

After finalizing the preparations, researchers analyzed the matches of the Iraqi and Iranian national teams who played with the help of a support team, then using Sports Stats Recorder application to record numerical data for 1/10/2024 till 20/10/2024. The primary experimental sample included four goalkeepers. In all, ten analyses were conducted and therefore ten matches were analyzed (five for each national team). The assessment of all games for both Iraqi and Iranian national teams was completed after 20 days, or a game every second day.

Data was processed by the researcher's team using Statistical Package for Social Science (SPSS) with a range of statistical techniques like; mean, Chi-square (χ^2), percentage, effectiveness index, skewness co-efficient, simple correlation coefficient (Pearson), median.

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Results

Table 5. Skill performance evaluations of the goalkeepers of the Iraqi national team (Iraq vs. Saudi Arabia) and the Iranian national team (Iran vs. Afghanistan) – First Match

No.	Variables	Iraqi National Team				Iranian National Team			
		Success	Failure	%	Effectiveness	Success	Failure	%	Effectiveness
GK1	Catching	7	0	100	6.673	6	0	100	0.6
GK2	the ball	0	0	0	0				
GK1	Deflecting	8	1	88.8	1.832	3	1	75	0.2
GK2	g by hand	0	0	0	0				
GK1	Clearing	5	0	100	11.248	7	0	100	0.7
GK2	by foot	0	0	0	0				

GK1 = First goalkeeper, GK2 = Second goalkeeper

Table 6. Skill performance evaluations of the goalkeepers of the Iraqi national team (Iraq vs. Uzbekistan) and the Iranian national team (Iran vs. Bahrain) – Second Match

No.	Variables	Iraqi National Team				Iranian National Team			
		Success	Failure	%	Effectiveness	Success	Failure	%	Effectiveness
GK1	Catching	5	0	100	1.235	8	0	100	0.8
GK2	the ball	0	0	0	0				
GK1	Deflecting	3	0	75	3.092	4	1	80	7.342
GK2	g by hand	1	0	25	0.632				
GK1	Clearing by foot	6	3	60	3.475	2	2	50	0

Table 7. Skill performance evaluations of the goalkeepers of the Iraqi national team (Iraq vs. Australia) and the Iranian national team (Iran vs. Kuwait) – Third Match

No.	Variables	Iraqi National Team				Iranian National Team			
		Success	Failure	%	Effectiveness	Success	Failure	%	Effectiveness
GK1	Catching	10	2	83.3	-2.049				
GK2	the ball					9	0	100	0.9
GK1	Deflecting	11	1	91.6	14.913				
GK2	by hand					3	0	100	0.3
GK1		7	1	87.5	1.783				

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GK2	Clearing by foot	4	0	100	0.4

Table 8. Skill performance evaluations of the goalkeepers of the Iraqi national team (Iraq vs. Thailand) and the Iranian national team (Iran vs. Kyrgyzstan) – Fourth Match

No.	Variables	Iraqi National Team				Iranian National Team			
		Success	Failure	%	Effectiveness	Success	Failure	%	Effectiveness
GK1	Catching	6	0	100	1.149	12	0	100	1.2
GK2	the ball	0	0	0	0				
GK1	Deflecting	11	0	100	3.444	4	0	100	0.4
GK2	by hand	0	0	0	0				
GK1	Clearing	3	1	75	4.644	6	1	85.7	0.5
GK2	by foot	0	0	0	0				

Table 9. Skill performance evaluations of the goalkeepers of the Iraqi national team (Iraq vs. Afghanistan) and the Iranian national team (Iran vs. Uzbekistan) – Fifth Match

No.	Variables	Iraqi National Team				Iranian National Team			
		Success	Failure	%	Effectiveness	Success	Failure	%	Effectiveness
GK1	Catching	2	0	25	0.234	12	0	100	1.2
GK2	the ball	6	0	75	0.691				
GK1	Deflecting	3	2	37.5	0.1	8	0	100	0.8
GK2	by hand	3	0	37.5	0.3				
GK1	Clearing	2	2	33.3	-0.034	11	2	84.6	0.9
GK2	by foot	2	0	33.3	0.218				

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Discussion

Table (5) the defensive performance effectiveness of the evolved goalkeepers was 19.753. Iraqis were up in the game so Saudis decided to high press and push forward to make it up. Moreover, the Saudi team often used on-field player advantage of the goalkeeper (flying goalkeeper), because of its great effectiveness in creating chances for goals and existence to in the goal itself. The Iraqi shot-stopper had a good game and was especially impressive at catching, clearing and saving one-on-ones as he contributed - with help of his teammates - to the win. He even managed to save a 5-metre penalty. This corroborates the observation in Abdul Fattah (2022) that a goalkeeper's performance in one-on-one situations is influenced by factors such as defensive cover support, the attacking ability of the opponent team, closing down on shooters and anticipating attackers' moves.

The average effectiveness of offensive performance and that of the defensive performance for the Iranian national team goalkeepers was (1.5). According to the scientists, this can be attributed above all to the team's compact and well-coordinated defensive play, as well as the strong performance of their goalkeeper, which played a significant part in ensuring that valuable points were added to their tally. The researchers concluded that a top team has an advantage because it has a better goalkeeper and is more likely to win and less likely not to lose. This is consistent with Shalaan and Naji (2016) who asserted that the goalkeeper significantly affects how play proceeds, match results, keeping clean sheets and achieving victory.

Table (6) indicates that the defensive performance effectiveness of the Iraqi goalkeepers reached (9.148). The researchers attribute this to the Iraqi goalkeeper's strong performance in the first quarter of the match, during which he successfully cleared all shots directed at the goal, playing a positive and influential role. This supports Shalaan and Naji (2016), who stated that clearing the ball provides the goalkeeper with an opportunity to reposition properly and allows defenders to reorganize in front of the goal. However, after the first 10 minutes, the goalkeeper suffered an injury that negatively affected his defensive performance, leading to his substitution after conceding three goals. A fourth goal was conceded when the Iraqi team applied the attacking system (Power Play), resulting in a turnover and a goal. The researchers emphasize the importance of relying on the goalkeeper in numerical superiority situations, as a field player performing Power Play must quickly return to the substitution area when possession is lost, which may leave the goal unguarded. In contrast, when the goalkeeper performs the role of a flying goalkeeper, he can quickly return to his goal to prevent scoring.

Iranian goalkeepers' defensive performance effectiveness achieved to (8.142). This is due to multiple Bahrain attempts on the Iranian goal and the goalkeeper's good

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save of several dangerous shots, by his precise position and swift response within rainy box. This is in accordance with Ibrahim (1985) who argued that the goalkeeper should respond to the movement of the ball and its location on the field to attain an optimal defensive angle against attackers' shots. In the last part of the match, Iranian goalkeeper was substituted with a field player for Power Play to be established, as it assured us the result and also potentiated the defensive efficiency of our goalkeeper allowing Iran to win.

Table (7) shows that the defensive performance effectiveness of the Iraqi goalkeepers reached (14.647). The researchers attribute this to facing a strong Australian attacking line, which highlighted the Iraqi goalkeeper's performance and his positive role in securing the three points and winning the match. The defensive performance effectiveness of the Iranian goalkeepers reached (1.6), which the researchers attribute to the team's lead in the match and the goalkeeper's ability to save many shots. He demonstrated strong anticipation and successfully closed shooting angles without conceding goals. This confirms Shalaan and Naji (2016), who emphasized the importance of reading attackers' intentions, anticipation, and predicting deceptive movements. The researchers believe that a highly competent goalkeeper always has a positive influence on the overall team performance, which contributes to achieving favorable results.

Table (8) indicates that the defensive performance effectiveness of the Iraqi goalkeepers reached (9.237). The researchers attribute this to the Iraqi team's lead and the goalkeepers' ability to save numerous shots from Thai players during both halves of the match. However, after the equalizing goal and the dismissal of two Thai players, ball possession shifted largely to the Iraqi team, which became the dominant side. As a result, defensive effectiveness declined relative to offensive effectiveness. The Iraqi team's use of the Power Play system led to conceding the decisive goal in the final 10 seconds of the match, resulting in elimination from direct qualification for the World Cup. Meanwhile, the defensive effectiveness of the Iranian goalkeepers reached (2.1), attributed to Iran's lead and Kyrgyzstan's reliance on a goalkeeper performing tactical offensive roles and numerical superiority (flying goalkeeper). The Iranian goalkeeper's solid defensive performance limited Kyrgyzstan's attacking threats and played a decisive role in securing victory. This aligns with J. (1993), who described the goalkeeper as having a dual function—either the first attacker or the last defender—and often being the most decisive player in critical situations.

Iraqi goalkeepers Defensive Performance Effectiveness Table (9) indicates that the efficiency of defensive performance of the Iraqi goalkeepers. The latter capitalized on aggressive game of Afghanistan in both halfs, and mostly with the tactical offensive duties employed and flying goalkeeper system applied by the Afghanistan team where those 2 had caused Iraq defensive inefficiency. However, the defensive performance effectiveness

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of Iranian goalkeepers opened 2.9), which can be ascribed to Uzbek players' repeated attempts on the goal and a major contribution of the Iranian goalkeeper in not letting goals through, making various saves. He impressed in the win on penalties and saved several spot-kicks as his side reached the final (and won) by shootout. The results indicate that the teams are likely to be successful if they have goalkeepers who can block penalty kicks in high motivation situations and, for this reason, coaches of goalkeepers should aim at developing this ability because futsal has become a specialized and scientific sport.

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Conclusions

- The marginal means for defensive skill performance in the goalkeepers of Iraqi national team had higher scores compared to Iranian national team goalkeepers in AFC Futsal Asian Cup 2024.
- The defense effectiveness performance values for the Iraqi and Iranian national team keepers didn't have any effect on the match results they played.
- Modern electronic applications are suggested in applying the knowledge of the performance of guard-defendants, because they help in determining an overview of the level to which our national team and local clubs are performing.
- to use the numerical values of skill performance for defender position of our national team to develop a tactical framework (goalkeeper) requires using numerical effectiveness.
- There should be technical analyst in the coaching staffs accompanying national teams and local clubs for international outings.

Appendix (1)
Form for Applying the Effectiveness of Defensive Skill Performance of Goalkeepers in the AFC Futsal Asian Cup 2024

Match: National Team / National Team ( )
Team Name:
Goalkeeper Name:
Goalkeeper Number:
Match Time:
Match Date:
Half Duration: From ____ to ____

Skill Performance Variables	Successful Attempts (Number)	Unsuccessful Attempts (Number)	Performance Effectiveness
Catching the ball	(Number)	(Number)	
Deflecting the ball by hand	(Number)	(Number)	
Clearing the ball by foot	(Number)	(Number)	

Effectiveness Equation:
Effectiveness = (Value of successful skill performance – Value of unsuccessful skill performance) / Playing time

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Appendix (2)

Names of experts and specialists to whom the form for determining the defensive skills of futsal goalkeepers was presented and who approved the use of the electronic analysis application (Sports Stats Recorder)

No.	Academic Title	Name	Specialization	Workplace
1	Prof.	Sabah Qasim Khalaf	Coaching – Football	College of Physical Education and Sports Sciences, University of Baghdad
2	Prof.	Asaad Lazim Ali	Measurement & Evaluation – Football	College of Physical Education and Sports Sciences, University of Baghdad
3	Prof.	Diaa Naji Aboud	Coaching – Football	College of Physical Education and Sports Sciences, University of Baghdad
4	Prof.	Mohammed Abdul Hussein Atiya	Motor Learning – Football	College of Physical Education and Sports Sciences, University of Baghdad
5	Prof.	Mohsen Ali Naseef	Coaching – Football	College of Physical Education and Sports Sciences, University of Baghdad
6	Prof.	Ahmed Murtadha Abdul Hussein	Coaching – Football	College of Physical Education and Sports Sciences, University of Karbala
7	Prof.	Naji Kadhim Ali	Coaching – Football	College of Physical Education and Sports Sciences, University of Baghdad
8	Prof.	Fares Sami Yusuf Malik	Measurement & Evaluation – Football	College of Physical Education and Sports Sciences, University of Baghdad
9	Assoc. Prof.	Wameed Shamil Kamil	Coaching – Football	College of Physical Education and Sports Sciences, University of Baghdad
10	Assoc. Prof.	Imad Kadhim Khalif	Injuries – Football	College of Physical Education and Sports Sciences, University of Baghdad
11	Assoc. Prof.	Maytham Habib Sabhan	Coaching – Football	College of Physical Education and Sports Sciences, University of Baghdad
12	Assoc. Prof.	Muneer Abdul Sahib Mohammed	Coaching – Football	College of Physical Education and Sports Sciences, University of Baghdad
13	Assoc. Prof.	Ahmed Dhari Hani	Psychology – Football	College of Physical Education and Sports Sciences, University of Baghdad

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14	Assoc. Prof.	Wissam Najib Asliwa	Coaching – Football	College of Physical Education and Sports Sciences, University of Baghdad
15	Assoc. Prof.	Khalaf Rabee Jameel	Testing & Measurement – Football	College of Physical Education and Sports Sciences, University of Mosul
16	Assoc. Prof.	Hawkar Salar Ahmed	Coaching – Football	College of Physical Education and Sports Sciences, University of Sulaymaniyah
17	Lecturer	Mustafa Jassim Abdulzaid	Football Coaching	College of Physical Education and Sports Sciences, Al-Mustaqbal University
18	Lecturer	Haider Talib Jassim	Coaching – Football	College of Physical Education and Sports Sciences, University of Baghdad
19	Lecturer	Hassan Mohammed Mousa	Coaching – Football	College of Physical Education and Sports Sciences, University of Diyala
20	Lecturer	Ahmed Hashim Saud	Management – Football	College of Physical Education and Sports Sciences, University of Baghdad
21	Assistant Lecturer	Mahdi Zidan Hammoud	Biomechanics – Football	College of Physical Education and Sports Sciences, University of Baghdad
22	Assistant Lecturer	Al-Amir Haider Hussein	Physical Fitness – Football	PhD Student, College of Physical Education and Sports Sciences, University of Baghdad
23	Assistant Lecturer	Azhar Taher Munshid	Coaching – Football	Ministry of Education, Rusafa Directorate / 2
24	Assistant Lecturer	Khairy Ahmed Saleem	Coaching – Football	College of Physical Education and Sports Sciences, University of Duhok
25	Assistant Lecturer	Ahmed Jaseb Mukhif	Coaching – Football	Karbala Education Directorate
26	Assistant Lecturer	Ihab Mohammed Farhan	Coaching – Football	Student Activities Department, University of Baghdad
27	Assistant Lecturer	Taybah Saleem Abdulmajid	Psychology – Football	College of Physical Education and Sports Sciences, University of Baghdad
28	Assistant Lecturer	Abdul Karim Ghazi	Coaching – Football	College of Physical Education and Sports Sciences, Al-Farahidi University
29	Assistant Lecturer	Mustafa Bijai Hamza	Coaching – Football	Dijlah University College, Physical Education
30	Assistant Lecturer	Ahmed Subhi Rahim	Coaching – Football	Dijlah University College, Physical Education
31	Assistant Lecturer	Jalal Abdul Karim Aboud	Coaching – Football	Dijlah University College, Physical Education

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32	Assistant Lecturer	Abdul Latif Mushtaq Abd	Coaching – Football	Student Activities Department, University of Baghdad
33	Assistant Lecturer	Laith Farhan Faraj	Coaching – Football	College of Physical Education and Sports Sciences, University of Baghdad

Appendix (3)

Illustration of the Sports Stats Recorder analysis application.

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Shukri, S. Y., & Benyoub, A. A. (2022). Analysis of the defensive tactics of the Algerian national football team in the 2019 Africa Cup of Nations. Published research, Faculty of Physical Education and Sports Sciences, University of Souk Ahras.

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A Comparative Analysis of the Electromyographic Activity of Selected Upper Limb Muscles Between the Right and Left Sides During the Magyar Skill on the Pommel Horse in Artistic Gymnastics

Najwa Safaa Mahdi [1], Ismail Ibrahim Mohammed [2]

[1,2] University of Baghdad, College of Physical Education and Sport Sciences.

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Abstract

The aim of this research is to analyze and compare the electrical activity of selected upper limb muscles between the right and left sides during the performance of the Magyar skill on the pommel horse in artistic gymnastics in order to identify any muscular activity asymmetries among national team athletes. The researcher employed the descriptive analytical method due to its suitability for the nature of the study. The sample consisted of seven (7) gymnasts from the Iraqi national gymnastics team. The mean age was 22 years (±2.381) mean height was 170.571 cm (±5.940) mean weight was 62.286 kg (±5.736) and mean training experience was 11 years (±1.826). Electromyographic (EMG) recordings were taken during the technical execution of the skill using a Noraxon EMG system. The study focused on three primary muscles: anterior deltoid, posterior deltoid and triceps brachii in both the right and left limbs. The results indicated no statistically significant differences between the sides in either peak or average muscle activation values suggesting a well-balanced muscular coordination as a result of effective training programs. The study recommends the use of EMG analysis as a precise diagnostic tool for performance evaluation and training guidance. It also calls for future research on other skills and apparatuses to further explore muscular balance in artistic gymnastics.

Keywords: Electromyography (EMG), Pommel Horse, Artistic Gymnastics, Magyar.

[1] University of Baghdad, College of Physical Education and Sport Sciences.
najwa.safaa2204m@cope.uobaghdad.edu.iq
[2] University of Baghdad, College of Physical Education and Sport Sciences.
ismail.ali@cope.uobaghdad.edu.iq

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Introduction

Artistic gymnastics is a complex sport which necessitates substantial muscular balance and coordination when executing advanced maneuvers on the pommel horse. These skills largely require the muscles in the upper limb to enable kinetic co-ordination and stability during performance. As a result, the Magyar skill is one of the most basic circular components in pommel horse routines since performing this trick requires symmetry and stability between the right and left sides to create fluidity and precision.

To analyze the muscular responses during the performance of this skill, we need to accurately measure them with appropriate instruments, since most versatile is electromyography (EMG). EMG is commonly employed to evaluate the muscular electrical activity corresponding to athletic performance in order to characterize neuromuscular coordination or shortcomings. As shown by Farina and Merletti (2004), EMG represents an ideal way to analyze muscle activity during the skill performance. " In a related context, Subasi (2019) found that balanced muscle effort among limbs signifies effective neuromuscular control. Akl et al. (2021) reported a significantly lower injury risk in repetitive movements due to balanced patterns of muscle activation. Additionally, Yadav & Sharma (2025) demonstrated that EMG was capable of identifying minor variations in muscle reaction while performing physical tasks. also stated that the establishment of EMG data-driven training programs can directly improve carrying out technical execution and create varied muscular fatigue (Rodrigues et al., 2023; Abdulhussein et al., 2026).

Thus, this makes it very important to analyze the electromyographic activity of selected upper limb muscles during the performance of a skill, i.e. Magyar, to determine the degree of balance and asymmetries between the right and left sides, which indirectly tells us about coordination in athletes. This analysis offers know-how-derived data that helps coaches train-based programs.

Methods and Instruments

The researcher used a descriptive–analytical approach, which is relevant to the nature of research because it aims to analyze electromyographic activity on specified upper limb muscles while performing Magyar skill on the pommel horse in artistic gymnastics.

The sample of the study comprised seven (7) athletes representing the Iraqi National gymnastics team, as they were purposely selected due to their high level of technical performance and training amount. The mean age of participants was found to be (22 ± 2.381) years and their ages ranged from 19 to 25 years. Participants had a mean height of (170.571 ± 5.940) cm, mean mass of (62.286 ± 5.736) kg, and mean training age (11 ± 1.826) years.

The experiment was conducted in the gymnastics hall of the College of Physical Education and Sport Sciences, University of Baghdad. Each participant began with a general and specific warm-up lasting 15 minutes, after which they were asked to perform the Magyar skill on the pommel horse.

A Noraxon EMG system comprised of multiple channels to detect surface muscle electrical activity was used to record the electromyographic activity. After cleaning the skin with alcohol to improve signal quality and reduce electrical impedance, four surface

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electrodes were placed on the skin. The muscles were recorded bilaterally (left and right sides) as follows:

1. Anterior Deltoid
2. Posterior Deltoid
3. Triceps Brachii

Data were collected during skill execution, and the following variables were extracted from the EMG signals:

- Peak value
- Mean value

The signals were processed using specialized software to convert them into numerical data suitable for statistical analysis.

Statistical analyses were conducted using SPSS software, including:

- Means and standard deviations for descriptive data
- Independent samples t-test to identify differences between the right and left sides

Results

Table 1. *Independent Samples t-test for Differences Between Right and Left Sides in the Magyar Skill for the Investigated Muscles (Peak and Mean Variables)*

Muscles	Variable	Right Side (Mean)	± SD	Left Side (Mean)	± SD	t-value	p-value	Significance
Anterior	Peak	1134.857	379.773	1160.271	463.251	0.112	0.912	Not sig
Deltoid	Mean	354.700	106.312	321.114	76.737	0.678	0.511	Not sig
Posterior	Peak	844.729	442.942	1311.300	742.466	1.428	0.179	Not sig
Deltoid	Mean	286.353	145.541	423.786	250.099	1.257	0.233	Not sig
Triceps	Peak	1344.014	677.240	1239.586	236.776	0.385	0.707	Not sig
Brachii	Mean	478.371	129.064	516.314	101.345	0.612	0.552	Not sig

Degrees of freedom (df) = (7 + 7 − 2 = 12), Significant at (0.05) level if p-value < 0.05.

Discussion

Electromyographic (EMG) activity analysis is one of the most accurate and in addition objective techniques in assessing efficiency muscle reactions to motor skills execution. This is crucial in sports with high neuromuscular coordination like artistic gymnastics that require striking integration between the upper and lower limbs to achieve balance and precision (Subasi 2019). Hence, investigation of potential side-differences in muscle activation during the performance of Magyar skill on pommel horse is needed to identify muscular asymmetries while seeking for optimal technical execution.

No statistically significant (p) difference was found between the right and left side with respect to the EMG activity of investigated muscles both for peak and mean variables at 0.05, as per independent samples t-test results shown in the table above. The muscles

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investigated were anterior deltoid, posterior deltoid and triceps brachii. The similar response of both extremities in terms of performance during the Magyar skill indicates that muscle groups within each limb show balanced contraction when performing this task, with no asymmetrical neuromuscular responses among players. This suggests:

1. Efficient distribution of effort between both arms.
2. The skill relies on a balanced motor pattern requiring muscular equilibrium on both sides.
3. Similar levels of muscle activation between limbs as a result of continuous skill training (Roberto & Dario, 2016).

Based on the Magyar skill that consists of continuous, circular movements with support from upper limbs, symmetrical balance and stability are required for these positive performance indicators in motor outcomes. The results also confirm the beneficial effects of training programs designed to enhance symmetric muscle control in both limbs, which corresponds with modern-day training paradigms focusing on symmetry and integrated activity within muscle groups required for multi-joint skills (Bompa & Buzzichelli, 2019; Abdulghani et al., 2025).

In addition to the above, the lack of any marked differences between sides in any of the muscles analysed indicates functional efficiency and demonstrates that participants were competent enough in order to not rely on one limb for a skill. It also indicates the efficiency of the selected system in muscle balance and strength bilaterally. This finding highlights the need for bilateral training in gymnastics programs to decrease injury risk due to muscular imbalances and improve motor balance (Behm et al., 2004; Abdulkareem et al., 2025).

We further concluded that EMG should be included as a tool to evaluate performance, due to its sensitivity in identifying slight functional differences that may contribute to the scientific design and prescription of training methods. As a matter of fact, the researcher suggests implementing EMG analysis in regular checks during gymnastics training to help with early detection of muscular imbalances and correcting their course before it provokes performance detriment.

Excessive unilateral muscle activity leading to balance issues may result in technical faults whilst performing (lateral deviation, inadequate control whilst changing direction or difficulty transitioning between skills)—none of which were present in the population sample.

Mohsen (2025) studied a set of pommel horse skills performed by gymnasts, and using EMG analysis found that differences between limbs are often non-significant for high-level athletes that is also in agreement with present study.

In light of the biomechanic features of the Magyar, this skill demands symmetrical use of both arms during the push-off and circular phases. This requires strength and muscular development to perform effectively, with balance on the equipment (Hassan & Abdulkareem, 2025).

Gymnastics skills that rely on bilateral support require integration between both limbs, which limits large discrepancies in muscle electrical activity—consistent with the current findings (Abuwarda & Gomaa, 2021; Essam & Shaboot, 2023).

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Furthermore, Seemann-Sinn et al. (2025) Performance on the pommel horse requires a high degree of muscular balance, and any coordination disturbance among the limbs can result in poor performance efficiency and risk of injury.

Conclusions

1. This result indicated that the Magyar skill is not directly separated into 2 sides in national teams of players as it is performed with a symmetrical muscular pattern which also means that training programs are successfully leading to muscular harmonious balance to perform this complex skill.
2. This suggests that muscle activation patterns were functional not only with respect to the motor characteristics of different multisystem kinetic but also towards the body stabilization necessary for proper execution of gymnastics technical skills.
3. The findings of this review yielded the important role of bilateral training, which predominantly allows symmetrical muscle-development and less reliance on unilateral movement activity essential for the injury prevention strategies resultant muscular imbalances.
4. These data decrease the diagnostic process of functionally relevant muscle adaptations and detect potential asymmetries at an early stage, underlining that EMG tools should become a part of gymnastics training and evaluation protocols.
5. The researcher's concludes that obtaining a balance between antagonistic muscle pairs is heterogeneous and future studies to develop a better understanding of the muscle balance mechanisms relative to types of skills and apparatus conditions are recommended, but from similar methodologies on various technical skills and devices in gymnastics.

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The researcher would like to put on record her indebtedness towards her academic supervisor, for the valuable guidance that he gave this study. We would like to thank Dr. Osama Al-Taie, Dr. Yasser Najah, Dr. Huda Hamid and Mr. Mustafa Ahmed for their valuable advice according to the scientific bases during the writing of this research;

We would also like to thank the athletes of the Iraqi National Gymnastics Team for their effective participation in conducting these experimental procedures. The researcher also extends his gratitude to the EMG device supplier for the technical assistance they provided, allowing him to collect electromyographic data.

Appendices

Appendix 1. *Experts and Specialists Consulted to Identify Key Muscles and Skills in Artistic Gymnastics*

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No.	Name	Position
1	Amer Sukran Hamza	Vice President of the Iraqi Gymnastics Federation
2	Mahmoud Saleh Mahdi	National Team Coach
3	Mowaffaq Jabbar Abdul Karim	National Team Coach
4	Saleh Noor Jaafar	International Judge (Yemen) and Certified Gymnastics Coach
5	Mazen Taha Omar	Certified Gymnastics Coach in the United States
6	Osama Ahmed Al-Taie	Lecturer at the University of Baghdad, Specialist in Physiology

Appendix 2. *Assistant Work Team*

No.	Name
1	Dr. Osama Ahmed Al-Taie
2	Dr. Yasser Najah
3	Dr. Huda Hamid
4	Mr. Mustafa Ahmed

Appendix 3. *Electromyography (EMG) Device*

Appendix 4. *Descriptive Data of the Research Sample*

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No.	Participant	Age (years)	Height (cm)	Weight (kg)	Training Age (years)
1	Omar Abbas	19	178	64	9
2	Hussam Mowaffaq	23	178	70	12
3	Abdullah Jamal	25	171	58	14
4	Mousa Jamal	21	163	54	10
5	Hussein Ali	19	170	65	9
6	Mohammed Issam	23	170	67	11
7	Mohammed Ali	24	164	58	12

Appendix 5. *A Sample Performance of a National Team Player in the Pilot Study*

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Appendix 6. *A Sample Performance of Selected National Team Players in the Main Experiment*

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The Effect of Static Stretching and Full Dynamic Stretching of Opposing Body Segments Using Elastic Resistance Bands on Motor Balance and Dynamic Flexibility in Youth Basketball Players

Omar Mohammed Majed [1]

[1] University of Baghdad, College of Physical Education and Sport Sciences.

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Abstract

This study aimed to investigate the effect of static stretching and full dynamic stretching exercises using elastic resistance bands on the development of motor balance and dynamic flexibility in youth basketball players. The research sample consisted of (12) youth players from Al-Adhamiya Sports Club basketball team, who participated in a training program utilizing elastic resistance bands alongside their regular training for a duration of (8) weeks, with (3) training sessions per week. To measure the study variables, the Modified Bass Test of Dynamic Balance was used to assess motor balance, and a dynamic flexibility test was employed to evaluate movement flexibility. The results revealed statistically significant differences between the pre- and post-tests of the experimental group in both motor balance and dynamic flexibility, in favor of the post-test, indicating the effectiveness of the training program using elastic resistance bands in improving these physical abilities. The researcher attributes this improvement to the nature of elastic resistance exercises, which provide progressive resistance throughout the full range of motion, thereby enhancing neuromuscular balance and increasing joint range of motion. Furthermore, the findings showed that training opposing body segments contributed to improving muscular balance and reducing asymmetry between the two sides of the body, while static stretching exercises enhanced muscular stability and neuromuscular control, and full dynamic stretching exercises contributed to increasing functional range of motion associated with basketball skill performance.

Keywords: elastic resistance bands, static stretching, full range of motion, balance, dynamic flexibility, basketball.

[1] University of Baghdad, College of Physical Education and Sport Sciences.
omar.m.m@cope.uobaghdad.edu.iq, https://orcid.org/0009-0001-5573-8681 .

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Introduction

The field of sports training is witnessing continuous development in the methods and tools used for athlete preparation, as coaches and researchers strive to adopt modern training programs that contribute to the enhancement of physical and motor abilities in line with the performance demands of various sports. Physical preparation is considered a fundamental basis for improving players' skill performance (Abdulhussein et al., 2026). Basketball is among the sports that require a high level of physical and motor efficiency due to the nature of its diverse movements, such as sprinting, jumping, and rapid changes of direction. Therefore, the development of motor balance and dynamic flexibility is regarded as a key factor in improving skill performance and movement efficiency among players (Abdulkareem et al., 2017).

Resistance exercises that use elastic bands have emerged as a modern alternative to traditional methods, in the same context, as this new training pattern produces progressive resistance over the entire range of motion, which is beneficial for promoting neuromuscular adaptations and improving dynamic balance and functional flexibility (Amer Abdulhussein et al., 2025). Thus, this study utilized exercises that combine static stretching and full dynamic stretching for different segments of the body in a way that matched the requirements of basketball. Measurements of the study variables were carried out by utilizing the Modified Bass Test of Dynamic Balance and a test of dynamic flexibility, both established as classic measures in various aspects of sports research (Hassan & Abdulkareem, 2025).

The importance of this research in its significance is to demonstrate the role and effect qualitatively with the addition of various elastic band resistance exercises carried out to improve motor balance and dynamic flexibility on youth basketball players, which will eventually help improve neuromuscular adaptation and increase movement efficiency. In addition, this study presents a training program that coaches can use to develop these physical qualities and improve skill performance as well as decrease the chances of sports injuries among players.

Basketball also includes multidirectional movements, including many repeated jump-landing sequences and physical contact between players throughout the performance; thus, it calls for a high degree of both motor balance and dynamic flexibility. Poor motor balance or reduced joint range of motion could result in decreased performance efficiency for youth players' skill level and a greater risk of sports injury. However, as previously mentioned the significance of physical abilities such as the functional development (agility) score card and some applied training programs which relate directly to youth basketball players do not provide enough attention to their motor balance and dynamic flexibility used with help of modern movement apparatus like an elastic resistance band. Accordingly, the research problem is concretized in the following question:

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Do static stretching and full dynamic stretching exercises using elastic resistance bands have a significant effect on developing motor balance and dynamic flexibility in youth basketball players?

Research Objectives

1. To identify the effect of static stretching exercises using elastic resistance bands on developing motor balance in youth basketball players.
2. To identify the effect of full dynamic stretching exercises using elastic resistance bands on developing dynamic flexibility in youth basketball players.
3. To identify the differences between pre- and post-tests in motor balance and dynamic flexibility among the study sample.

Research Hypotheses

1. There are statistically significant differences between the pre- and post-tests of the experimental group in motor balance in favor of the post-test.
2. There are statistically significant differences between the pre- and post-tests of the experimental group in dynamic flexibility in favor of the post-test.

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Methods and Materials

Research Design and Participants

The research methodology represents the fundamental approach selected by the researcher to obtain results, as phenomena can be studied through scientific methods that align with the nature of the research problem. Accordingly, the researcher employed an experimental method using a one-group design due to its suitability for the nature of the study problem. The selection of the sample is closely related to the characteristics of the population from which it is drawn, as well as to the nature of the research problem, since it represents the model upon which the study is conducted. Using a purposive sampling method, the research sample was selected from players of Al-Adhamiya Sports Club to implement the experimental procedures related to the study topic. The sample consisted of (12) players, who were chosen due to their regular attendance in training sessions, the availability of the training facility, the proximity of the training center, and the ease of access for the researcher. The researcher also conducted a homogeneity test for the research sample, as presented in Table (1).

Table 1. *Homogeneity of the Sample in Variables (Age, Training Age, Height, and Body Mass)*

No.	Variables	Unit of Measurement	Mean	Standard Deviation	Skewness
1	Height	cm	180.13	1.26	0.194
2	Body Mass (Weight)	kg	70.56	1.46	0.153
3	Chronological Age	years	17.06	0.85	0.13
4	Training Age	years	2.75	0.78	0.49

Equipment Used

First: Exercise Implementation Tools

1. Elastic resistance bands of different colors (varying resistance levels).
2. Exercise mats for static stretching.
3. Training markers or cones.
4. Large flexible exercise balls (optional).
5. Stopwatch.
6. Measuring tape.

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7. Medical scale for body weight measurement.
8. Stadiometer for height measurement.
9. Exercises Used

Static Stretching and Full Dynamic Range Exercises

These exercises involve isometric contractions of muscles—meaning, the length of the muscle remains unchanged during exercise because there are no visible movements at a specific joint or body segment. This means that in its active (contraction) and passive (elongation) phases, the movement occurs through the joint's full range of motion under opposing resistance. Covering the whole dynamic range of potential joint motion, these exercises develop strength along with stability and flexibility, improving neuromuscular coordination by generating force through a complete range of motion. They work toward muscular stability and joint control through the entire range of motion, enhancing neuromuscular regulation as well. In addition, they promote stability in the body's center of mass during movement and from one position to another for improved athleticism. These exercises work because they strengthen stabilizing muscles on one side while lengthening the opposing muscles on the other, and therefore foster what is called dynamic flexibility — which is a joint's ability to move through a wide range during true motor performance with adequate muscular control. This is different from static flexibility that is functionally associated with the nature of movement.

First: Measurement Tools and Tests

Modified Bass Test of Dynamic Balance (Halabchi et al., 2020)

Used to determine someone's capacity for both accurate jumps as well as maintaining balance during and post-movement. Test is a valid measure of dynamic balance, especially in activities that combine movement and postural control.
The test requires a stopwatch, a measuring tape, and eleven markers of size (1 inch × 0.75 inch), which are fixed on the ground in a specific arrangement. During the test, the participant begins by standing on the starting point using the right foot. Upon the signal, the participant jumps to the first marker using the left foot and attempts to maintain balance on the ball of the foot for as long as possible, with a maximum duration of five seconds. The participant then proceeds to jump to the second marker using the right foot, alternating feet with each subsequent marker while maintaining balance on the ball of the foot each time. It is important that the foot completely covers the marker during landing without any part extending beyond it.

Points are awarded both for the accuracy of their landing and how stable they can remain. For each time the participant correctly lands on a marker, they receive five points.

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As well, one point is given for every second the contestant remains on balance on the marker (max of five seconds). Hence the test has a maximum total score of 100 points.
If the heel or any part of the body except for the ball of foot touches ground after landing or if they are unable to stop, they do not score 5 points even if he markerclearly on ground. In these situations, the subject may regains balance on the ball of foot and tries to hold it for up to five seconds. In addition to that, if any balance error is made before the 5 second duration could also mean a loss of one point per second as well. If they lose balance completely, though, the participant has to return to the current marker and attempt a jump again at the next marker with the correct foot.

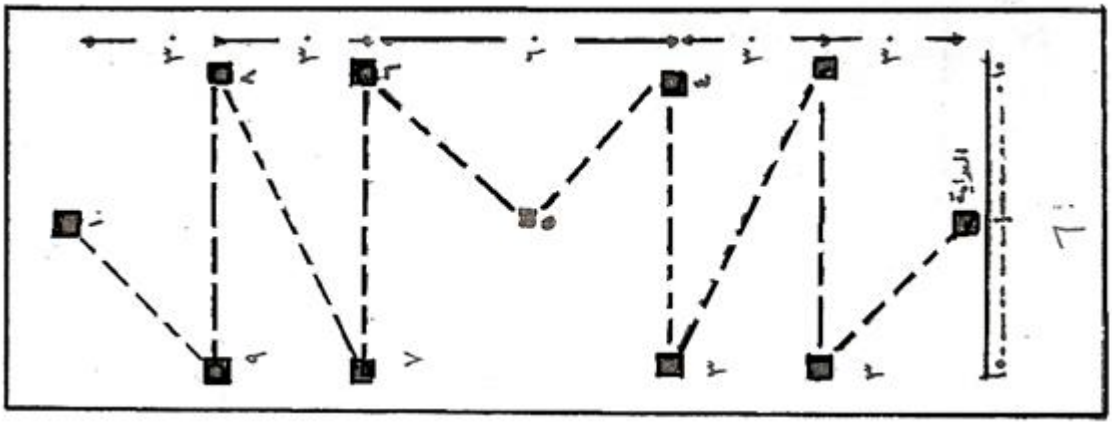

Figure 1. ***Illustration of the Modified Bass Test of Dynamic Balance***

Second: Dynamic Flexibility Test

Dynamic Flexibility (Movement Flexibility) Test (Mayorga-Vega et al., 2014)

This is a dynamic flexibility test that targets trunk flexion, extension and rotation. It assesses a participant's ability to execute controlled repeated movements through functional range of motion.

The test requires a stopwatch and a wall. Two marks (×) are drawn: one on the ground between the participant's feet, and another on the wall behind the participant at mid-back level. Upon the start signal, the participant bends the trunk forward and downward to touch the ground mark with the fingertips, then immediately extends the trunk upward while rotating to the left to touch the mark on the wall behind with the fingertips.

The same movement is then performed to the right side.
Performance is recorded by counting the total number of correct touches made on both marks within a period of 30 seconds.

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Main Experiment

After completing the pre-tests, the researcher initiated the implementation of the main part of the training program, which was specifically designed by the researcher. The program included static stretching exercises for one part of the body combined with full dynamic range movements for the opposing body segments, performed using elastic resistance bands or without them, in order to examine their effect on motor balance and dynamic flexibility in youth basketball players under the age of 18. The program was applied to the experimental group, which consisted of (12) players.

Results

Table 2. *Descriptive Statistics, Paired Differences, and t-Test Results for Pre- and Post-Tests*

Variables	Tests	Mean	Std. Deviation	Mean Difference	Std. Difference	t-value	Sig (p)	Significance
Modified Bass Test (Dynamic Balance)	Pre-test	54.9	0.875	5.50	0.84	20.466	0.000	Significant
	Post-test	60.4	0.516					
Dynamic Flexibility Test	Pre-test	48.3	0.823	6.70	1.33	15.841	0.000	Significant
	Post-test	55.0	0.816					

Discussion

The present study indicated statistically significant differences in both dynamic balance and flexibility, between the pre- and post-tests with a more favorable outcome for the post-test. Mean (54.90) and post-test (60.40) score for dynamic balance, mean pretest score on the dynamic flexibility variables increased from (48.30) to (55.00). The macht determined t-values demonstrated that all improvements were statistically significant ($p = 0.000$), and it has to be emphasized that the overall effectiveness of a specified training program in improving the motor abilities of participants is greatly expressed in this research.

Several studies have suggested that dynamic balance improvement may be related to neuromuscular adaptations from structured motor practice. Balance relies on the coordination of sensory receptors, working muscles and the integration of the central nervous system to control center of mass during movement. Previous literature shows that practicing balance can improve postural control and neuromuscular coordination,

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ultimately resulting in better dynamic balance task performance (Ringhof & Stein, 2018; Muehlbauer et al., 2021; Abdulhussein, 2025).

Another type of exercise is one that challenges the perceptions of the sensorimotor system and increases a person's ability to stabilize themselves between different positions in movement. This has a positive reflection on dynamic balance performance. It has been confirmed by studies that youth and athletes have better motor control and postural stability if they participate in specialized balance training programs (Duquette et al., 2022; Sánchez-Barbadora et al., 2025; Abdulhussein & Al-Juboori, 2024).

The performance results were also clearly improved in the post test with regard to dynamic flexibility. This is due to the mechanical and muscular adaptations gained by performing stretching and movements exercises repeatedly in the training program. These exercises promote joint range of motion and positively affect the mechanical properties of muscles and tendons, leading to better dynamic flexibility (Alizadeh et al., 2023; Abd Alqader et al., 2025).

Alizadeh et al. (2023) suggests that consistent training, either through strength training or stretching exercises, leads to improved range of motion as a result of neuromuscular adaptations within the musculoskeletal system. Flexibility also benefits the overall motor function by minimizing muscular resistance while performing motion and increasing coordination efficiency (Donti et al., 2022).

Similarly, in physical education and related fields studies indicate starting the development of motor performance components such as flexibility and balance to promote skill (an important factor in performance) alongside being physically adept is essential at increasing both their scale performances (students and any athlete). Thus, these are the components that not only improve movement efficiency but also prevent injuries in performance (Pfeifer et al., 2022; Komatni, 2022).

Overall, we can assume that the training program has led to neuromuscular and mechanical adaptations following the practice performed by participants in both tests (post-test dynamic balance and post-test dynamic flexibility). Consistent interval training of structured exercises helps to achieve better control of movement and improvement in joint range of motion as part of a greater physical manifestation including performance motor skills.

Conclusions

1. Static stretching and full dynamic range exercises with elastic resistance bands resulted in statistically significant improvements in motor balance of youth players, the study's outcomes show.
2. The exercises led to an improvement in dynamic flexibility, especially in the joints involved in basketball skill execution.

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3. Training antagonistic segments (upper with lower limb, and right with left) improved neuromuscular balances (reduction of estimates between the two sides of the body).
4. In addition, static stretching exercises improved muscular stability with the result that efficient neuromuscular control was increased and reflected positively in both performance movement stability.
5. Because full dynamic range exercises were performed, the appropriate functional ranges of motion needed to appropriately execute skills as well as transitional and rotational movements within basketball were improved.
6. Elastic resistance bands issued progressive and safe resistance, whilst also activating deep muscles in the body that contribute to balance.
7. Static stretching with full dynamic range exercises were shown to be greater than either methods independently.

Recommendations

1. Youth basketball players should include static stretching and dynamic full range exercises utilizing elastic resistance bands in their training programs.
2. Training opposing body segments is needed to achieve muscular balance and decrease movement asymmetries.
3. These talents should be incorporated in both the general and exact segment of the training session, especially before mastering move abilities.
4. Progressive overload of elastic resistance Mechanical PropertiesThe principle of progressive overload must be applied for elastic resistance, either according to the players' training age or performance level.
5. Players' development can be monitored, through periodic assessments of motor balance and dynamic flexibility.
6. A particular focus on core stability exercise practice should be combined with elastic resistance band training.
7. Further training can be performed on other age groups to assess the training response through developmental stages.

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The Learning Gap between Classroom Education and Artificial Intelligence-Based Education in Curriculum Design among Students of the College of Physical Education and Sports Sciences from the Students' Perspective

Yasir Hussein Khadair [1], Abduallah Ghazi Hamdan [2]
[1,2] University of Baghdad, College of Physical Education and Sports Sciences

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Abstract

The present study aimed to identify the learning gap between classroom-based education and artificial intelligence (AI)-based education among students of Colleges of Physical Education and Sports Sciences. It also sought to determine the effectiveness of classroom education and AI-based education in reducing the learning gap among these students. The research problem addressed the following questions: Are there statistically significant differences in the learning gap between students who learn through traditional classroom education and those who learn through AI-based education in Colleges of Physical Education and Sports Sciences? What is the nature of the learning gap between classroom education and AI-based education among these students? Which educational approach is more effective in reducing the learning gap? The results of the study indicated that there is a learning gap between classroom education and AI-based education among students of Colleges of Physical Education and Sports Sciences. The findings also revealed that the use of artificial intelligence technologies contributes to improving the quality of the educational process and enhancing the design of educational curricula. Furthermore, AI helps address individual differences among students by providing learning content that aligns with their needs and learning abilities. Based on these findings, the researcher recommends enhancing the integration of artificial intelligence in the educational process. AI technologies can provide advanced analytical tools that assist teachers in monitoring students' progress and diagnosing learning difficulties more accurately. In addition, several challenges still hinder the effective implementation of AI in education, which requires further efforts to overcome these obstacles and promote the successful integration of AI technologies in educational environments.

Keywords: AI, education, educational curricula

[1] University of Baghdad, College of Physical Education and Sports Sciences.
yaser.hussein1204a@cope.uobaghdad.edu.iq, https://orcid.org/0009-0001-7039-1065
[2] University of Baghdad, College of Physical Education and Sports Sciences.
Abdullah.G@cope.uobaghdad.edu.iq, https://orcid.org/0009-0005-3496-8217

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Introduction

The educational process plays a major role in the development of countries because it constitutes the essential infrastructure for their progress. Recent advancements in information technology, particularly in the field of artificial intelligence (AI), have further contributed to this development.AIIt was a major challenge to the educational process, as it integrated many technologies and applications into one gap, which is artificial intelligence, thus highlighting many electronic educational platforms and creating electronic educational classroom commands.Despite the numerous contributions of artificial intelligence (AI) to the development of the educational process, its application in curriculum design still faces a clear disparity between available capabilities and the level of actual implementation within educational institutions. This disparity is particularly evident in faculties of physical education and sports science, where teachers' and students' experience with AI technologies varies, leading to a learning gap characterized by the inadequate integration of these technologies in curriculum design to align with student needs and modern learning requirements.. Educational systems have undergone fundamental transformations in recent decades as a result of the rapid development of information and communication technologies. This has directly impacted teaching methods and learning approaches, with traditional classroom-based rote learning no longer the dominant model. Instead, modern educational models have emerged that rely on interaction, personalization, and self-directed learning, most notably AI-based education. Artificial intelligence is considered one of the most important outcomes of the Fourth Industrial Revolution, given its ability to analyze educational data, adapt content to learners' characteristics, and provide immediate feedback that contributes to improving learning outcomes. (Luckin, 2016).In this context, the concept of the learning gap has become one of the contemporary educational concepts that attracts the attention of researchers, as it refers to the differences between what learners are expected to achieve in terms of learning outcomes and what is actually achieved in the educational reality, as a result of differences in educational environments, teaching methods, or the technological tools used. ((OECD, 2020).This gap becomes even more apparent when comparing traditional classroom education, which relies heavily on direct instruction and classroom control, with AI-based education, which provides flexible, interactive, and learner-centered learning environments.. Artificial intelligence contributesAI is reshaping physical education by offering innovative teaching methods, personalized training programs, and immersive learning environments. Artificial intelligence technologies enable the design of individualized training programs tailored to each student's needs, enhancing learning outcomes and physical performance. AI also provides real-time feedback, dynamic adjustments to training plans, and monitoring of students' overall health. (Cao & Yu, 2025; Zhou et al., 2024) .. The integration of virtual reality (VR) technologies with artificial intelligence enhances the learning experience in physical education through interactive

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training environments, allowing the practice of complex athletic skills in controlled realistic conditions. Artificial intelligence tools also help to accurately assess athletic performance, contributing to the design of more effective training plans (Zhang, 2021; Deng et al., 2025).This issue is of particular importance in faculties of physical education and sports science, given the nature of their programs which combine theoretical, skill-based, and motor aspects, and require modern teaching methods capable of taking into account the individual differences between students, improving skill performance, and enhancing cognitive understanding of sports movements and skills..A study emerged(Zawacki-Richter, O., Marín, VI, Bond, M., & Gou, 2019) The use of artificial intelligence technologies in sports education contributes to improving motor learning, developing basic skills, and raising the level of motivation towards learning compared to traditional classroom education..Despite these capabilities, classroom-based teaching remains the dominant model in many physical education and sports science faculties, while artificial intelligence is used in a limited or unstructured manner. This raises questions about the extent of the learning gap between the two models and which is more effective in achieving the desired learning outcomes. Furthermore, comparative studies in this field, particularly within the Arab context, remain limited. This necessitates further scientific research to highlight this gap and provide indicators that can be used to develop educational programs. Based on the above, this study comes as a scientific attempt to compare the learning gap between classroom education and AI-based education among students of physical education and sports science colleges, contributing to enriching educational literature and providing results that can support educational decision-makers in adopting more effective educational models..The research problem, however, sought to answer the following questions: 1.Are there statistically significant differences in the learning gap between students who learn through classroom instruction and students who learn through AI-based instruction in faculties of physical education and sports science? 2.What is the nature of the learning gap between classroom education and AI-based education among students of physical education and sports science colleges? 3. WhichWhich of the two educational models is more effective in reducing the learning gap among students in faculties of physical education and sports science? The research objectives were: 1. Identifying the learning gap between classroom education and AI-based education among students of physical education and sports science colleges.2. IdentifyingThe effectiveness of classroom teaching and AI-based education in reducing the learning gap among students of physical education and sports science colleges.

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Learning gap: The concept of the learning gapLearning Gap is one of the modern educational concepts thatRecently appearedWith developmentsystemsEducation and the differences in learning environments. This refers to the difference between the expected level of learning.Achievement of its realizationLearners have different learning objectives and levels of understanding.real or actualWhat the learner achieves in the educational reality as a result of differences in educational conditions, teaching methods, or technological capabilities used in education.. The organization has defined ((OECD, 2020) The learning gap:The difference between expected learning outcomes for learners and the actual level of achievement they attain is a result of differences in educational environments or available learning opportunities.As it indicates(Luckin, 2016)However, the learning gap may arise as a result of differences in teaching methods or the use of educational technology, as diverse learning environments lead to disparities in the acquisition of knowledge and skills among learners..

In light of What the definitions or concepts of the learning gap have brought forth ifThe learning gap in this study can be defined as:

Disparities in levels Learning outcomes between learners result The difference in The teaching style used, whether He was Traditional classroom education or AI-based education.

Previous studies:

- study(Sheri-Lynn Skwarchuk, Heather Douglas, 2025) The researchers used the descriptive method in the research procedures, and the sample size used in the research was 471 students. The research results wereSuch as the improved questionnaire in This study is essential to assess how generative artificial intelligence impacts higher education and how it can be used within it..maybe The use of these tools should contribute to promoting positive practices in the application of generative artificial intelligence. And raised Level of educational standards.
- study**(Chan & Zhou, 2023)**The researchers usedA quantitative investigative approach (questionnaire design) was used to develop an instrument that measures the variables of knowledge, value, and cost associated with its use.AIAs for the research sample, whereParticipate in the study405 university students from higher education institutions.Statistical methods usedFor confirmatory factor analysis(Confirmatory Factor Analysis) With correlation coefficientsPearson's correlation between variablesSearch resultsThere is a strong positive correlation between the perceived value ofGenAI and intent of use.

There is a weak negative correlation between perceived cost and intent to useGenAIandThe results indicate that students who see greater value in artificial intelligence are more likely to use it in learning, while some believe that the

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associated costs reduce their intention. The results indicate that students who see greater value in artificial intelligence are more likely to use it in learning, while some believe that the associated costs reduce their intention..

- study**(Ahmed AlAnzi et al, 2026)**The researcher adopted the descriptive method to achieve the study's objectives. The research sample consisted of male and female teachers and students from Hal School, totaling 384 individuals. The research results were as follows: Results Artificial intelligence contributes to facilitating the monitoring of students' progress and improving performance.Key challenges include weak technological infrastructure and limited resources. Recommendations include teacher training and developing educational infrastructure..
- **(Kashive, N., Powale, L., & Kashive, K., 2021)** A study confirmed thatUnderstanding users' perceptions of the role of artificial intelligence in enhancing personalized learning, including the personal learning profile and learning network. Personality, and studying its impact on ease of use, effectiveness, and satisfaction with e-learning.,The study also relied on structural equation modeling to collect data from students and professionals. The results revealed the effectiveness of artificial intelligence applications and their suitability for information exchange among learners, and confirmed that AI-supported e-learning contributes to developing curriculum content and creating new teaching methods that enhance the effectiveness of the educational process.
- **study (Sanusi, IT, Olaleye, SA, Agbo, FJ, 2022)** To explore the competencies necessary for high school students to masterUsemArtificial intelligence, with data analysis 605 Nigerian secondary school students, as the study emphasized, stressed the importance of collaboration and teamwork among students to promote artificial intelligence literacy and keep pace with technological developments. The study concluded that educational competence is not limited to cognitive aspects, but extends to include skills and personal attributes that are appropriate to the nature of the course and the development of suitable educational content..
- **study(Jaawani, Afaf, and Al-Kaabi, Sulaiman, 2024)**I confirmed to AThe conference will review artificial intelligence applications in education and analyze their educational impact, while identifying the challenges facing their implementation in the educational process.The results showed that artificial intelligence applications, despite their great potential, face obstacles that limit their effectiveness, and The most prominent of them Weak internet networks and a lack of experience among some teachers in using artificial intelligence technologies, Some applications conflict with values community.

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Similarities and differences between previous studies and how to benefit from them:

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Similarities between previous studies

1. Studies agree on the importance of employing artificial intelligence in education. As most studies, such as the study, have confirmedChan & Zhou (2023) and Kashive et al. (2021) Artificial intelligence contributes to the development of the educational process and the improvement of the learning experience..
2. Using descriptive or quantitative methods in studies Most previous studies have relied on the descriptive or survey method to analyze students' and teachers' opinions on the use of artificial intelligence in education..
3. Focus on the role of artificial intelligence in developing educational curricula Studies have shown that artificial intelligence helps in designing flexible educational content that is compatible with learners' needs..
4. Studies confirm the importance of training teachers in modern technologies.

Studies have shown that the success of implementing artificial intelligence in education depends largely on the training of teachers and the development of their digital skills..

5. Focusing on the role of technology in improving learning outcomes Most studies have indicated that the use of modern technologies contributes to improving academic achievement and enhancing interaction within the educational environment..

Differences between previous studies

1. Differences in study objectives Some studies have focused on students' attitudes towards the use of artificial intelligence, such as the studyChan & Zhou (2023), while other studies have focused on the impact of artificial intelligence on the development of the educational process, such as the study by Kashive et al. (2021).
2. ADifferences in research samples The study samples varied betweenUniversity students-High school students teachers,While the current study focused on students of faculties of physical education and sports science.
3. Differences in educational environments for studies Some studies have been conducted in different educational settings such as:

Higher education-school education-e-learning While the current study focuses on the university environment in physical education colleges.

4. Differences in data collection tools

The studies used a variety of tools such as: questionnaire-Structural equation modeling-Educational data analysis
The current study used a learning gap scale with a five-point Likert scale..

Benefit from previous studies

1. Building the theoretical framework of the study

Previous studies have helped to clarify the concept of artificial intelligence in education and the learning gap..

2. Defining the research problem and its objectives

The results of previous studies contributed to identifying the research problem related to the gap between classroom education and AI-based education..

3.Choosing the right study method
The researcher adopted the descriptive approach based on numerous previous studies that used this method in studying educational phenomena..

4.Developing the measurement tool used in the study
5.Some of the measures used in previous studies were utilized when constructing the learning gap scale..
6.Interpretation of the results of the current study
Previous studies helped in interpreting the results and comparing them with the results of other research in the field of artificial intelligence and education..

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Figure 1. *The diagram illustrates the interactive relationship between artificial intelligence, curriculum design, and the roles of teachers and learners in shaping the learning gap*

Search procedures

Firstly:-Research Methodology:I dependResearcher inthe studyTo useThe descriptive approach; because it suits the nature ofResearch objectives

Research community: Students of the Faculty of Physical Education and Sports Sciences for the academic year 2025-2026

Third: Research sample: The researcher selected the research sample using the methodSimple Random ,The research sample consisted of'studentsAll'Physical Education and Sports ScienceAt the University of BaghdadFor the academic year2025-2026Because they were suitable for the nature and objectives of the study. The total sample size was [missing information].For the community (400) student The basic sample (200) students asA pilot sample consisting of (50) students, used for the purpose of verifyingPhrases andclarityAnd he understoodTool paragraphs and property calculationPsychometric'she has,As shown in the table below.

Table 1. *shows the research population, the pilot study, and the research sample*

Research community	Exploratory experiment	Percentage	Research sample	Percentage
400	50	12.5%	200	50%

Statistical methods

The researcher usedfrom Statistical Portfolio CommandsSuitable for natureSearchIts objectives for analysisaccuracyData, usingThis is amazingStatistical portfolio(SPSS), and these methods were represented by the following:
arithmetic mean (Mean).-standard deviation(Standard Deviation).-standard error(Standard Error). Frequencies and percentages. Cronbach's alpha stability coefficient(Cronbach Alpha). Pearson correlation coefficient(Pearson Correlation). K-Square Test(Chi-Square).

Exploratory experiment

The researcher distributed the scale form, consisting of 15 items, to a sample from outside the research. The total number is 50, representing 12.5%, along with the support team (Appendix 4) to determine the following:

1. The ease or difficulty of the paragraphs.
2. Time taken to answer the paragraphs.
3. The appropriate tools for filling out the form.
4. The mechanism for distributing the form.

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The scientific basis of the scale

that scaleThe AI-led learning gap in curriculum design among teachers and studentsThe researchers used the following methods: (a form to determine the validity of paragraphs from Arabic and foreign sources, a data entry form, and statistical methods specific to the study). DeterminedgaugeThe AI-led learning gap in curriculum design among teachers and students By conducting a survey of previous studiesStudy(Ahmed Ghanem, 2026)If the scale consists of (15 paragraph) The two axes are: the first axis (10 paragraphs) and the second axis (5 paragraphs).

1- The experts agree

The scale was presented to teachers and specialists to determine its validity and suitability for the study, and the scale was adopted, as shown in argument number 2.

Table 2. *shows the validity of the scale items according to the experts*

The AI-led learning gap in curriculum design among teachers and students

Paragraphs	It is suitable	%	Not suitable	%	chi value Calculated	tabulated value of ka	Significance
1	11	100%	0	0%	11		
2	11	100%	0	0%	11		
3	11	100%	0	0%	11		
4	11	100%	0	0%	11		
5	11	100%	0	0%	11		
6	10	90.90%	1	9.1%	7.36		Moral
7	10	90.90	1	9.1%	7.36		
8	9	81.80%	2	18.2%	4.45	3.84	
9	10	100%	1	9.1%	7.36		
10	11	100%	0	0%	11		
11	11	100%	0	0%	11		
12	2	18.2%	9	81.80%	7.36		
13	4	36.36%	7	63%	7.36		Immaterial
14	1	9.1%	10	90%	7.36		
15	5	45.45%	6	54.54%	5.45		

2 – **Scale Likert Scale The quintet**

The researcher used a five-point scale Likert Scale To determine the response of the study sample's estimates, the overall scale scores and their range were appropriately defined, and the arithmetic means were calculated for the five categories according to the scale.Likert ScaleAs shown in Table 3, the scale scores.

Response Options.	Very large	large	Medium	few	Very few
the weight	5	4	3	2	1

3 - **the validity of internal consistency**

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To ensure the validity of the research instrument items, the researcher calculated the correlation coefficient between each score and one of the three questionnaire axes, and the total questionnaire score, using a pilot sample of 50 students from the overall study population. This is shown in Table (3).

Table 3. *shows the internal consistency validity of the scale*

Axes	scale	Number of phrases	Stability level
the first	The role of integrating artificial intelligence	10	0.84
the second	The most prominent challenges and obstacles facing teachers when integrating artificial intelligence	5	0.87
overall scale score			0.85

It showsFrom Table (3), the values of the reliability coefficient(Cronbach's Alpha)ForAxesThe three For the scaleIt came in at a high level, ranging between (0.84-0.87),All of them are statistically significant at a significance level of 0.05, as they reachedThe overall reliability coefficient of the scale (0.85These are values that exceed the scientifically acceptable limit (0.70) according to the standardNunnally (1978),It becomes clear thatscaleEnjoyWith a high degree of internal consistency and suitability for field application..

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Results

Table 4. *The arithmetic mean and standard deviation are shown. The AI-led learning gap in curriculum design among teachers and students*

Paragraph	arithmetic mean	standard deviation	standard error
1	4.135	0.959	0.067
2	4,240	0.857	0.060
3	4.010	0.961	0.067
4	3.990	0.997	0.070
5	3.815	0.977	0.069
6	3.840	1.004	0.071
7	3.875	1.002	0.0706
8	3.770	1.030	0.072
9	3.820	1.083	0.076
10	3.845	1.070	0.075
11	3.840	1.004	0.071
12	3.875	1.002	0.070
13	3.770	1.030	0.072
14	3.820	1.083	0.076
15	4.010	0.961	0.067

Table 5. *shows the results of the arithmetic means, percentages, and frequencies for each item on the first axis scale. The role of artificial intelligence (sample = 200)*

T	Paragraphs		Very large	large	Medium	few	Very few	arithmetic mean	standard deviation	Ranks
1	Integrating artificial intelligence into curriculum design contributes to improving the quality of the educational process.	Sample 200	94	47	40	14	5	4.135	0.959	2
		%	47%	23.5 %	20%	7%	2.5 %			
2	Artificial intelligence helps develop educational content that is more relevant to students' needs.	Sample 200	95	69	26	9	1	4,240	0.857	1
		%	47.5 %	34.5 %	13%	4.5%	0.5 %			
3	The use of artificial	Sample	78	61	42	16	3	4.010	0.961	3

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	intelligence contributes to enhancing interaction between teacher and student within the classroom.	200 %	39%	30.5 %	21%	8%	1.5 %			
4	. Artificial intelligence can support the development	Sample 200 %	81 40.5 %	56 28%	44 44%	18 9%	1 0.5 %	3.990	0.997	4
5	Integrating artificial intelligence contributes to raising the efficiency	Sample 200 %	62 31%	58 29%	57 28.5%	19 9.5%	4 2%	3.815	0.977	9
6	Artificial intelligence makes it easier to accurately monitor students' progress.	Sample 200 %	67 33.5 %	56 28%	53 26.5%	21 10.5 %	3 1.5 %	3.840	1.004	8
7	Artificial intelligence enables the design of more diverse and flexible learning activities.	Sample 200 %	70 35%	51 25.5 %	50 25%	19 9.5%	10 5%	3.875	1.002	5
8	Artificial intelligence helps to take into account the individual differences	Sample 200 %	63 31.5 %	57 28.5 %	45 22.5%	25 12.5 %	10 5%	3.770	1.030	10
9	Artificial intelligence contributes to reducing the teaching load	Sample 200 %	71 35%	53 26.5 %	36 18%	29 14.5 %	11 5.5 %	3.820	1.083	7

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	on the teacher.									
10	Artificial intelligence provides analytical tools that help in making	Sample 200	73	51	41	21	14	3.845	1.070	6
		%	36.5 %	25.5 %	20.5%	10.5 %	7%			
Predicted average		3.934								
Standard deviation		0.736								
standard error		0.052								

Table No. (5) of the AI-based Learning Gap Scale in Curriculum Design for Teachers and Students. We note that the arithmetic means of the scale items All the items have high-quality means and standard deviations. The weighted mean for the entire scale is 3.934, and the standard deviation is 0.736, indicating that all items on the scale have very good values. The items are ranked from highest to lowest based on their means.

Second paragraph:- Artificial intelligence helps develop educational content that is more relevant to students' needs. If it comes in first place I obtained the highest arithmetic mean if it reached 4.240 and its standard deviation reached 0.857.The researcher attributes this to the fact that AI-assisted education fulfills learners' desires in terms of developing their educational process and enhances students' achievement of educational goals, as it aligns with the study.(Luckin, 2016) Artificial intelligence can contribute to personalizing and adapting educational content based on each learner's needs, thus enhancing learning effectiveness and increasing the achievement of educational goals. The Organisation for Economic Co-operation and Development (OECD) has also confirmed this.He also mentioned((OECD, 2020) The use of artificial intelligence in education enables the analysis of educational data and the delivery of personalized learning experiences, which enhances learner satisfaction and contributes to improving learning outcomes.From these studies and the arithmetic means of the paragraph, we interpret that the educational process supported by artificial intelligence provides educational environments capable of balancing individual differences among learners and achieving their educational goals more efficiently compared to other methods of teaching.**ParagraphFirst: Integrating artificial intelligence into curriculum design contributes to improving the quality of the educational process.**

It obtained a mean of 4.135 and a standard deviation of 0.959, ranking second, indicatingThis is based on existencedealamarkedaAmong the members of the research sample regardingThe importance and roles of intelligenceArtificial intelligence in improving curricula and teaching methodsHe confirms The researcher indicated that designing educational curricula with the help of artificial intelligence improves teachers' methods in the educational process, as this technology facilitates the creation of a learning

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environment for teachers that meets the needs of learners.(Holmes, W., Bialik, M., & Fadel, C., 2019)He emphasized that employing artificial intelligence in curriculum design allows for the customization of educational content according to students' needs, thus contributing to enhancing the quality of the educational process.(Chen, L., Xie, H., Zou, D., & Xie, H., 2020) The integration of artificial intelligence in education is not limited to interaction alone, but extends to improving curriculum design and keeping pace with individual differences..It also promotes (Luckin, 2016)and(Woolf, BP, 2020)Regarding the ability of artificial intelligence to support teachers in developing more flexible curricula that are responsive to learners' needs.. Third paragraph The use of artificial intelligence contributes to enhancing interaction between teacher and student within the classroom. It obtained a mean score of 4.010 and a standard deviation of 0.961, ranking third.The researcher believes that the success of the educational process primarily depends on communication between the teacher and the learner and their achievement of the objectives. This depends on the teacher's role in developing curricula, methods, and approaches, and the learner's role in creating a suitable learning environment.(Zawacki-Richter, O., Marín, VI, Bond, M., & Gou, 2019) The application of artificial intelligence in higher education leads to improved interaction and academic communication, which positively impacts the achievement of educational goals..He mentioned(Luckin, 2016) Artificial intelligence does not aim to replace the role of the teacher, but rather to enhance it by providing tools that help them understand the needs of learners and stimulate positive interaction within the educational environment.. ParagraphFourth: Artificial intelligence can support the development of innovative teaching strategies..I obtained a mean of 3.990 and a standard deviation of 0.997. This indicates a good degree of agreement among the research sample regarding the role of artificial intelligence in renewing teaching methods and strategies.,The researcher attributes this result to artificial intelligence.He presentsTeachers have analytical and predictive tools that help them develop strategies.theteachingtheData-based,Which works on ConsiderationIndividual differences betweenstudentsActive learning styles, such as adaptive learning, problem-based learning, and blended learning, are supported. Artificial intelligence also contributes to enhancing capabilities.teacherChoosing appropriate teaching methods and techniques, in line with curriculum objectives.The educational processModern, male(Karsenti, 2019) It affirms that artificial intelligence contributes to the development of innovative teaching strategies based on interaction and personalization, and enhances the teacher's role as a learning designer.And he mentioned(Feng & Law, 2021)The study found that artificial intelligence applications are bringing about a qualitative shift in teaching strategies, contributing to improving the quality of the educational process. In paragraph five, the seventh rank was indicated by the statement that artificial intelligence enables the design of more diverse and flexible educational activities, achieving a mean score.(3.785) and a standard deviation of (1.002), indicatingThis topresence of a degreefromAgreement of moderate to high levels by individualsSamplearoundAdwarArtificial intelligence is diversifying educational

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activities and blending them according to the needs of learners.The researcher attributes this result to the fact that artificial intelligence applications contribute to providing diverse educational activities (interactive, digital, individual, and group), offering teachers greater flexibility in creating activities that cater to individual learners' differences. They also allow learners to choose activities that align with their abilities and interests, thus enhancing learning capacity and increasing motivation. This finding is consistent with Holmes et al. (2019), who indicated that artificial intelligence supports the design of flexible and adaptive learning activities that improve learner engagement within the classroom environment. Luckin (2018) also confirmed that artificial intelligence helps build learning environments rich in diverse activities that consider different learning styles. A study by Feng & Law (2021) indicated that employing artificial intelligence in education enables the development of adaptive learning activities that contribute to enhancing learner interaction and independence. Paragraph ten ranked sixth.Artificial intelligence provides analytical tools that aid in making better educational decisions. The study achieved a mean of 3.845 and a standard deviation of 1.070. The researcher attributes this result to the fact that AI applications provide teachers and educational administrators with the ability to analyze student performance data (grades, academic excellence, student participation), track their academic progress, and predict learning difficulties. This helps in making data-driven educational decisions, whether in modifying curricula or teaching methods, to positively impact and improve the educational process. Paragraph nine: It came in seventh placeArtificial intelligence contributes to reducing the teaching load on the teacher.The researcher obtained a mean of 3.820 and a standard deviation of 1.083. The researcher confirms that modern technologies, including artificial intelligence, have positive roles in the educational process by automating some teaching tasks such as preparing activities, correcting assignments, and analyzing student results. This allows teachers to dedicate more time and effort to the educational and interactive aspects of the classroom.Paragraph six: It came in eighth placeArtificial intelligence makes it easier to accurately monitor students' progress.If you obtained a mean of 3.840 and a standard deviation of 1.004, the fifth item ranked ninth.Integrating artificial intelligence contributes to raising the efficiency and professionalism of teachers.The arithmetic mean was 3.815 and the standard deviation was 0.977. Paragraph eight ranked tenth.Artificial intelligence helps to take into account the individual differences between learners. I obtained a mean score of 3.770 and a standard deviation of 1.030. The researcher attributes this result to the fact that artificial intelligence software relies on analyzing data about learners and their learning patterns. This highlights the provision of educational content, activities, methods, and teaching approaches that align with learners' abilities, aptitudes, and interests, and is consistent with the principle of considering individual differences, which is one of the modern educational foundations in designing any educational curriculum. This result is consistent with what he indicated. Luckin et al. (2016) demonstrated that artificial intelligence (AI) is an effective tool for personalizing learning according to each learner's characteristics, thus contributing

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to improved learning outcomes. Holmes et al. (2019) also confirmed that intelligent learning systems help support individual differences within the classroom by providing flexible and adaptive learning pathways. Furthermore, Zawacki-Richter et al. (2019) indicated that AI applications in higher education contribute to enhancing personalized learning, taking into account the individual differences among students.

Table 6. *shows the main challenges and obstacles facing teachers when integrating artificial intelligence. Sample: 200*

T	Paragraphs		Very large	large	Medium	few	Very few	arithmetic mean	standard deviation	Ranks
1	**Strengthening partnerships between schools, universities, and research centers to develop innovative educational applications.**	**Sample** 200	**94**	**47**	**40**	**14**	**5**	4.115	0.959	2
		%	**47%**	**23.5 %**	**20%**	**7%**	**2.5%**			
2	**The need to provide specialized training programs for teachers on artificial intelligence**	**Sample** 200	**95**	**69**	**26**	**9**	**1**	4.132	0.857	1
		%	**47.5%**	**34.5 %**	**13%**	**4.5 %**	**0.5%**			
3	**Developing digital curricula that take into account the practical integration of artificial intelligence tools.**	**Sample** 200	**78**	**61**	**42**	**16**	**3**	4.011	0.961	3
		%	**39%**	**30.5 %**	**21%**	**8%**	**1.5%**			
4	**Organizing regular workshops and seminars to spread the culture of artificial**	**Sample** 200	**81**	**56**	**44**	**18**	**1**	3.990	0.997	4
		%	**40.5%**	**28%**	**44%**	**9%**	**0.5%**			
5	**Allocating a separate budget to support the application of artificial intelligence in educational curricula**	**Sample**	62	**58**	**57**	**19**	**4**	3.815	0.977	5
Predicted average		3.4022								
standard deviation		0.9502								
standard error		0.115								

From Table No. (6) For measuring the learning gap based on artificial intelligence in curriculum design for teachers and studentsThe focus is on the most prominent challenges and obstacles that teachers face when integrating artificial intelligence.

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The arithmetic means of the scale items They all have high quality in terms of arithmetic means and standard deviation, if the weighted arithmetic mean of the scale as a whole reaches 3.4022The standard deviation for the scale as a whole was 09502This indicates that all items on the scale have very good values. The items were ranked according to their mean scores, from highest to lowest.

The second paragraph came in the first order:The need to provide specialized training programs for teachers on artificial intelligence received the highest average rating.4.With a score of 132 and a standard deviation of 0.857, providing training programs, workshops, and academic lectures on artificial intelligence technologies equips learners with the experience and knowledge necessary for their development, facilitates their effective use of these programs, and presents them to learners in the best possible way. The second-ranked program came in first place.Strengthening partnerships between schools, universities, and research centers to develop innovative educational applications, which received a mean of 4.115 and a standard deviation of 0.959, indicates that...High agreement among members of the research sample regardingimportancecooperationInstitutionsIn support of employmentTechnologies AI in the educational process,The researcher attributes this result to the fact thatcooperationEducationaland scientificAmong educational and research institutions, it contributes todevelopment (Experiences and knowledge)and providingenvironmentExperimental development of educational applications based onAI, which is reflectedWith positive development towardsImproving the quality of educational curriculaAnd showingModern teaching methods and techniquesIt contributes to meetingLearner requirements. AlsoThis collaboration allows forLinking theory with practical application, and enhancingthought andEducational development based on scientific research,This result is consistent with what he indicated. OECD (2021)Collaboration between educational institutions, universities, and research centers is a key factor in developing educational innovation based on smart technologies. UNESCO reports (2019) also confirmed that research partnerships contribute to accelerating the development of innovative educational applications and enhancing the effectiveness of using artificial intelligence in education. Holmes et al. (2019) indicated that innovation in AI-based education depends largely on collaboration between educational practitioners, researchers, and policymakers. The third point, ranked third, is: Developing digital curricula that practically integrate AI tools. The study obtained a mean of 4.011 and a standard deviation of 0.961, indicating a relatively high level of agreement among the research sample.,The researcher attributes this result to the digital curricula that employ Tools AI that It contributes to updating educational content and linking it.These technologies with applicationsThe process, and providingan environment withInteractive learning that is compatible withneedsModern education, which isIt aims atThe educational process, and this result is consistent with what he indicated.Holmes et al. (2019)Integrating artificial intelligence into digital curricula is a cornerstone of educational development,

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providing opportunities for adaptive and interactive learning. UNESCO (2019) also affirmed that developing AI-based digital curricula is a pivotal step towards improving the quality of education and keeping pace with digital transformations. The fourth item ranked fourth: organizing periodic workshops and seminars to spread the culture of artificial intelligence among teachers and students. The arithmetic mean for the item was 3.990 and the standard deviation was 0.997, indicating a good consensus on the importance of building cognitive and professional awareness of AI culture..This is explained by the successThese applications and technologies AI in education is not shortens Only on availability These requirements Rather, it requires Continuous and intensive development for teachers and learners, This knowledge provides themUnderstanding the mechanisms for employing them in a correct educational manner, and this result is supported by what the reports have confirmed.OECD (2021)Developing digital skills and disseminating an AI culture through continuous training is a prerequisite for ensuring the effective use of modern technologies in education. Karsenti (2019) also indicated that preparing and training teachers in AI technologies contributes to improving their teaching practices and enhancing their receptiveness to educational innovation. The fifth point, ranked fifth, was: allocating a separate budget to support the application of AI in educational curricula. Its arithmetic mean was 3.815 and its standard deviation was 0.997, reflecting a high degree of agreement.Average and somewhat trending upwardsThe researcher attributes this result to the fact that learners It may not They see The financial and administrative aspects directly impacted the process, despite their significant importance in supporting sustainability.AI in Education,This result is consistent with what he indicated.OECD (2020)While providing the necessary funding and technological infrastructure is crucial for the success of AI initiatives in education, its impact is often indirect from the learners' perspective. UNESCO (2021) also emphasized that the lack of sustained financial support can be a major obstacle to the mainstreaming of AI applications in educational curricula.

Conclusions

The study reached a number of conclusions and it:

thereA learning gap exists between classroom education and AI-based education among students in faculties of physical education and sports science..ContributesUseatArtificial intelligence technologies in improvingQualityQuality of the educational process and development of educational curriculum design.ContributesArtificial intelligence in taking into account individual differences betweenstudentsBy providing educational contentharmoniousWith needsstudents.EnhancesArtificial intelligence analytical toolsminute The teacher meetsIn monitoring student progress and diagnosing learning difficulties more accuratelyThere is a groupFactorsAmong the challenges facingEmpowerment and employmentArtificial intelligence in education, among the most prominent she Inadequate training for some teachers and few Skills and Technical capabilities.

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Recommendations

In light of the study's findings, the researcher recommends the following: activationWorkshops, courses and programmesTraining for teachers and learnersHelpIn developmentSkillsIn the use of artificial intelligence technologies in education.SupportEmploying artificial intelligence in the educational process to contribute to improvementandAchieving educational goals and taking into account individual differences betweenstudents.mixArtificial intelligence applications inInnovationRandDesigning and developing educational curricula throughProgramming and preparationModern digital curricula that support interactive and adaptive learningandDeveloping the professional competence of teachers in the field of artificial intelligence through organizing specialized training courses and workshops..Seeking helpArtificial intelligence technologies in supporting decision-makingand developmentEducational decisions through data analysisStudents and their learningDiagnosing learning difficulties. Strengthening cooperationSubscriberBetween educational institutions, universities and research centersAndScientific؛To supportinnovation educationBased onApplicationsFor artificial intelligence and providing supportTechnical, programming, and engineeringNecessary.

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The impact of metacognitive strategy on positive thinking and developing some complex football skills for students

Mohammed Katea Mohsen[1] ،Rafid Ali Dawood.[2] Maytham Habib Subhan[3]

[1,2,3] University of Baghdad, College of Physical Education and Sport Sciences.

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Abstract

The aim of the research was to prepare educational units using the meta-cognitive strategy in positive thinking and cognitive achievement and developing some complex skills in football for students, prepare two scales of positive thinking in football for students, identify the effectiveness of educational units using positive thinking and developing some complex skills in football for students, the researchers used the experimental method by designing the experimental and control groups to suit the nature of the problem. The community of students of the Secondary School for Sports Sciences affiliated to the General Directorate of Education in Rusafa II was identified, numbering (90) students, and the sample members were selected with a number of (90) students, i.e. (72.222%) of the research community, and the research sample was divided into a sample to prepare the scale under study, numbering (35) students, and the main experiment sample, numbering (20) students with a single experimental group system, and the number of the control group was also (20) students, and the number of the exploratory experiment group was (5) students, and (5) students were excluded for not committing. The researchers adopted the (Mahmoud, 2015) scale for positive thinking (appendix), as the scale consists of (23) statements, and the scale was corrected according to two answer alternatives, (A, B). After that, the exploratory experiment was used, which is considered "practical training for the researcher to identify the difficulties he encounters during the test to avoid them in the future" (Al-Shawk and Al-Kubaisi, 2004, p. 91). Therefore, the researcher conducted an exploratory experiment on (10/1/2025) on the exploratory experiment sample of (5) students. After that, the researchers conducted the pre-tests for the research sample, and then the main experiment was applied, followed by the post-tests. After that, the data for

[1] Mohammed Katea Mohsen,
mohammed.gatie2204p@cope.uobaghdad.edu.iq.
[2] Rafid Ali Dawood
rafid.a@cope.uobaghdad.edu.iq
[3] Maytham Habib Subhan
maytham@cope.uobaghdad.edu.iq

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the pre- and post-tests for the experimental group were transcribed by the researchers, and statistically processed, and the results were obtained.

Keywords: (meta-cognitive strategy, positive thinking, complex football skills for students).

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Introduction

Fast changes and technological progression in the world today have impacted education in general and physical education in specific. Success in teaching, mastering it, and achieving the goals should be organized with meticulous planning. Teachers must have a wide understanding of all its various aspects. General education, examinations, and curriculum are a system, and the classroom environment is a system. So the school is part of the educational system established by society to help students socially and make them useful members of society. teaching process has become a system for developing a plan to invest in learning and the interconnected relationships within it, to motivate students to respond in specific situations to have particular experiences and interconnected, organized skills to achieve particular goals according to a structured scientific plan. Physical education curriculum is not just about imparting information to students. Today, they require planning and studying students' readiness and abilities for scientific thinking, as well as inducing appropriate changes in student behavior. The term "metacognition" is used to refer to knowledge related to knowledge itself, or to the very concept of science. Metacognition can be defined as the study or examination of the processes and structures that constitute knowledge and understanding. In social sciences and information science, the term refers to the higher study of how knowledge is formed and transferred, and how it can be improved. Metacognition may relate to questions of how we know, how knowledge is organized, and how knowledge influences behavior and decision-making. It can also refer to issues like how information is categorized and how performance on cognitive tasks can be improved. In the field of information technology, metacognition can include the study of how knowledge is organized and used in intelligent systems, such as content management systems, artificial intelligence, and data analytics. In general, metacognition is a term that depends on a deep understanding of leveraging and improving knowledge to enhance the performance of individuals and systems in sport.

For all the progress in teaching methods in physical education and sports science, the teaching practices still rely on traditional, rote-learning methods that directly transmit knowledge, far from modern strategies that depend on the student as the central player in the learning process. This led to a weakness in students' positive thinking skills development and a limited ability to develop complex football skills. Many educators suffer from paying attention to students' individual characteristics, failing to consider differences in abilities, interests, and motivation, and they don’t use educational opportunities and activities that contribute to the holistic development of the learner's personality. This has negatively impacted students' cognitive and skill performance, so we need effective teaching strategies like metacognitive strategies that focus on developing self-awareness of learning, improving positive thinking, and regulating self-effort during the acquisition and execution of complex football skills.

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The research aimed to develop a scale for positive thinking in football for students and prepare educational units with a metacognitive strategy in positive thinking and cognitive achievement and the development of some complex skills in football for students to identify the effectiveness of educational units using positive thinking and the development of some complex skills in football for students.

Procedure:

The nature of the problem determines the researcher's choice of the appropriate method for this problem (Raheem, Shaker, 2025, p14). The researchers used the descriptive method and the experimental method by designing experimental and control groups to suit the nature of the problem.

research community is (90) students from sport sciences school in general directorate of Education of Al-Rusafa II, the sample includes (65) students, representing (72.222%) of the research population. The research sample was divided into a scale development sample of (35) students, a main experiment sample of (20) students (using a single experimental group), and a pilot study group of (5) students. (5) students were rejected for non-compliance.

#	Description	Number
1	Experimental	20
2	Scale Development	35
3	pilot study	5
4	Excluded	5
5	Total	65

Table1. shows the research sample distribution

indicators	measurement	mean	SD	skewness
weight	(kg)	64.700	2.496	0.373
height	(cm)	172.900	2.601	0.136
age	(years)	17.400	0.516	0.484

Table2. shows sample homogeneity in height, weight and age

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2-1 field research procedures:

2-1-1 positive thinking scale items:

Researchers adopted (Mahmoud, 2015) scale for positive thinking (appendix), the scale consists of (23) statements, and the scale was scored according to two alternatives of the answer, (a, b).

Table3. shows positive thinking scale choice scores

type	Scores
Positive	1
Negative	0

The researchers used the statistical analysis of the scale's statements. By the statistical process, the availability of the scientific conditions for the scale is confirmed (Rahim, Shaker, 2024, page 18), which are validity and reliability.

1- Scale validity: Researchers used several types of validity tests to verify the scale:

a- face validity: presenting the scale items to a group of experts and specialists to assess their suitability for measuring the phenomenon being measured (Haider, Hazaa, 2019, p. 17). To make the scale suitable for the research, the researchers included the scale items in a survey questionnaire (Appendix 1), to obtain the agreement of the specialist experts (Appendix 2). The researchers presented the items and required a 75% agreement for an item to be accepted. All items have a 75% agreement to be accepted.

b- construct validity: This type of validity is achieved by statistical analysis of the statements (Radhi, Salah, 2023, p. 23), and the researchers verified it by extracting the following indicators:

- First: statements' discriminatory ability: the researchers adopted the two extreme groups method in calculating the statements' discriminatory ability using the (T-Test) for independent samples. Analyzing the statements is to keep the statements with high discrimination, the good statements in the scale, and experts indicate that the percentage of (27%) of the lower group and (27%) of the upper group is the best percentage, by which we obtain the highest discrimination coefficients. The (T-Test) was used to show the mean significance differences between the lower and upper groups. It was found that all statements were statistically significant at the significance level of (0.05), as shown in Table (4).

Table 4. shows the items discriminatory ability on the positive thinking scale

upper	1.0000	.00000	3.674	.005	Significant
lower	.4000	.51640			
upper	.7000	.48305	3.674	.000	Significant
lower	.0000	.00000			
upper	1.0000	.00000	4.583	.002	Significant

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lower	.4000	.51640			
upper	1.0000	.00000	4.583	.000	Significant
lower	.2000	.42164			
upper	1.0000	.00000	6.000	.002	Significant
lower	.4000	.51640			
upper	1.0000	.00000	2.449	.037	Significant
lower	.6000	.51640			
upper	.9000	.31623	9.000	.000	Significant
lower	.0000	.00000			
upper	1.0000	.00000[a]	2.449	.025	Significant
lower	1.0000	.00000[a]			
upper	.0000	.00000[a]	2.449	00.0	Significant
lower	.0000	.00000[a]			
upper	1.0000	.00000	9.000	.000	Significant
lower	.6000	.51640			
upper	1.0000	.00000	4.583	.000	Significant
lower	.6000	.51640			
upper	.9000	.31623	3.000	.008	Significant
lower	.0000	.00000			
upper	1.0000	.00000	2.449	.025	Significant
lower	.3000	.48305			
upper	.5000	.52705	3.674	0.021	Significant
lower	.0000	.00000			
upper	1.0000	.00000	4.583	.000	Significant
lower	.6000	.51640			
upper	.6000	.51640	4.583	.001	Significant
lower	.0000	.00000			
upper	1.0000	.00000	3.674	.005	Significant
lower	.3000	.48305			
upper	.7000	.48305	4.583	.001	Significant
lower	.0000	.00000			
upper	1.0000	.00000[a]	3.674	.002	Significant
lower	.0000	.00000[a]			
upper	1.0000	.00000	9.000	.000	Significant
lower	.4000	.51640			
upper	.7000	.48305	4.583	.000	Significant
lower	.0000	.00000			
upper	1.0000	.00000	3.000	.001	Significant
lower	.4000	.51640			

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upper	1.0000	.00000	2.449	.005	Significant
lower	1.0000	.00000			

Significant < (0.05)

- Second: Internal consistency coefficient: This aims to verify the homogeneity and coherence of the statements in the study of the phenomenon under investigation and verify the validity of the scale using the internal consistency coefficient. The researchers identify the correlation between the score of each scale statement and the total scale score using Pearson's simple correlation coefficient. All correlations were found to be significant because they were below the significance level of (0.05), as shown in Table (5).

Table 5. shows the internal consistency coefficient of the positive thinking scale

#	Pearson's simple	Sig	Significance
.1	-.542**	.001	Significant
.2	-.441**	.008	Significant
.3	-.682**	.000	Significant
.4	-.562**	.000	Significant
.5	-.742**	.000	Significant
.6	-.699**	.000	Significant
.7	-.466**	.005	Significant
.8	-.355*	.036	Significant
.9	-.431**	.010	Significant
.10	-.631**	.000	Significant
.11	-.631**	.000	Significant
.12	-.504**	.002	Significant
.13	-.699**	.000	Significant
.14	-.726**	.000	Significant
.15	-.596**	.000	Significant
.16	-.504**	.002	Significant
.17	-.665**	.000	Significant
.18	-.677**	.000	Significant
.19	-.813**	.000	Significant
.20	-.758**	.000	Significant
.21	-.677**	.000	Significant
.22	-.539**	.001	Significant
.23	.504**	.002	Significant

Significant < (0.05)

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2- Scale reliability: Cronbach's alpha coefficient used via (SPSS). A good scale is one that is reliable (Khlaifawi, 2024, p. 25). The reliability coefficient was found to be 0.937, which is considered a high value for reliability at a significance level of 0.05.

2-1-2 Complex football tests:

The first Complex skill test (Aloun, 2015, p. 77) measures the following Complex skill performance in football: (passing, receiving in a confined space with quick turns, sprinting with the ball followed by passing and receiving, and shooting accuracy). The second Complex skill test (Aloun, 2015, p. 79) measures the following Complex skill performance in football: (running and ball control, speed of change of direction, and shooting accuracy). The third Complex skill test (Aloun, 2015, p. 80) measures the following Complex skill performance in football: (passing and receiving, quick turns in a confined space, and shooting accuracy towards a divided goal).

2-1-3 pilot study:

pilot study considered "practical training for the researcher to personally identify the difficulties encountered during the test to avoid them in the future" (Al-Shouk & Al-Kubaisi, 2004, p. 91). Researchers conducted a pilot study on January 10, 2025, on a sample of five students to be able to.

1- Identify the validity of the tests that were used in the research.
2- Identify the problems and obstacles that the sample may face during the tests.
3- Identify the validity of the equipment and instruments used in the testing.
4- Identify the time required to perform each test.
5- Identify the competence of the support team.

2-1-4 pre-tests:

Researchers conducted the pre-tests within two days. First day (Tuesday) (1/14/2025) included (presenting of positive scale questionnaire), second day (Wednesday) (1/15/2025) included (complex skills tests), with the support team.

2-1-5 educational program:

Metacognitive strategies are effective educational strategies that aim to empower learners to deal with their own learning processes by becoming aware of their thinking patterns and adapting them to the requirements of the educational or training situation. These strategies help learners plan ahead, self-monitor during performance, and self-evaluate afterward. Depending on this principle, this educational program was designed to develop positive thinking and specific complex football skills in students. The program ran for three months, from February 2, 2025, to May 3, 2025, with three training sessions per week, totaling 36 sessions, each lasting 90 minutes. program was built on three main phases: the preparation and orientation phase, which aimed to promoting positive thinking, build motivation to learn, and cultivate self-awareness and an understanding of the program's objectives; the learning and application phase, which focused on developing students' complex skill performance by integrating skills like passing, movement, creating

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space, receiving, dribbling, finishing, and complex defense, also training them in higher-order thinking strategies such as planning, decision-making, self-monitoring, evaluation, and reflective thinking; and finally, the assessment and consolidation phase, that aimed to reinforce self-learning and solidify the acquired cognitive, skill-based, and affective skills. The program relies on a balanced time allocation between the cognitive and skill-based aspects in each unit, incorporating educational activities that promote reflective thinking skills through the use of mind maps, exploratory questions, group discussions, and self-assessment cards. Thus, the program not only aims to improve students' skill performance but also to cultivate thoughtful players capable of planning, making appropriate decisions in changing game situations, self-evaluating their performance, developing self-confidence, and fostering positive attitudes toward learning and playing, which positively impacts both their athletic and personal development.

2-1-6 post-tests:

After finishing the main experiment, the post-tests were conducted for the research sample in two days. The first day (Sunday) corresponding to (4/5/2025) included (presenting the positive scale questionnaire), and the second day (Monday) corresponding to (5/5/2025) included (complex skills tests, performance endurance test), in order to reach accurate results, as "one of the most important ways to know the quality is to conduct tests to ensure the validity of the educational program" (Qasim Lazam and others, 2005, 156). The implementation procedures were adopted by the same initial support staff who conducted the pre-tests, and the same procedures were adopted in terms of time, place, tools used, and preparing all the conditions surrounding the pre-tests, in order to avoid variables that could affect the results of the post-tests.

2-2 Statistics:

The researcher used (SPSS):

- Mean.
- Standard deviation (SD).
- Skewness.
- Cronbach's alpha.
- Independent samples t-test.
- Dependent samples t-test.
- Pearson correlation.

3-Results:

The researchers processed the data for the pre- and post-tests of the experimental group and analyzed it statistically, the results shown in Table (6).

Table 6. shows the means, deviations, (t) values, and the significance of the post-tests and pre-tests for the experimental group

Variables	measurement	group	mean	SD	T	Significance
Positive thinking	Degree	Pre-test	12.100	1.682	22.015	0.000

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		post-tests	17.300	1.490		
Test 1	Second	Pre-test	17.620	1.635	7.538	0.000
		post-tests	14.600	1.635		
Test 2	Second	Pre-test	18.335	1.252	15.603	0.000
		post-tests	15.030	1.138		
Test 3	Second	Pre-test	55.790	2.609	25.229	0.000
		post-tests	44.355	3.156		

Significant < (0.05) freedom degree (19)

4-Discussion

From table (6), using the t-test for paired samples, the significance value (0.000) is less than (0.05) at 19 degrees of freedom, there is a statistically significant difference for the post-test.

The results of the experimental group between the pre- and post-tests showed a significant and noticeable improvement in the variables of positive thinking, cognitive, and complex football skills development. This improvement reflects the effectiveness of the educational programs by using the metacognitive strategy. This improvement is attributed to the fact that this strategy helps learners to organize their thought processes and developing their abilities in planning, self-monitoring, and self-evaluation, lead them to a qualitative transformed in their thinking and learning style, that is positively reflected in their cognitive and skill levels.

In positive thinking, metacognitive activities, such as self-reflection, asking questions, and using thought cards, helped improve students' self-perception and confidence in their ability to face challenges within the educational and athletic context. This is matching with (Hughes et al. 2019, p. 305), that applying metacognitive thinking strategies contributes to building positive attitudes among learners and boost levels of self-motivation and effective engagement in learning tasks. And in cognitive achievement, integrating metacognitive processes like learning planning, monitoring comprehension within activities, and self-assessment after task completion helped to improving students' ability to understand theoretical and tactical expressions related to football. Flavell (1979, p. 906) confirmed that learners who use metacognitive strategies have a greater ability to organize their information, connect between concepts, and understand complex concepts deeply, which is reflected in their higher levels of cognitive achievement. And in complex football skills, focusing on conscious thinking within performance has improved the quality of execution of complex technical and tactical skills. Students have become more

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capable of reading situations, planning their next move, and making accurate decisions during play. Abdelghani Abdelaziz (2006, p. 98) point to that integrating cognitive and skill processes by reflective thinking training is one of the most effective methods for developing athletic performance, especially in team sports that require quick decision-making and multiple solutions within a single situation. This matches what Abdel Hamid (2005, p. 77) says: that educational programs with organized thinking and self-monitoring lead to improve technical and physical performance. These programs lead learners to develop creative solutions during skill performance, thus enhancing technical competence and intelligent responses to changing situations on the field. These results confirm that the use of the metacognitive strategy under the researcher's supervision contributed significantly to improve in the intellectual, cognitive, and skills levels of the experimental group. The benefits extended beyond skill improvement to include improved thinking quality, increased self-awareness, and the ability to organize learning and performance processes independently and effectively (Alhussin, 2025, p. 19).

5-Conclusions

1. The study results confirmed that using the metacognitive strategy represents an effective educational approach in developing positive thinking among students. This strategy contributed to enhancing self-awareness, self-regulation skills, and flexibility in facing educational and athletic situations, which in turn boosted students' confidence in their abilities and developed their psychological attitudes toward learning and training.
2. The results showed that students who participated in the metacognitive-based educational program achieved tangible cognitive development that went beyond passively receiving information. They became more capable of organizing knowledge, understanding relationships between concepts, connecting different situations, and making conscious decisions, which supports their future academic and professional development.
3. The study indicated that complex skills in football require not only physical or technical training but also, to a greater extent, parallel cognitive training. The ability to read game situations, plan movement, and make quick decisions are a mental processes closely linked to effective skill performance.
4. The results demonstrate that training programs based on advanced knowledge, such as metacognition, not only contribute to improve on-field performance but also extend their impact to enhancing the quality of self-directed learning, self-reliance, and problem-solving skills in various educational and life contexts.
5. The results reinforce the modern educational trend that effective education in the sports field should be holistic and integrated, aiming to develop cognitive, skill-based, and affective abilities simultaneously, rather than focusing solely on skill development.

6-Recommendations

1. School and sports institute administrations must create supportive learning environments that foster positive thinking by providing spaces for discussion, reflective thinking, and self-assessment within physical education classes.

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2. Encourage researchers to conduct follow-up studies to examine the impact of metacognition on other variables such as emotional intelligence, critical thinking, creative thinking, mathematical problem-solving, and psychological adjustment among athletes.
3. Proposed developing an educational metacognition model to suit the specific characteristics of different sports (team and individual).
4. Integrated cognitive training methods should be adopted within sports clubs and schools. Training should not be limited to physical and skill-based aspects but should also include training athletes in conscious thinking, self-monitoring, and independent decision-making during performance.
5. Developing specialized training packages for physical education teachers and coaches, including tools for practically applying metacognitive strategies in the sports field.
6. Design an educational and training activities that mixed with mind maps, thinking cards, self-assessment questions, and interactive digital platforms to enhance metacognitive thinking among learners and athletes.

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The effectiveness of an educational model based on video self-observation and guided feedback in learning and retaining basic skills among young gymnasts

Prof. Dr. Mohammed Mohammed Abdulaziz Ahmed[1], Dr. Mohammed bin Issa Al-Saeed[2]
[1,2,] College of Sport Sciences and Physical Activity – King Saud University.

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Abstract

This study aimed to investigate the effectiveness of an integrated instructional model based on visual modeling, video-based self-observation, guided feedback, and an externally focused attention framework on learning and retaining fundamental gymnastics skills among young gymnasts compared with the traditional teaching method. A quasi-experimental design with two groups (experimental and control) was employed. The sample consisted of 40 young gymnasts aged 8–10 years from a sports academy in Riyadh, randomly assigned into two equivalent groups (20 participants each).

The instructional program was implemented over eight weeks, with two training sessions per week, each lasting 90 minutes, according to a protocol that included warm-up, video demonstration, part-to-whole guided practical training, self-observation through video analysis, followed by re-application and applied play. Performance was evaluated in five fundamental skills (forward roll, backward roll, handstand, front balance, and cartwheel) using a validated skill performance rating form. Measurements were conducted at three stages: pre-test, post-test, and a retention test four weeks later. Data were analyzed using t-tests, repeated-measures ANOVA, and effect size indicators (Cohen's d, partial η^2).

The results revealed equivalence between the two groups at the pre-test stage, followed by statistically significant superiority of the experimental group in both the post-test and retention test, with very large effect sizes. The experimental group showed big improvement between the pre- and post-tests and maintained nearly the same performance level in the retention test, whereas the control group exhibited only limited improvement and partial skill loss.

[1] Professor of Biomechanics and Movement Analysis, Department of Biomechanics and Motor Behavior – College of Sport Sciences and Physical Activity – King Saud University
mahmed2@ksu.edu.sa
[2] Associate Professor of Motor Learning, Department of Biomechanics and Motor Behavior – College of Sport Sciences and Physical Activity – King Saud University
mialsaeed@ksu.edu.sa

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The study concludes that the integrated instructional model based on video self-observation and guided feedback is more effective than the traditional method in accelerating the acquisition of fundamental gymnastics skills, improving performance quality, and enhancing short-term learning retention among young gymnasts. Accordingly, the study recommends adopting this model in gymnastics teaching programs and sport science curricula.

Keywords: **Learning**, **feedback**, **young gymnasts**.

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Introduction:

Gymnastics is one of the most important individual sports that requires a unique integration between physical abilities, fine motor skills, body awareness, and mental discipline, where coordination between strength, flexibility, balance, and neuromuscular control (Schmidt & Lee, 2019). The basic skills in gymnastics are highly specific in terms of their complex motor structure, precision of execution, and the need for gradual learning based on the principles of motor learning and neuromuscular adaptation. This makes it an important field of research, which is reflected in the development of teachers' and coaches' skills in gymnastics and is evident in effective teaching methods and constructive feedback in different learning environments. Studies have shown that traditional teaching methods based on repetition and direct demonstration may not be sufficient to impart the required motor skills in gymnastics, especially given the variation in motor abilities among students (Sadowski et al., 2013). These methods do not use an interactive learning environment that helps the learner to observe themselves and analyze their performance, and interact with the movement model according to their individual characteristics. so, it become necessary to find more comprehensive and flexible modern educational models that care about learner's characteristics and encourage their active participation in the learning process. designing educational models (Instructional Design Models) are the most important trends in developing sports education and training. These models help mix up of motor learning principles with modern educational technology, to guaranty the transfer of knowledge to real performance situations (Amri-Dardari et al., 2022). An educational model is not just a teaching plan, it is complete system including objectives, content, strategies, assessment, the learning environment, and feedback. Several models developed in this field, such as Gagnes' Events of Instruction model, Merrill's Principles of Instruction model, and Dick and Carey's model, all of it confirms the importance of a gradual learning process, from understanding to application, and from repetition to mastery. In sports science field, advanced educational models such as (Teaching Games for Understanding, Nonlinear Pedagogy, and Hybrid Models) represent a scientific way that seeks to merge cognitive, emotional, and motor aspects into the learning process (Harvey et al., 2020). The results of many studies shows that integrated models that rely on visual feedback, video analysis, external attention, and the use of three-dimensional motion simulation significantly improve the technical performance of young gymnasts (Sigrist et al., 2013; Wulf & Lewthwaite, 2016). According to these data, gymnastics education is not only a skill acquisition process, but it is a cognitive-perceptual-motor system that requires the activation of visual perception processes, movement mental representation, and motor control. So, designing an integrated educational model that takes into account the sequence of sensory stimuli, instant feedback, and the gradation of difficulty can make a qualitative shift in learning gymnastics basic skills such as: handstands, forward and backward rolls, jumping, balancing on the bar, and safe landing. Many studies also confirm that mixing digital technology into gymnastics education is a promising trend in modern motor

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learning, as e-learning environments and analytical video help the student to self-review, compare with the ideal model, and identify errors with high temporal and spatial accuracy (Farouk et al., 2021). Therefore, designing an interactive digital learning model based on video and instant feedback can improves the process of skill retention and transfer to new situations, which will positively impact the quality of motor education in sports science colleges. Recent studies have shown that the use of analytical video and visual feedback is clearly superior to traditional methods in improving motor performance accuracy and learner motivation (Bouzid et al., 2025). Interactive digital media also proven effective in increasing engagement and attention among young gymnasts (Petrusic et al., 2022). Self-observation studies confirmed that showing a learner's previous best performance helps to improved balance, accuracy, and skill retention (Ginsburgh et al., 2017; Ste-Marie et al., 2011, 2012). Studies have also shown that external attention is superior to internal attention in learning and maintaining balance skills (Chiviacowsky & Wulf, 2015). Analytical reviews shown that visual feedback, especially slow-motion video, is most effective for complex skills like gymnastics (Sigrist et al., 2013). Studies also confirmed that a mixed feedback pattern (correction + reinforcement) is the most efficient for motor learning (Niznikowski et al., 2012) practical studies shows that using video modeling, showed a significant improvement in the quality of technical performance and skill retention (Boyer et al., 2009). Arab studies have also confirmed the effectiveness of active learning and practical application compared to direct instruction (Qutb et al., 2020). And the importance of scheduling training programs to improve learning outcomes (Mahmoud Bilal, 2015). According to these findings, the research utilizes these results to develop an integrated educational model based on video, self-observation, guided feedback, and external attention to improve the learning and retention of gymnastics skills. Many studies have explored educational use of modeling and multimedia feedback, that proof its effectiveness in developing students' acquisition of physical skills in sports science subjects (Musleh, 2020; Al-Zahrani, 2018; Al-Dossari, 2021). These studies indicate that modern models not only demonstrate the skill but also involve the student in understanding its mechanical, kinematic, and physiological stages, which enhances the student's ability to analyze and self-modify performance. the study responds to the scientific need for a modern educational model for teaching basic gymnastics skills, that depend on the scientific principles of motor learning, cognitive information processing theories, and digital visual modeling, and aims to develop the performance of young gymnasts and achieve more stability learning. study also analyze the impact of this model on various learning variables, such as acquisition speed, performance quality, and skill retention, compared to traditional direct learning.

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Research Problem:

despite the variety of motor learning methods used in teaching gymnastics skills, slow skill acquisition and poor retention are still noticed in young athletes when using traditional methods based on verbal explanation and direct demonstration, especially with basic complex skills. Studies show that using visual video modeling, self-observation, and guided feedback can improve the quality of motor learning. but most studies take each element without linking it to objective measurements of short-term skill retention. The research gap is the lack of integrated educational models that combine self-observation video, perfect modeling, and externally focused guided feedback within experimental framework can measure the effect of such a model on learning and retaining basics gymnastics skills compared to the traditional method.

Research goals:

1. identify the effect of the proposed educational model compared with traditional method on improving the performance level of basic gymnastics skills among the participants.
2. identify the effect of the model on the retention of basic skills after 4 weeks.
3. identify the effect of the educational model on learning and retaining basic gymnastics skills.

Research Hypotheses:

1. There are statistically significant differences between the mean scores of the experimental and control groups in the post-test of basic gymnastics skills performance, favoring the experimental group.
2. There are statistically significant differences between the mean scores of the experimental and control groups in the retention test after 4 weeks from the end of the program, in terms of skill performance level for basic gymnastics skills, in favor of the experimental group.
3. There are statistically significant differences between the mean scores of the experimental group in the pre-test and post-test of basic gymnastics skills performance, in favor of the post-test.
4. 4. There are differences in favor of the effect sizes of the educational model, which are large values, indicating a strong actual effect of the model on learning and retaining basic gymnastics skill.

Procedure:

- Research Methodology:

the experimental method with a two-group model: an experimental group receiving the integrated educational model, and a control group receiving the existing traditional education used in this study.

- Study Sample:

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study sample consists of (40) young gymnasts, selected purposively from sports academies in Riyadh, aged (8-10) years, and randomly divided equally into two groups (20 young gymnasts in each group).

First, Equivalence between the two groups in physical characteristics:

To ensure the validity of the experimental results and the possibility of attributing next differences to the effect of the educational program used, pre-equality between the experimental and control groups was verified in both physical and physiological characteristics using the independent samples t-test. This was done on the sample of young gymnasts (8-10 years old), as shown in Table (1).

Table1. (t) test results for pre-equivalence between the experimental and control groups in the physical and physiological variables of junior gymnasts (8–10 years old)

variable	experimental (M ± SD)	control (M ± SD)	t	df	significance
Age (years)	9.10 ± 0.60	9.10 ± 0.50	0.00	36.80	unsignificant
Height (cm)	134.20 ± 6.10	133.70 ± 6.40	0.25	37.91	unsignificant
Mass (kg)	31.40 ± 4.20	31.10 ± 4.60	0.22	37.69	unsignificant
BMI (kg/m²)	17.40 ± 1.50	17.30 ± 1.60	0.20	37.84	unsignificant
Standing Broad Jump (cm)	146 ± 18	145 ± 19	0.17	37.89	unsignificant
Medicine Ball Throw (m)	3.60 ± 0.50	3.50 ± 0.60	0.57	36.80	unsignificant
Grip Strength (kg)	16.20 ± 3.10	15.90 ± 3.00	0.31	37.96	unsignificant
20m Sprint (s)	4.78 ± 0.29	4.81 ± 0.31	-0.32	37.83	unsignificant
4x10m Shuttle Run (s)	13.20 ± 0.60	13.30 ± 0.70	-0.49	37.13	unsignificant
Flexibility (Sit & Reach) (cm)	20.40 ± 5.10	19.80 ± 5.30	0.36	37.94	unsignificant
Plank Stability (s)	58 ± 18	56 ± 17	0.36	37.88	unsignificant

The results in Table (1) shows that all statistical significance (p) values for comparisons between the experimental and control groups in the anthropometric variables (age, height, mass, and BMI) and physical variables (explosive power, arm strength, grip strength, speed, agility, flexibility, and trunk strength) were not statistically significant ($p > 0.05$), which means no significant differences between the two groups before using the

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program. the close convergence of means and standard deviations shows a high degree of homogeneity and pre-equivalence in the physical and anthropometric characteristics associated with the performance requirements of gymnastics for this age group. This result confirms the internal validity of the study, allowing any subsequent differences in post-measurements to be attributed to the educational program's effect rather than to initial differences between the two groups.

Tools:

First, performance evaluation form design:

A standardized skills evaluation form was designed for the basic gymnastics' skills (forward roll, backward roll, handstand, front balance, and sideways somersault) on a scale of (0–100) based on a documented judging framework and using international judging rules. The form was presented to accredited judges to verify its validity and reliability, and the results are shown in Table (2).

Table2. statistical coefficients of the skill performance evaluation form in basic gymnastics skills (validity and reliability)

skill	validity Index	referees' agreement percentage	internal consistency	Overall evaluation
forward roll	0.89	0.78	0.88	Acceptable – High stability
backward roll	0.91	0.82	0.86	Acceptable – High stability
handstand	0.93	0.85	0.91	Acceptable – High stability
front balance	0.88	0.76	0.87	Acceptable – High stability
sideways somersault	0.92	0.81	0.89	Acceptable – High stability
overall average	0.91	0.80	0.88	Excellent validity and reliability

The statistical analysis of the skill performance assessment form refers to high degree of validity and reliability. Content validity coefficients ranged from 0.88 to 0.93, values exceeding the scientifically acceptable threshold. The judges' agreement on the importance of the items also demonstrated a good level of judge acceptance. average of internal consistency ($\alpha = 0.88$) in the excellent reliability range, reflecting the homogeneity of the items and their ability to measure a single skill structure accurately. form's suitability for using in the scientific and practical evaluation of basic gymnastics skills confidently confirmed by the results.

Second, scientific standards and principles for designing the educational program:

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The educational program designed according to the principles of motor learning and theories of cognitive processing, and modern educational design models in sports science. The program depends on an integrated educational model that mixed visual modeling, video self-observation, guided feedback, and external attention as un important basics for effective motor learning. Using a short video showing for an ideal perfect performance model at the beginning for each unit to make a clear mental image of the skill. Appling self-observation after each training set to improve motor cognitive and self-correction. Feedback was provided at a standardized rate (20%) according to the Bandwidth Feedback model to reduce dependence on the instructor. The program relied on external attention to improve balance, force regulation, and reduce small errors. The gradual progression in learning skills was also considered, from segmentation to integration to automated performance. this perfect design helps to improve the quality of motor acquisition and increasing the level of long-term skill retention.

Third, educational program time line:

according to a time plan educational program organized within 8 weeks to account the gradual progression from learning basic skills individually to integrating them into complete movement sequences. the weekly unit included skill training for (almost 40 minutes), followed by a video show of the perfect ideal performance model, and visual analysis and self-observation via video, then reapplying and practicing. then set the proportions and patterns of feedback according to the (V/A/M/C) code, distributed among visual, auditory, modeling, and combined, and maintaining a standardized overall feedback percentage not mor than (20%) of the total attempts. This gradual structure reflects the trainees' transition from reliance on direct external guidance in the initial weeks to increased reliance on self-observation and visual analysis in subsequent weeks, thus supporting independence in learning and consistency in skill performance.

(90-minute) training unit:

the educational unit take (90 minutes) divided in a way that balances the requirements of physical preparation, skill learning, and motor knowledge. (15) minutes for general and specific warm-ups, (10) minutes for showing the model video and explaining the main technical points, thin a guided practical training time of (40) minutes according to the principle of Part → Whole with video recording, then (15) minutes for analyzing the video and self-observation in slow motion, then (5) minutes for reapplying after analysis to confirm corrections, and (5) minutes for applied play or skill challenge to transfer the skill to situations closer to reality.

Feedback documentation model:

To adjust and standardize the feedback according to motor learning principles, the researchers used a model to record the type of feedback provided (visual, verbal, dual, kinesthetic, or no feedback), the number of attempts that received feedback compared to the total number of attempts, and the timing of feedback delivery (during or after performance). A representative sample of sessions (6 out of 16) was analyzed to confirm

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adherence to the planned feedback rate (almost 20%). The actual rate ranged between 18% and 22%, reflecting good procedural discipline and allowing for attributing differences in results to the effect of the learning program.

Researcher's observations on commitment	Timing (during/after the performance)	Feedback type (V/A/M/C/N)	Precenting %	Number of attempts with feedback	Number of attempts	skill	Player code	Session number

Tools

• Specific skill tests to measure basic gymnastics skills (forward roll, backward roll, handstand, front balance, sideways somersault).

• Video Recording: A single camera to record the performance before and after, to review self-reports, and then to analyze the performance and review the technical execution.

• Coach's Observation Sheet for direct observation of trainees' performance during training, to record the number of repetitions, feedback intervals, and type of feedback, based on research protocols on feedback repeating.

• Use of forms and observations to record performance scores (Schmidt & Lee, 2019; Musleh, 2020).

Procedures:

1. Obtain parental/sports academy consent.
2. Conduct a standardized pre-test, record performance via video, and have it evaluated by two independent judges to calculate the consistency coefficient between judges.
3. Participant-randomly assign participants to two age- and skill-equivalent groups.
4. Performing the protocol for 8 weeks with the experimental group.
5. Administer a post-test to both groups after completion of the proposed program.
6. A retention test 4 weeks after the experimental group completes the proposed program.

Results:

Table4. Results of the (t) test to measure pre-equivalence in the level of skill performance in gymnastics between the experimental and control groups

Skills	experimental (M)	experimental (SD)	control (M)	control (SD)	t	SIG
forward roll	49.0	7.2	48.6	7.4	0.19	unsignificant
backward roll	50.3	7.0	49.8	7.2	0.24	unsignificant
handstand	48.8	7.5	49.1	7.3	0.12	unsignificant
front balance	49.5	7.1	48.9	7.3	0.26	unsignificant

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sideways somersault	50.1	7.3	49.7	7.1	0.18	unsignificant
Overall average skill performance	**49.5**	**7.2**	**49.2**	**7.3**	**0.15**	unsignificant

The results in Table (4) indicate no statistically significant differences between the experimental and control groups in the pre-test of all basic skills, demonstrating that homogeneity and equivalence were achieved between the two groups before the program was implemented. This is a prerequisite for ensuring internal validity and attributing any subsequent differences to the effect of the educational program itself (Thomas, Nelson, & Silverman, 2015; Schmidt & Lee, 2019).

Table5. Results of the (t) post-test comparison between the experimental and control groups in the level of skill performance in gymnastics

Skills	Experimental (post-test) M±SD	control (post-test) M±SD	t	SIG
forward roll	**82.4 ± 6.1**	61.3 ± 7.4	**9.55**	significant
backward roll	**84.7 ± 5.8**	63.9 ± 7.1	**10.22**	significant
handstand	**88.3 ± 6.5**	66.1 ± 7.5	**11.10**	significant
front balance	**83.5 ± 6.3**	62.7 ± 6.9	**10.01**	significant
sideways somersault	**85.1 ± 6.0**	64.5 ± 7.3	**10.40**	significant
Overall average skill performance	**84.8 ± 6.1**	63.7 ± 7.2	**11.25**	significant

results in Table (5) confirm the existence of statistically significant differences between the experimental and control groups in the post-test, favoring the experimental group in all basic skills demonstrated by the junior gymnast, this confirms the effectiveness of the educational model based on video self-observation, visual modeling, and guided feedback. the big differences confirm a big improving in accuracy and motor control, like Ste-Marie et al.'s (2012) findings regarding the role of self-video in enhancing internal motor model development. The results also support Wulf's (2013) observations concerning the impact of external attention on stability and balance. We can see the greatest differences were observed in the handstand skill, a finding corroborated by Sigrist et al.'s (2013) study, which demonstrated the sensitivity of balance skills to multimedia feedback.

Table6. Results of the (t) test to compare the skill retention level of both the experimental and control groups after 4 weeks of the end of the program

Skills	Experimental (retention) M±SD	control (retention) M±SD	t	SIG

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forward roll	**80.1 ± 5.9**	58.2 ± 6.8	**10.33**	significant
backward roll	**82.8 ± 6.0**	59.4 ± 6.5	**11.02**	significant
handstand	**86.5 ± 6.2**	61.1 ± 7.0	**11.40**	significant
front balance	**81.4 ± 5.8**	57.7 ± 6.2	**10.66**	significant
sideways somersault	**83.6 ± 6.1**	58.9 ± 6.8	**10.98**	significant
Overall average	**82.9 ± 6.0**	59.1 ± 6.7	**12.10**	significant

The results in Table (6) confirm the continued superiority of the experimental group in all basic skills after four weeks, confirming strong motor retention and long-term learning stability. This superiority reflects the effectiveness of the model depends on video self-observation and guided feedback in supporting skill sustainability (Boyer et al., 2009; Ste-Marie et al., 2012), as well as its role in saving the skill in long-term memory through external guidance and graded feedback (Magill & Anderson, 2022). The handstand skill recorded the highest retention rates, which is consistent with the nature of balance skills that respond strongly to multimodal feedback (Schmidt & Lee, 2019).

Table7. Results of the (t) test to compare pre- and post-test measurements, and post-test and retention within each of the experimental and control groups in skill performance

group	compare	(Mean Diff.)	t-value	(p-value)	Significant
experimental	post ← pre	+18.70	2.33	0.001	Significant improvement
	retention ←post	-0.92	-0.52	0.61 unsignificant	High stability and no loss
control	post ← pre	+6.62	3.45	0.002	Limited improvement
	retention ←post	-1.61	-0.98	0.33 unsignificant	Partial loss and instability

The results of the paired t-test show that the experimental group achieved a significant improvement between the pre- and post-tests, with no significant differences between the post-test and the retention test, indicating high stability of the skill and its transfer to long-term memory (Schmidt & Lee, 2019). the control group showed limited improvement accompanied by a significant loss of retention, reflecting the weakness of

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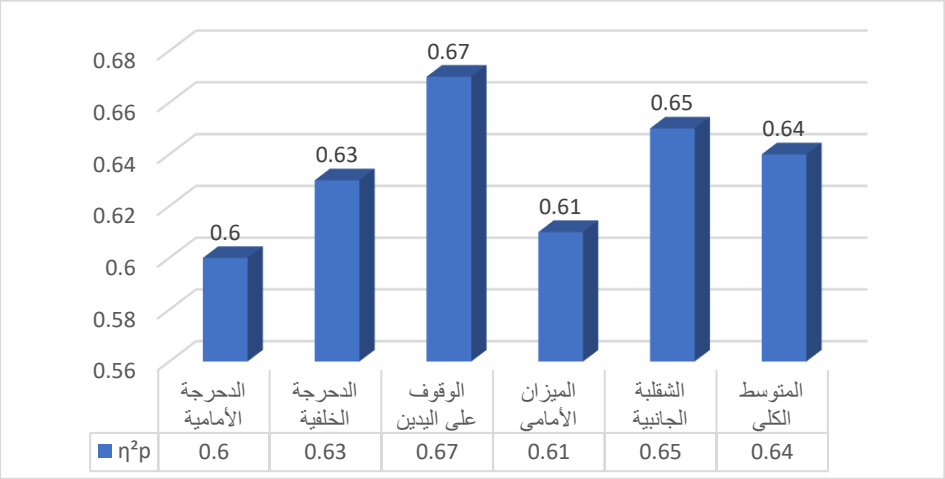
the traditional method compared to models based on external feedback and visual modeling (Wulf & Lewthwaite, 2016).

Figure1. (amount of effect size according to the value of the partial eta square) for the basic skills training program in gymnastics**



forward roll
backward roll
handstand
front balance
sideways somersault
Overall average

results in figure 1, showing the effect sizes and the high partial eta-squared value (η^2p, 0.60–0.67), confirm that between 60% and 67% of the change in performance level is directly comes from the program and not to random factors which is confirming the effectiveness of the educational model.

These results are matches with Schmidt & Lee's (2019) about the role of visual modeling in rebuilding internal motor schemas, with Magill & Anderson's (2022) findings about the effect of guided feedback in strengthening motor memory and enhancing retention. The results also support Wulf's (2013) assertion that using external guidance plus video analysis can enhance the quality of learning by 3 to 5 times compared to traditional methods. so, the effect sizes reflect the success of the educational program in developing skill performance and enhancing the stability and coordination of movement in young people.

Table8. The results of the analysis of variance for repeated measurements to measure the effect of time, group and the interaction between them on the level of skill performance between the experimental and control groups

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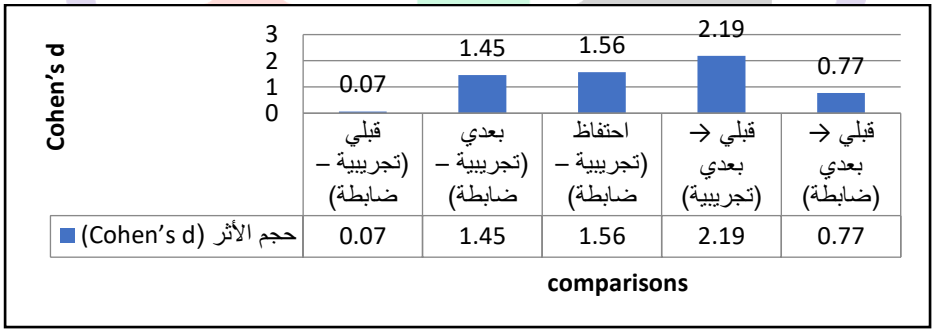
Differences	Freedom degree	(ANOVA)	Effect size measure	Significance level
(Time Effect)	2	165.40	0.78	Significance ($p < 0.001$)
(Group Effect)	1	89.25	0.70	Significance ($p < 0.001$)
(Time × Group)	2	110.55	0.74	Significance ($p < 0.001$)
(Error)	76	—	—	—

results in Table (8) show a big significant effect of time, group, and their interaction on skill performance levels, reflecting a marked enhancing across all three measurements (pre-test, post-test, and retention), with a clear advantage for the experimental group. The interaction effect (Time × Group) further confirms that the enhancing was greater in the experimental group compared to the control group, both in the post-test and the four-week retention test, which is confirm the effectiveness of the educational model in accelerating acquisition and enhancing long-term learning retention. These results are consistent with Schmidt & Lee's (2019) findings on the role of visual feedback in enhancing internal motor representation, Wulf & Lewthwaite's (2016) findings on the effectiveness of external focus and self-observation, and Ste-Marie et al.'s (2012) studies on the power of self-modeling in improving motor control and retention.

Figure2. (Cohen's d) effect size for inter-group and intra-group comparisons between the experimental and control groups at different measurement stages of learning basic gymnastics skills



results in figure 2 show that the high effect size values confirm that the educational model used not only produced statistically significant differences but also a practical change in the learners' skill performance, spatially in the experimental group, which achieved a large effect size (d = 2.19) between the pre- and post-tests. and continued the large effect size in the retention test (d = 1.56) confirms the program's effectiveness in improving learning retention and long-term transfer. These results confirm Sigrist et al. (2013) and Wulf (2013) findings about the impact of visual modeling and guided feedback on improving performance quality and motor retention.

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Discussion

The study results, according to multiple statistical analyses, showed that the educational model applied to the experimental group was more effective than the traditional in learning and retaining basic gymnastics skills.

descriptive table showed that the two groups were equivalent before the study start. but the experimental group's performance improved significantly in the post-test, with big stability in the retention test, unlike the control group, which showed limited improvement and a slight decline in follow-up.

These results confirmed by independent samples t-tests, where the differences in the post-test and retention scores highly significant and showed a large effect size in favor of the experimental group. This refers to the improvement was not a statistical accident but rather has significant practical value in athletic performance.

Paired t-tests using for examining the differences to each group, the educational model resulted in a substantial and very significant improvement between the pre- and post-tests, but performance almost remained constant between the post-test and the retention period. This explains the model's ability to stabilized learning in the short term. limited improvement in the control group, a partial loss of skill was appeared after the stopping period, confirming the weakness of the traditional method stability.

repeated-measures analysis of variance (Mixed ANOVA) showed a main effect of time (overall improvement over time) and a main effect of group (experimental advantage). and the most important finding was the interaction effect (Group × Time), which confirmed that the amount of improvement was clearly different between the two groups, favoring the educational model.

Cohen's d-size measurements results support these findings. The values were very large ($d > 1.4$) in comparisons between the two groups after the intervention and exceeded ($d = 2.0$) when measuring improvement within the experimental group, indicating a very strong practical effect that can be relied upon in field applications. When considering the improvement rate, the integrated model nearly tripled the improvement compared to the traditional method (41.9% vs. 15.1%). It also helped solidify learning with a retention rate of less than 2%, compared to a loss exceeding 3% in the control group.

Compared to previous studies, these results align with Amri-Dardari et al.'s (2022) findings on the importance of self-observation combined with external attention in improving gymnastics skill learning. They also support Sadowski et al.'s (2013) findings on the effectiveness of bandwidth feedback in learning complex skills. Furthermore, these results are consistent with recent reviews emphasizing the need to integrate teaching models rather than relying on a single method to meet the diverse needs of young gymnasts.

Therefore, it can be concluded that the integrated educational model is not merely an alternative to traditional education, but rather a modern and effective framework that

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achieves better learning, ensures sustained performance, and enhances the value of the educational process in gymnastics

Conclusions:

study results showed highly effective in improving the learning of basic gymnastics skills for educational model compared to the traditional method. The experimental group, trained according to new model, reached a significant improvement in their technical performance between the pre- and post-tests. This confirms the effectiveness of the educational design based on visual modeling and interactive feedback. the four-week retention test results showed that the experimental group kept their high level of performance, which is mean that the model not only facilitated immediate learning but also gives a short-term retention. The statistical differences between the two groups have highly significant, with big effect sizes confirming the practical effectiveness of the educational model. The percentage of performance improvement clearly for favor of the experimental group, outperforming the control group that used the traditional teaching method. so, it can be confirmed that the integrated educational model is more effective and efficient in developing basic gymnastics skills, as it combines cognitive, motor, and perceptual aspects and provides an interactive learning environment that enables learners to acquire and retain skills with a higher degree of stability and continuity.

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Recommendations:

In study's findings, the researchers recommend the following:

- Execute the complete educational model in teaching basic gymnastics skills for different educational stages.
- Improve sports curricula to include mixed and interactive learning strategies instead of traditional learning.
- Prepare training courses for coaches to familiarize them with the mechanisms of Appling modern models in sports education.
- arranging similar studies on other skills in different sports to verify the model's effectiveness in different environments.
- Use modern technological tools (such as analytical video and digital feedback) within the educational model to enhance its effectiveness.

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The Basic Stability of The Core Muscles and Its Relationship to Some Defensive Skills in Basketball Players Under 16 Years Old

Yaseen Abbas Yaseen [1], Ahmad Aboodee Al-Ruhaim [2],
1,2 University of Kufa, College of Physical Education and Sports Sciences

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Abstract

The importance of the research lies in involving the process of developing core stability of the trunk muscles, as it treats the athlete's body as a single unit, specifically targeting the trunk muscles in basketball players. Therefore, the researchers wanted to explore this experiment. The research problem focused on the observation made by the researchers and their monitoring of most matches in the Iraqi Premier League, as well as their work as supervisors at the Al-Najaf Youth Forum and their observation of some local tournaments and league matches. They noticed that most coaches, whether national team coaches or club coaches, rely on a comprehensive training regimen for body muscles without paying attention to the deep trunk muscles (core stability) during their training application on the players, which leads to incomplete muscle strength in players, especially in the trunk area, and since it has a significant impact on mastering defensive skills. The research aimed to prepare exercises to develop core stability to strengthen the trunk muscles and some defensive skills for players under 16 years old in basketball, and to identify the effect of these exercises in developing core stability to strengthen the trunk muscles and some defensive skills for players under 16 years old in basketball. The researchers chose the experimental method using the two groups of experimental and control as it suited the research problem. As for the research samples, they were represented by basketball players at the National Center for Talent Care in Najaf Al-Ashraf, numbering (26) players, all of whom were selected for the experiment. The most important conclusion drawn by the researchers is that the development of flexibility, trunk strength, balance, and coordination positively reflected on the development of defensive movement and defensive follow-up performance. The main recommendations were the importance of using specific and targeted training to achieve defined objectives in developing basic stability according to standardized scientific principles to raise the training level of basketball players across various categories.

Keywords: Functional training method, accuracy of spiking.

[1] University of Kufa, College of Physical Education and Sports Sciences.
yassina.alkhazali@student.uokufa.edu.iq
[2] University of Kufa, College of Physical Education and Sports Sciences.
ahmeda.hussein@uokufa.edu.iq

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Introduction

Sports have become in the third millennium an important part of individuals' lives and hold significant importance in modern human life. Progress and development in all areas of life have led to changes in lifestyle to suit the demands of this era, characterized by its speed and advancement. Sports have a share in this progress, as they have become an integral part of daily life, as well as a fertile field for researchers.

Basketball is one of the team sports and is considered one of the most popular games. In some countries, it has even ranked first among other games due to its wonderful combination of technical performance and fast rhythm, which excites the audience.

It is noticeable that the current rapid development in the training world is simply a result of using specialized training methods such as Pilates exercises, which help players perform well and prevent injuries in most different sports. The effect of core strength training on athletic performance is particularly significant in sports like basketball, which require fast and coordinated movements.

The kinetic chain refers to interconnected groups of body parts, muscles, and joints that work together to perform movements. In this chain, the trunk coordinates the movements of the upper and lower parts of the body and acts as a central axis. Therefore, enhanced trunk strength may improve physical performance in athletes, especially in terms of dynamic balance and agility. The fundamental stability of the deep trunk muscles is one of the important factors in performing most body movements that contribute to balance, maintaining body posture, as well as serving as the foundation for initiating every movement. Strengthening the trunk muscles is very important as it contributes to the development of physical and motor abilities and achieving better performance, which is clearly reflected in the generation of different forces in young athletes. Various defensive methods and forms have been diversified, and emphasizing effective defense in basketball has become a clear characteristic of the game. Many coaches believe that the optimal way to win a match is through vigilant defense, as a team with cohesive defense largely controls the match outcomes. The trunk muscles, which include the abdominal muscles ,The oblique muscles.

The importance of this research lies in the necessity of incorporating Pilates exercises into training, which helps coaches and players in the training process by engaging in the development of core stability and trunk muscle strength. This approach treats the athlete's body as a single unit, specifically targeting trunk muscles, ultimately achieving optimal strength stability. This enables the regulation of exercises and the continuation of training in a scientifically studied manner.

Also, not neglecting the importance of defense, whether individually or in teams, as it is considered a fundamental factor in the difference between high-level teams and modest-level teams. Especially the youth category, which is considered an important age group and the foundation in the training process of this game, as they are the pillar on which achieving sports ambitions depends. This requires preparing exercises to develop physical and motor

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abilities according to the applied scientific principles, as they are the basis for effective defense .

Therefore, through the researchers' field experience, through their observation and follow-up of most matches of the Iraqi Premier League, and through their work as supervisors at the Najaf Youth Forum and their monitoring of some local championships and league matches, they noticed that most coaches, whether national team coaches or club coaches, rely on a comprehensive training approach for the body muscles without paying attention to the deep trunk muscles (core stability) while applying the training approach to the players. This leads to incomplete muscular strength in the players, especially in the trunk area, which has an effective impact on mastering defensive skills.

Accordingly, the two researchers have defined the research objectives: to prepare exercises for developing core stability to strengthen trunk muscles and some defensive skills for players under 16 years old in basketball, and to identify the effect of exercises in developing core stability to strengthen trunk muscles and some defensive skills for players under 16 years old in basketball .

As for the research domains, the human domain consisted of basketball players at the National Center for Sports Talent Care in Najaf Al-Ashraf, while the temporal domain was from 30/10/2024 to 10/3/2025, and the spatial domain was the indoor hall at the National Center for Sports Talent Care in Najaf Al-Ashraf.

Methodology

Research Method

The experimental method was selected as it aligns with the nature of the research problem. The study was designed using two equivalent groups (experimental and control) with both pre-test and post-test applications.

Research Population and Sample

The research population was identified as the players, represented by the basketball players at the National Center for the Care of Sports Talent in Najaf Al-Ashraf (2024–2025), numbering (26) players.

Devices, tools, and means used in research

Data collection methods

- Arabic and foreign sources and references
- Observation and experimentation
- Tests and measurements.

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Tools and equipment used

1 -Laptop computer (Acer type) made in China .
2 -Video camera, quantity (1), Canon type, made in Japan for the purpose of documenting tests .
3 -Electronic medical scale, made in China, Silver Crest type, for conducting uniformity .
4 -Electronic stopwatch, quantity (2), made in China, digital type .
5 -Basketballs, quantity 20 .
6 -Ball carrying basket, quantity (2), locally made .
7 -Medicine balls of various weights (2 kg, 3 kg), quantity (6) .
8 -Stability ball, quantity (3) .
9 -Platform with a height of (50 cm), quantity (2) .
10 -Dumbbells of various weights (2 kg, 3 kg, 4 kg), quantity (18) .
11 -Colored paints and adhesive tapes for marking tests .
12 -Measuring tape with a length of (10 meters), made in China .
13 -Whistle, quantity (1), Fox type, made in China .
14 -Video camera, Canon type, quantity (2) .
15 -Office supplies (ballpoint pens and papers).

Field Research Procedures

Description of the tests used in the research

After reviewing numerous sources, scientific references, and similar studies, the measurements and tests for measuring the research variables were identified, which can measure and represent the research variables in their measurement.

Trunk Flexion Test from Standing) (Alawi and Radwan, 1982, pp. 341–344)

Purpose: To assess trunk and thigh flexibility during forward bending from a standing position.

Equipment: A 20 cm measuring stick or wooden ruler, and a stable bench, chair, or flat table capable of supporting the examinee's weight.

Procedure: Attach the ruler to the edge of the bench/table so that half extends above and half below the edge. The zero mark should align with the bench edge; upward deviations are recorded as negative, downward as positive.

Performance: The examinee stands at the edge with feet on either side of the ruler, bends forward, and reaches fingers toward the ruler. They then continue bending slowly and steadily, keeping fingers aligned and moving parallel to the ruler.

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Test instructions

The test is performed without stiffness in the arm, trunk, and neck muscles. The test is carried out from a kneeling position. The trunk is bent downward slowly and forcefully, with an attempt to achieve the maximum possible bending range. It is preferable to give the test subject two or three attempts as a means of warming up and practicing the test before measurement, noting that this should be done before climbing onto the table. The subject should direct their gaze downward towards the scale. It has been shown that bending the trunk forcefully downward achieves better results; however, this method of performance reduces the consistency and objectivity of scores due to the difficulty of calculating the score. Therefore, when calculating the score, it is required that the subject maintains their final position for a duration of 2–3 seconds.

Test Management

- A supervisor monitors performance and calculates scores .
- A recorder calls on the examinees and records the results.
- Scoring: Lab score: The highest point the lab can reach from bending the trunk forward to the bottom.

Defensive Follow-up Test: (Hussein, 2012, p. 99)

- Purpose of the test: To measure the speed of defensive rebound performance .

- Equipment used: Tape, measuring tape (20m), marker number (1), electronic stopwatch, whistle, one basketball, papers and pens for recording .

- From the point under the basket and at a distance of (2m) forward, a mark is placed on the ground .

- Performance description: The defending player stands with the mark between his feet and his back to the backboard, holding the ball over his head with his arms. Upon hearing the start signal via the whistle, the player performs a front half-turn with the right foot, then shoots the ball at the backboard to rebound defensively and returns with the ball to the first mark to perform defensive rebound from the other side by executing a front half-turn with the left foot and returning to the first mark, as shown in Figure (9) in the six steps .

- Test conditions: Execute the test steps quickly .

- The defending player's stance before starting the performance should have bent knees.

- Before catching the ball from above, the player takes a step toward the board, with the right foot forward on the right side and the left foot forward on the left side.

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-Touch the board from both sides, completing eight repetitions, and then return to the starting mark.

-Only one attempt.

-Test administration: start and finish are signaled with a whistle along with timing.

-Recorder: calls out the names and observes the performance while recording the test time.

-Scoring: the player's time to complete the test for the eight attempts is recorded, using the start and finish whistle as reference.

Pilot Experiment

The pilot experiment was conducted prior to the main study to detect potential challenges and limitations. Its aims include:

The aim of the pilot experiment for the tests is as follows:

1. Ensure the suitability of the field and tools, confirming their appropriateness for the tests.
2. Prepare the assisting team and identify potential difficulties they may encounter.
3. Determine the required duration for the tests.
4. Identify practical challenges the researcher may face during test implementation.
5. To ensure the suitability of the components of the training loads for the research sample individuals.

Main Experiment

Pre-tests

After completing and validating the exploratory experiment, the researchers proceeded with the main study by administering the tests to the research sample. The pre-tests were conducted on November 3, 2024.

Equivalence of the two research groups

To attribute differences in the post-test results to the variables under study, the researchers first verified the equivalence of the two groups. This was accomplished by applying the independent samples t-test to the selected research variables.

Table 1. *Shows the equivalence of the research groups*

Research Variables	Unit of measurement	Regulation		Experimental		t value	sig	Significance
		will	A	will	A			
Trunk muscle strength	kg	57.00	11.674	54.625	6.545	0.502	0.624	Not sig
Defensive Follow-up	second	22.400	3.590	23.157	4.305	0.382	0.708	Not sig

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Post-tests

With the assistance of the support staff, the researchers conducted the post-tests for the research sample following the completion of the training program on May 1, 2025. The tests were administered under the same conditions as the pre-tests, maintaining consistency in the sequence and procedures.

Statistical Methods Used

The researchers employed the Statistical Package for the Social Sciences (SPSS) to analyze the collected data and interpret the research results.

Results

Table 2. *Means, Standard Deviations, t-Values, and Significance Levels for the Control Group (Pre- vs. Post-Tests).*

Research Variables	Unit	Pre-test		Post-test		t value	Sig value	Sig
		will	A	will	A			
Trunk muscle strength	kg	57.000	11.674	62.375	11.400	6.715	0.000	sig
Defensive Follow-up	second	22.400	3.590	20.750	3.651	5.459	0.000	sig

Table 3. *Arithmetic Means, Standard Deviations, t-Values, and Significance Levels for the Experimental Group (Pre- vs. Post-Tests of the Researched Variables)*

Research Variables	Unit	Pre-test		Post-test		t value	Sig value	Sig
		will	A	will	A			
Trunk muscle strength	kg	54.625	6.545	75.625	7.744	25.493	0.000	sig
Defensive Follow-up	second	23.157	4.305	18.796	2.093	11.152	0.000	sig

Table 4. *shows the calculated value (T) for the independent samples, the significance level of the test, and the significance of the differences between the post-test results of the control and experimental groups for the studied variables.*

Research Variables	Unit	Regulation		Experimental		t value	Sig value	Sig
		will	A	will	A			
Trunk muscle strength	kg	62.375	11.400	75.625	7.744	2.719	0.017	sig
Defensive Follow-up	second	20.750	3.651	18.796	2.093	2.920	0.015	sig

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Discussion

After analyzing the outcomes of the experimental and control groups, the findings revealed statistically significant differences across all tests, with the advantage consistently favoring the experimental group. The researchers attribute this to the use of exercises, which means that the performance of the trunk muscles in the experimental group improved noticeably after the training period, while similar improvements were not recorded in the control group. This difference is due to the focus on building the strength and stability of the "Powerhouse," the concept introduced by Joseph Pilates himself. He explained that the center of the body (from the pelvis to the lower ribs) represents the main point from which all movements originate and should be strengthened and maintained active throughout the exercise. In this context, Isaacowitz and Kleubinger define (Core Stability) as "the neuromuscular control that allows the pelvis and spine to be maintained in the desired position while moving the limbs or the body as a whole without unintended distortions or compensations".

. Accordingly, exercises targeting the deep muscles in the trunk area work to enhance this neuromuscular control, leading to better support of the pelvis and spine during movement .

The duration of the training, during which exercises were applied, was also sufficient to achieve this improvement, because any change requires a period of time to have a clear impact on the body's abilities, which in turn affects performance levels. This was confirmed by (Abu Al-Ala Ahmed) quoting both (Wilmore and Costill) that most changes resulting from training occur during the initial period of the program within 6-8 weeks (Ahmed, 1996, p. 32).

From the table, it is clear that significant differences emerged between the post-test results of the experimental and control groups in motor abilities specifically trunk muscle performance and selected defensive skills. These differences favored the experimental group, which distinguished itself by avoiding routine and employing exercises characterized by variety, specialization, and focused application.

The improvement in the flexibility variable and the strength of the trunk muscles is attributed by the researchers to exercises that include movements taking the limbs' range of motion to the natural limit of movement or to their widest range. These exercises also target the deepest layer of the abdominal muscles. Previous studies have confirmed that deep trunk muscles, such as the Transversus Abdominis, the spinal extensor muscles, and the pelvic floor muscles, play a vital role in stabilizing the spine and protecting the lower back. For example, Sacowitz and Clippinger explain that the Transversus Abdominis contracts automatically to support the spine and pelvis before movements with small forces, making it like a natural corset for the body.

For this reason, the correct method in many of its exercises requires conscious exhalation to stimulate this muscle to contract. It is also important to coordinate the work

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of all trunk muscles (external and internal) together, as the internal abdominal muscle (Internal Oblique) is functionally connected with the transverse muscle, which is why training focuses on improving strength, endurance, and neuromuscular coordination of all abdominal muscles. Strengthening them is the key to good performance, relieving back pain, and reducing waist circumference (Austin, 2012, pp. 6–7), as sources confirm that reducing fat in the muscle area increases its elasticity .

Karon Carter (Karter, 2001, p. 21) indicates that the highest rate of muscle stretching development can occur through yoga exercises, while the highest rate of muscle strength development can occur through weight training. She also noted that both muscle stretching and strength can be developed simultaneously through the exercises used.

As for the development of the balance trait, the researchers also attribute it to these exercises that include movements aiming to change the body's center of gravity, in addition to compound movements in various directions, as they cover a comprehensive range of muscular motion. In addition to the abdominal muscles, they activate the group of back extensor muscles, including the Erector Spinae and the Multifidus muscle, which is considered one of the most important stabilizers of the lumbar vertebrae. It has been found that strengthening these promising muscles prevents the tendency to bend the back forward (anterior displacement) and contributes to preventing common back injuries and post-injury spinal problems. According to Isacowitz and Klebingger, the exercises used specifically focus on engaging the Multifidus muscle, as it is a large muscle with a vital role in stabilizing the lower spine and aiding patients' recovery from lower back injuries. Strengthening these deep muscles leads to a coordinated contraction of all stabilizing muscles during movement.

,which is essential for achieving effective spinal stability. Panahan and colleagues (2020) emphasized that this co-contraction of the core muscles is the main mechanism for achieving spinal stability, and that classic exercises targeting this group improve trunk stability and strength without unnecessary strain on the deep structures of the spine .

King (2006, p. 31) indicates that training works on the principle of focus by perceiving each movement and controlling it with the mind, as the mind must always be in a state of full concentration on the performance goal .

Cardiorespiratory fitness and exercises follow the principle of (FITTE), which is an abbreviation for Frequency, Intensity, Type, Time, and Enjoyment. These exercises work on coordination and connection through muscular training and mental focus simultaneously, leading to an increased sense and awareness of the movement performed by the individual during exercise, especially the compound movements included in these exercises that require coordination between muscles and nerves. These exercises operate on the principle of concentration, which has helped in the development of the neuromuscular system. Ghanem (2018, p. 103) cited Michael (King,2001) stating that activating concentration gives the individual skill. At the beginning of practicing exercises, the practitioner tends to rush through the difficult part of the movement to finish it as

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quickly as possible, but by activating concentration during performance, the practitioner can properly control the execution of the skill. Moreover, the repetitions used in repeating all exercises are factors that helped develop motor coordination. This is also emphasized by Mufti Ibrahim, Wajih Mahjoub, and(Badri,2000).

The rapid development of coordination is attributed to the development of mental and intellectual levels, as well as the development of physical and motor abilities, and to the motor experiences stored in memory. This helps accelerate good movement coordination. (Both Michael King and Denise Austin 2002), and quoting Joseph Pilates agree that the exercises used help to move with more precision and reveal the natural dimensions of the body. Usually, the practitioner does not have awareness of how to move in the surrounding space, and because the exercises require not only correct movement but also correct breathing, the practitioner will thus gain more awareness of how to find their personal space through focus and precision (Pilates, n.d., p. 21).

As for the development observed in the defensive variables (defensive tracking) of the experimental group, the researchers attribute it to the exercises that gave the player superiority in motor abilities, which served as the foundation that enhanced the player's movement and facilitated easy movement (as a result of the acquired abilities) on the court to perform defensive duties, whether with or without the ball. The researchers attribute the significance of the differences in these defensive skills to the exercises, as the exercises used in this approach positively affected the development of defensive tracking, because they focused on developing the abilities specific to tracking, which are (coordination and balance), which directly impact the performance of these defensive skills, namely (pivoting and turning towards the basket to block the attacker and proper timing for jumping at the moment of shooting, as well as defensive movement to intercept passes that require high coordination). The results of the skill performance test for these skills in the experimental group were higher than in the control group, confirming the suitability of the type of exercises in improving the abilities specific to defensive skills through motor integration by combining flexibility and strength as a trait.

Physical fitness, coordination, and balance, which contribute to improving the performance of defensive tasks, and this was affirmed by Qasim Hassan Hussein who said: 'Focus should be on training coordination and motor linkage and including it in the training program, as using motor coordination over a long period and with continuous repetition will lead to habituation to the ideal motor and temporal framework' (Hussein, 1991, p. 47). The researchers also attribute the significance of differences to the development of physical and motor abilities, because most motor skills in all sports in general, and in basketball in particular, depend on the athlete's physical and motor abilities for good performance. 'Motor skill cannot be achieved without the presence of specific physical abilities, and likewise, mastering and improving the skill aspect of a sporting activity is not possible in the absence of specific physical abilities.' Many experts and specialists in the field of training science advise the necessity of developing skill performance through the

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development of specific physical abilities for each activity. All these mentioned factors have effectively contributed to showing significant results between the experimental and control groups in the post-test, in favor of the experimental group in performance tests .

Defensive skills, and thus the two researchers achieved one of the research objectives.

The experimental group, through the exercises, gained the ability to move laterally or move from back to front, as well as the ability to perform repeated jumps upwards. Brian Wanes confirms that 'the player who jumps for the follow-up is the winner, as his chances of getting the ball increase more effectively' (Coleman & Ray, 1980, p. 107). This led to the development of the defensive skills under study as a result of using the mixed training composed of specialized exercises. The desired results came as a result of the correct combination of these exercises, which stems from the proper specification of the exercises and their non-conflict, in addition to the coordination of the exercises with the supporting tools, such as using a stability ball in the exercise and in the training unit itself. The development of the physical capacities of the experimental group players in the working muscles, due to the inclusion of physical exercises, affected movement development as it reduced the players' random movements, which contributed to their performance during skill tests. As for defensive follow-up, the results came from using exercises of different intensities with dumbbells.

This helped in focusing performance on different muscles with appropriate motor execution, as the movements of a basketball player mainly rely on these muscles since most of the exercises used were highly effective due to isolating the muscles not involved in the movement, which directly impacted the skill, making it more difficult than during the test (the development of both the motor and physical aspects is an essential and important factor in performing defensive skills, influenced by motor speed and reaching the required technical level), (Al-Khashab et al., 1988, p. 49). In addition, the gradual increase in intensity level led to muscle development, as well as an increased ability for repeated movement in different directions due to the development of coordination, which positively affected its function. Studies proved (the existence of a significant correlation between physical and skill levels) (Jawad, 1995, p. 107).

This indicates the appropriateness of the exercises under study with the players' abilities. Similarly, the improvement was a result of the increased training intensity while regulating rest periods in the exercises and their impact, which had a positive effect on this improvement in the research sample. Mona Abdel Sattar affirmed (that the development of skills should be accompanied by the development of physical fitness elements as well as the development of motor skills as a single integrated process) (Abdel Sattar, 1989). The exercises had a significant impact on developing the defensive player's movement skills through flexibility, coordination, balance, and trunk muscle strength, which in turn led to the improvement of the player's defensive movement.

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Here, the difference between the results of the experimental group and the control group becomes clear, as those results favored the experimental group, since its exercises were focused on improving the players' physical abilities, in addition to the coach using the remaining time of the training units to develop skill-related abilities. Thus, the exercises became more precise, directed, and beneficial for the players. Muhannad Abdul Sattar emphasized, 'The development of skills should be accompanied by a process of developing physical fitness elements as well as the development of motor skills, as they are two parts of a single process.' (Al-Ta'i et al., 1995, p. 15). The fatigue generated by the effort exerted, whether in training or competition, causes the player to lose focus and time during skill performance. Abdul Hakim Al-Ta'i et al. mentioned that 'one cannot expect good team play without good physical preparation, because basketball is a strenuous and aggressive sport, which requires players to have high skill and physical fitness. Many teams have good skills but are unable to win due to their players losing physical fitness during the match, while other teams lack precision in skill and tactical preparation because they '

Physically incomplete in general, which negatively affects basketball skills; therefore, the development of physical abilities under study helped the experimental group players to perform skills better and carry out skill tasks at a high proficiency. These differences are also based on the nature of training. The control group received traditional, non-specialized training, often focusing on skill exercises or general strengthening without precisely targeting the deep trunk muscles. On the other hand, the experimental approach was carefully designed to continuously stimulate the core of strength, prompting clearer and more precise motor performance. This explains that the results of this study align with what is reported in the scientific literature, as trunk muscle training programs often show superiority in improving core muscle strength and stability compared to other forms of exercise.

Conclusions

1. Training according to motor performance has great importance in developing defensive skills in basketball.
2. Regulated-intensity training, which employs the physical and skill aspects of the core stability muscles using training tools, has great importance in developing trunk strength and defensive skills.
3. The development of flexibility, trunk strength, balance, and coordination has positively reflected on the development of defensive movement and the performance of defensive follow-up.

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Recommendations

1. The importance of specialized and targeted training to achieve specific goals in developing core stability based on regulated scientific foundations to raise the training level of basketball players for different categories.
2. The necessity of regulating the training load of exercises, due to its high positive impact on the player during performance.
3. The necessity of knowing and incorporating modern training into the training program of other sports, which require varied motor programs through the integration of the physical aspect with the skill aspect.

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The Effect of Game-Based Learning Using Small-Sided Games on the Performance of the High Serve Skill in Badminton among Beginner Female Students

Tamara Sabah Crook [1], Shahad Jumaa Abdulzahra [2], Marwan Mustafa Sami [3]

[1,2] University of Baghdad, College of Physical Education and Sport Sciences.

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Abstract

The purpose of this study was to investigate the effect of a game-based learning strategy using small-sided games on improving the performance of the high serve skill in badminton among beginner female students. The study employed an experimental design with a pre-test and post-test for two groups. The participants consisted of 40 first-year female students from the College of Physical Education and Sport Sciences at the University of Baghdad. The participants were randomly divided into two groups: an experimental group (n = 20), which was taught using a game-based learning strategy involving small-sided games, and a control group (n = 20), which followed the traditional teaching method based on explanation, demonstration, and repetitive drills. The experimental program lasted eight weeks, with two instructional sessions per week. A standardized badminton high serve skill test was used to measure the participants' performance before and after the instructional program. The collected data were analyzed using descriptive statistics and inferential statistical tests, including paired samples t-test and independent samples t-test. The results revealed significant improvements in both groups between the pre-test and post-test measurements. However, the experimental group showed significantly greater improvement compared with the control group in the post-test results. The findings suggest that game-based learning using small-sided games provides an effective teaching strategy for enhancing motor skill acquisition and improving badminton serve performance among beginner students in physical education settings.

Keywords: Game-Based Learning, Badminton, High Serve Skill, Motor Learning

[1] University of Baghdad, College of Physical Education and Sport Sciences.
Tamara.s@cope.uobaghdad.edu.iq
[2] University of Baghdad, College of Physical Education and Sport Sciences.
Shahad.J@cope.uobaghdad.edu.iq
[3] University of Baghdad, College of Physical Education and Sport Sciences.
marwan.m@cope.uobaghdad.edu.iq

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Introduction

Motor learning is among the basic scientific domains that are studied in physical education and sports sciences; therefore, it refers to the mechanisms through which one learns motor skills with practice and experience. Effective teaching strategies are essential for skill acquisition in sports, helping to facilitate learning and enhance performance outcomes. In more recent years, pedagogical practice during physical education has progressed from traditional teacher-structured methodologies to learner-focused teaching strategies that aim to increase engagement, motivation and participation at the time of gainful skill (Renshaw & Chow, 2019; Regan, 2025).

Closely related to these contemporary approaches, more recently, game based learning has received a great deal of attention in the literature as an effective pedagogical method that includes elements of play into the process of learning. This application reduces the monotony of repetitive training by making it more engaging through dynamic and interactive environments that replicate real sporting contexts, therefore promoting motor skill acquisition in a learning context. Many feel that such game-based approaches facilitate cognitive, social, and physical learning by providing practice of skills in a meaningful context (Kinnerk et al., 2018; Harvey & Cope, 2025).

In addition, recent studies show that adding games in physical education programs motivates students more, increases their enjoyment and engages them, which are key factors of effective motor learning resulting in long-term retention (Breed et al., 2025; Beni et al., 2017). Consequently, game-based learning has become a prominent instructional approach in modern sports education, especially for novices who need non-threatening and stimulating contexts to learn.

Badminton is one of the most popular racket sports played in educational institutions because it is relatively easy to master and helps improve coordination, agility, and motor control. In order to perform well in a game, it is crucial for players to master fundamental badminton skills, including the high serve that can start play and perhaps position an opponent within the framework of playing strategy on-court (Phomsoupha & Laffaye, 2015; Abdulkareem et al., 2025). Then, many novices have trouble executing this skill well due to challenges' coordination, timing and motor control.

Research in motor learning indicates that the acquisition of skills is better when learners are practicing within conditions similar to those actually performed. If we consider that there is an end stage in which learners can reproduce movement solutions, then the learning environment must allow for play to happen (in structured play situations) whereby the learner must explore, adapt and problem-solve as they execute a movement solution (Chow et al., 2021; Abdulkareem & Hassan, 2025). The environmental enrichment and functional task training strategies are congruent with recent ecological dynamic perspectives of motor learning which emphasize that behavior emerges from the interaction

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of an organism with both a task and its environment to solve a problem, and thus serves to enhance skill acquisition.

In the context of physical education, recent studies that small-sided games contribute to skill acquisition by providing more opportunities for repetition and helping develop peri perceptions (Woods et al., 2020; Hammami et al., 2018; Abdulhussein, 2025). Consequently, the application of small-sided games in badminton instructional programs represents a productive approach to enhance skill performance among novice learners.

Although badminton is considered a significant part of physical education curriculums, many beginning students face challenges in learning basic skills like the high serve. Because traditional teaching methods cast some sort of practice for practice's sake, students' motivation drops and their chance to use skills contextually is often limited. As a result, the students may not be able to execute that skill as well in a game.

However, badminton is very much a part of PE curriculums, and many beginning students encounter challenges in developing basic skills such as the high serve. Because traditional practices are often demonized as practice for the sake of practice, this kills students' drive and leaves many with limited opportunities for contextualized skill usage. The students might then not perform that skill as effectively in a game.

The aim of this study is to identify the effect of the game-based learning strategy using small-sided games on improving the performance of the high serve skill in badminton among beginner female students, as well as to determine whether this instructional approach can enhance the effectiveness of motor skill learning compared with traditional teaching methods in physical education.

It is hypothesized that there will be statistically significant differences between the pre-test and post-test results in the performance of the high serve skill in badminton among beginner female students in favor of the post-test. It is also hypothesized that the use of the game-based learning strategy using small-sided games will lead to significant improvements in the performance of the high serve skill among the participants.

The relevance of the study is to try to use a contemporary instructional technology in motor learning in physical education. Based on this study, therefore, an exploration of how small-sided games as a game-based learning tool will contribute to the betterment of badminton teaching delivery especially towards beginner students. The results may also identify creative alternative teaching styles for physical educators that increase involvement, motivation, and skill acquisition in their students. Results also might promote the new modern motor learning approach to be incorporated into University physical education programs, which can help in development of sport teaching methods.

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Methodology

Research Design

In this study an experimental research design with a pre-test and post-test control group was used to explore the effect of a small-sided games game-based learning strategy on beginner female students high serve skill performance in badminton. The experimental design of the study was chosen so that researchers could explore causal relationships between instructional strategies and skill development, controlling for alternative explanations.

The study involved the participation of two groups: an experimental group who were taught using the game-based instructional strategy comprised of small-sided games and a control group that was subjected to the prevailing traditional instruction method commonly practiced in badminton classes. Pre- and post-tests were administered to both groups to assess the high serve skill performance. Two teaching sessions were conducted twice a week for as long as eight weeks during the experimental program.

Participants

Participants in this study were female undergraduate students enrolled in their first year at the College of Physical Education and Sport Sciences, University of Baghdad. Selection was done from students of badminton practical curriculum. Forty students were purposively selected because they were beginner, so they had never received formal training course in badminton; especially on high serve skill that became the target of this study

The participants were randomly segregated into two groups of equal size. 20 students in the first group constituted the experimental group and were taught with the game-based learning strategy (based on small-sided games). The comparison group also comprised 20 students and received the typical teaching method of badminton class as a traditional training method.

A pre-test was conducted for the control group and experimental group to measure both groups' initial level of performance in high serve skill in badminton prior to implementing the program. Before commencing the educational intervention, a pre-test was performed to ascertain that the experimental and control groups were considered homogeneous in regard to the study variable. To check if the two groups differed significantly in terms of pre-test data, an independent samples t-test was carried out on this data. Furthermore, the analysis indicated there were no statistically significant differences between experimental and control groups on pre-test findings suggesting that the compared groups were equivalent in terms of baseline high serve skill performance before applying experimental program.

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Table1. *Equivalence between the Experimental and Control Groups in the Pre-Test of the High Serve Skill*

Variable	Group	N	Mean	Std. Deviation	t-value	Sig. (p)
High Serve Skill (Score)	Experimental	20	4.85	1.12	0.41	0.68
	Control	20	4.70	1.09		

The results shown in Table (1) indicate that there were no statistically significant differences between the experimental and control groups in the pre-test scores of the high serve skill ($p > 0.05$), confirming the equivalence of the two groups before the implementation of the experimental program.

Instruments and Equipment

In order to achieve a precise recording of the performance of the subjects, numerous instruments and apparatuses were employed in this study, as well as assist in performing the experimental protocols. To ensure an appropriate environment for both group (pre-test and post-test) during practical sessions and skill tests, all of these were carried out on a proper international standard badminton court.

For the instructional sessions and the testing protocols, participants used badminton rackets and shuttlecocks to perform the high serve skill. We used tape measure and markers to set up the testing field precisely speaking define the target areas in an opponent side. This ensured from each entry the serving zones were established and proper uniformity in testing was maintained.

Furthermore, score sheets were prepared to record the results of each participant during high serve skill test so that researchers could systematically write down accuracy and performance scores. To ensure the important measurable characteristics of each skill could not only be accurately evaluated during testing procedures, but also reviewed at a future date if necessary, when needed, a video recording camera was utilized throughout this process.

Moreover, a standardized skill test developed to assess the badminton high serve was used for measurement within the study. The purpose of the test was to objectively measure how well each participant had performed in a standardized way. This increased reliability and validity of measurements was due in part to the use of these instruments and tools during the course of the study.

Skill Test

In order to assess the accuracy of badminton high serve skill performance, an accurate test for badminton high serve (Phomsoupha & Laffaye, 2015) was carried out. The above test is frequently used in badminton skill assessment research as it enables the

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investigators to consistently and objectively measure serve accuracy and control at multiple locations.

The test was performed on a regulation BWF badminton court. Marking tape was used to create several target zones on the service area of the opposite court. The zones are scored based on how accurately the shuttlecock lands and the tactical value of the marked area.

Each participant was explained the high serve skill and how it should be properly performed before they started. To get accustomed to the testing process, participants were also provided with two practice trials. Post familiarization, subjects executed ten number 1 high serves from the specific service position in the legal area.

The opposing participant would try to send the shuttlecock landing into their target zones in the opponent's court during the test. Points were given based on how accurate of a serve was. As a specific example, the central and deep target zones close to the back boundary line of the court were given higher scores on this logic as that would be considered optimal tactical placement of a high serve in badminton. Points introduced by Koji's serves that hit less specific areas scored lower (so-called, the 'dynamic areas' scored), while no points were given for serves landing outside of the actual area or as faults.

The sum of the scores from the ten attempts was taken as measure for the level of skill in badminton high serve. Higher scores reflected better accuracy and control over the serve. The test was administered under standard conditions in all subjects for the pre-test and post-test. The experiment was only conducted with the same equipment, court setup and testing procedures.

This badminton serving accuracy test has been applied in many studies for skill assessment, as well as physical education, related to performance improves on a specific skill (in this case serving) on beginner players.

Experimental Procedure

The experimental procedures of this study were carried out during the academic semester within the badminton practical course for first-year female students at College of Physical Education and Sport Sciences University of Baghdad. The experiment had a duration of eight weeks, which was composed by two instructional sessions per week, for a total of 16 instructional sessions. The duration of each session was 90-minute long, which is the common period for a practical sports lesson in our college.

In order to know the initial level of performance in badminton high serve skill; pre-test was administered in both experimental and control groups prior to conducting the experimental programme. All participants received the same pre-test conditions regarding court, equipment, and testing procedures. The pre-test results were then recorded in order to establish equivalence between the two groups prior to initiation of the intervention.

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The experimental program was applied after performing pre-test. In the experimental group, a game-based learning strategy based on small-sided games was used to promote execution and ball placement accuracy of the high serve skill. The idea behind this approach was to incorporate mini-structured games into the learning framework, thus facilitating interactive learning environments in accordance with real badminton gameplay situations. These games were structured in a way that promoted reinforced motor learning of the high serve skill, and at the same time, facilitated coordination, timing, and tactical awareness. Furthermore, increased student engagement and motivation with the use of games have been noted as essential attributes in the motor learning process.

Instruction always had three main components: the initial phase, where we warmed up; the instructional phase, where the subject of learning was explored; and a closing phase. During these warm up activities, the students executed general and sports particular work out to physically get ready for the session. The primary lesson phase consisted of demonstrations of the high serve technique followed immediately by engagement in structured small-sided practice games to encourage correct movement patterns and to increase accuracy during serving. Lastly, the final section consisted of short evaluation, feedback and cool-down activities.

Unlike the experimental group, the control group's involvement used the conventional method of teaching, which included explanation, demonstration of skill execution by an instructor and part repetition individual drills to practice high serve. While both groups taught the same skill and received an equal total amount of instructional time, how they were taught was different.

After the eight-week instructional period, both groups received a post-test under the same standardized conditions as in the pre-test. The reason for carrying out the post-test is to see how much improvement was achieved in the correctness of using the high serve skill and to compare the effectiveness of game-based learning strategy with traditional teaching method.

Table 2. *The Educational Program for the Experimental Group*

Week	Session Focus	Small-Sided Game Used	Objective of the Game	Duration
1	Introduction to high serve technique	Target Serve Game	Familiarizing students with high serve mechanics and target zones	20 min
1	Basic serve control	Serve Accuracy Challenge	Developing initial control of shuttle direction	20 min
2	Serve height and distance	Deep Court Target Game	Training students to send the shuttlecock toward the backcourt	25 min

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2	Serve consistency	Consecutive Serve Game	Increasing repetition and consistency of high serves	25 min
3	Serve precision	Zone Scoring Game	Improving accuracy by aiming at different scoring zones	30 min
3	Decision making	Serve and Recover Game	Combining serve execution with movement preparation	30 min
4	Tactical serve placement	Opponent Target Game	Learning tactical placement of the serve	30 min
4	Competitive practice	Serve Competition Game	Increasing motivation through competitive play	30 min
5	Accuracy under pressure	Time-Limited Serve Game	Performing serves within time constraints	30 min
5	Repetition training	Multi-Serve Game	Increasing number of skill repetitions	30 min
6	Game simulation	Mini Badminton Game (Half Court)	Applying serve skills in simplified game situations	35 min
6	Tactical awareness	Serve Strategy Game	Choosing appropriate serve placement	35 min
7	Performance consistency	Accuracy Ladder Game	Gradually increasing difficulty of serve targets	35 min
7	Skill refinement	Precision Target Game	Refining technique and shuttle trajectory	35 min
8	Integrated gameplay	Small-Sided Match Play	Applying serve skills in realistic match situations	40 min
8	Final practice	Competitive Serve Challenge	Preparing participants for the post-test	40 min

Statistical Analysis

Statistical Package SPSS was used to analyze the data collected. Ver. 26 Mean and standard deviation were calculated for descriptive statistics of participants' performance scores in pre-test and post-test measurements. Statistical analyses were further made to infer significance of the differences observed in the results. To determine the extent of improvement in performance for the high serve skill, a paired samples t-test was conducted to compare pre-test and post-test scores within each group. In addition, an independent

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samples t-test was performed to compare the post-test scores of participants taught through the game-based learning strategy using small-sided games (experimental group) and those who were instructed according to the traditional teaching method (control group). The significance level for all analyses was $p \leq 0.05$.

Results

Table 3. Comparison Between Pre-Test and Post-Test Results for the Experimental Group in the High Serve Skill

Test	N	Mean	Std. Deviation	t-value	Sig. (p)
Pre-Test	20	4.85	1.12	11.27	0.000*
Post-Test	20	8.95	0.97		

Table 4. *Comparison Between Pre-Test and Post-Test Results for the Control Group in the High Serve Skill*

Test	N	Mean	Std. Deviation	t-value	Sig. (p)
Pre-Test	20	4.70	1.09	4.63	0.000*
Post-Test	20	6.10	1.02		

Table 5. *Comparison Between the Experimental and Control Groups in the Post-Test of the High Serve Skill*

Variable	Group	N	Mean	Std. Deviation	t-value	Sig. (p)
High Serve Skill	Experimental	20	8.95	0.97	9.01	0.000*
	Control	20	6.10	1.02		

Note. Significant at $p \leq 0.05$.

Discussion

The results of this study showed that both the experimental group and control group made significant improvement in high serve skill performance between the pre-test score and post-test score after the different subjective feedback interventions given to them. Yet the difference in improvement was significantly greater for the experimental group than that of the control group. It means that applying game-based learning strategy by using small-sided games, has an impact on precision and performance of the high serve skill level in the sample of study as a whole were beginner female students.

Game-based learning environments are dynamic, interactive learning situations that help in developing better motor skills, which is the reason behind the considerable improvement achieved by students belonging to experimental group. Such small-sided games enable learners to repeat their skills over and over within meaningful context that

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are similar to real-game scenarios, improving both motor coordination and tactical awareness. Such a finding echoes the tenets of ecological dynamics perspectives on motor learning, highlighting how effective skill acquisition considers interaction among the learner-user-tasks-environment (Chow et al., 2024; Hassan & Abdulkareem, 2026; Hammood et al., 2024). After learning skills through game-like environments, learners will better adapt their movements, allowing them to acquire more functional motor solutions.

More number of skill repetition with small sided games also plays an important role for improvement in experimental group. However, in reality learners often perform skills in a vacuum as part of track-based practices that do not truly reflect the dynamism of gameplay. In turn, small-sided games facilitate more continuous engagement and consequently increased opportunities to perform skills; thus, enhancing motor learning through practice with feedback. Previous studies of our own have shown that engaging in game-based practice led to much more handling and growing skills learned per practice (Silva et al., 2021; Abdulghani et al., 2025).

In addition, game-based learning can enhance students' motivation and satisfaction in the learning process. Motivation is thought to be an important contributor to motor learning, as motivated learners often practice with greater effort and attention. The small-sided games have a competitive and fun element to them, which motivates participants to engage in a less boring alternative that takes shape outside of drills. It is evident from studies in physical education literature that, with game-centered approaches the students' enjoyment and motivation are increased which influence their learning outcome positively (Werner et al. 1996; Mondil & Shukr, 2023).

Further, the findings showed that the controls have had moderate improvements from pre- to post-test assessments. This is not surprising, as regular practice with the skill during instruction sessions likely improved performance. Skill acquisition can still occur using traditional teaching methods grounded in demonstration and repetition, especially for novice learners who need well-defined technical instruction and organized training sessions (Schmidt et al., 2018; Ali & Remadan, 2021). But the degree of improvement was not as great as that seen in the experimental group, emphasizing the benefits of introducing game-based components into learning.

These settings might proof to be a driving force behind the mind-set created by small-sided games, which help explain the performance increase seen for the experimental group in post-test results. These games mimic the real playing scenario, where learners must adapt their foot-work, maneuver projectile trajectory and adjust body mechanics. These types of environments build in the learners the technical know how, perceptual and decision-making skills required for proficient execution within badminton (Davids et al., 2013; Hussein & Abedulkareem, 2017; Otte et al., 2019; Rabeea et al 2024).

The effectiveness of the game-based learning strategy is also explained by its consistency with many modern pedagogical approaches in physical education, emphasizing student-centered instruction. These craft learners to search for movement

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solutions rather than simply copying the techniques being shown. This allows for engagement with the learning process and creates a better understanding of how to execute skills (Light & Harvey, 2017; Maki and Mahdi, 2018).

Collectively, the results of this study add to the increasing body of evidence supporting game-based instructional strategies as effective for improving sports education through motor skill acquisition. This implies that small-sided games–based badminton instruction may create a productive learning experience for beginner learners through skill repetition in more than contextual and engaging way, which leads to higher performance of the high serve skill.

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Conclusions

This study's results suggest that such a game-based learning strategy, using small-sided games, significantly improved performance of the high serve skill in badminton by beginner female students. The finding that the experimental group improved more than the control group implies that incorporating structured games into the learning process serves as an enriching learning environment, increasing skill rehearsal frequency and improving coordination and enthusiasm during motor acquisition. These findings all clearly establish that game-based learning approaches are effective in developing basic badminton skills of school children at elementary level.

Recommendations

According to the study findings, physical education teachers should consider game-based learning principles and small-sided games when teaching badminton skills because they could increase motivation and can promote skill acquisition especially for novice learners. The findings can also be used to progress the teaching of other racket sport skills in physical education contexts. Moreover, future studies are suggested to analyses the outcomes of game-based learning on other badminton skills with a larger sample and different age groups to further clarify the role of contemporary teaching methods in motor learning process as well as sports education.

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Psychological hesitation and its relation to the performance level of diving skill among second year female students

Tiba Zaid Hikmat [1]

[1] University of Baghdad, College of Physical Education and Sports Sciences

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Abstract

The significance of the present research is to know the nature of the relationship between psychological hesitation and the level of skill performance in the diving skill among second-year female students at the Faculty of Physical Education and Sports Sciences, University of Baghdad, for the academic year (2024-2025). It also intends to introduce the idea of psychological hesitation in diving skill and how to deal with it. The researcher used the descriptive analytical approach because it is appropriate to the nature of the study. The research sample consisted of (30) female students, purposely selected from those who regularly attended the practical classes, aged between (19-21) years.

The researcher applied a Psychological Hesitation Scale, a Diving Skill Performance Evaluation Form, and a demographic information questionnaire. Data were analyzed with the suitable statistical methods using Statistical Package for the Social Sciences (SPSS v26).

The results demonstrated a high level of psychological hesitation in the students, especially in the dimension of hesitation in motor decision-making. They further reported a strong, statistically significant negative correlation between psychological hesitation and skill performance ($r = -0.721$), suggesting that as psychological hesitation increases, technical performance decreases. The study recommends the need to include psychological preparation in educational programs, to take a gradual approach in teaching skills, and to periodically assess the levels of psychological hesitation in order to improve the quality of skill performance.

Keywords: Psychological Hesitation, Diving, Swimming, Skill Performance Level

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[1] University of Baghdad, College of Physical Education and Sports Sciences.
tiba.zaid2104p@cope.uobaghdad.edu.iq

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Introduction

Diving is considered to be a sport of advanced physical and psychological skills, because the psychological factor is a key element that can directly affect the efficiency of performance. The importance of this skill is that it requires a high level of self-control, the ability to make the right decisions at critical moments, and enough confidence to carry out the necessary movements in the air and in the water. In the current era, characterized by growing physical and technical requirements, the performance of the task is possible only if it is based on a solid psychological preparation. This explains why the psychological aspect has become a focus of attention for both coaches and researchers.

Psychological hesitation is one of the most common behavioral and psychological phenomena among female students in the process of performing dives, especially in the initial stages of learning the skill. The signs of anxiety, the fear of failure or injury, appear, which may cause the student not to execute the dive or to execute it incorrectly and unbalanced. Psychological hesitation is a mental oscillation and indecision in making adequate motor decisions. It is seen as a hindrance to learning. This is especially true in educational environments without psychological training as well as physical and technical drills. Its danger is that it does not always happen directly, but through non-verbal signs such as motor hesitation, withdrawal from the execution, the reduction of the number of attempts or even the attempt to justify the avoidance of the performance.

The study's specificity lies in the fact that it was conducted with female students in the second year of Physical Education and Sports Sciences faculties, a year in which students begin to deal with more advanced practical issues related to sports skills and, therefore, new psychological challenges that are not presented in the previous stages. Furthermore, the university environment, which is supposed to be stimulating, may sometimes constitute an additional source of psychological stress, whether due to academic evaluation pressures, competition with peers, or fear of making mistakes in front of the instructor or colleagues. This increases the likelihood of psychological hesitation becoming apparent in certain high-risk skills such as diving.

Previous studies addressing similar topics include Ibrahim (2013), which developed a counseling program to reduce psychological hesitation among students at the College of Physical Education in some gymnastics skills. Sahee (2017) examined the effectiveness of two counseling methods (self-talk and stopping negative thoughts) in reducing psychological hesitation among middle school students. Al-Mutani (2014) investigated an educational-counseling program using self-examination to suppress psychological hesitation in performing the snatch lift. Hatem (2013) found variation between psychological hesitation level and scoring accuracy in football players, with no significant difference due to lack of attention to the psychological aspect. Abu Al-Tayeb (2020) indicated an effect of emotional intelligence and its dimensions (independence, social communication, adaptability) in reducing psychological hesitation among Jordanian national team swimmers. Thanon (2012) identified the degree of psychological hesitation

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among players of University of Mosul college teams in individual sports and its relationship with their achievement levels.

Research Objectives

1. To identify the level of psychological hesitation among second-year female students.
2. To measure the level of performance of the diving skill among second-year female students.
3. To reveal the nature of the relationship between psychological hesitation and the performance of the diving skill.

Research Hypotheses

There is a statistically significant relationship between psychological hesitation and the performance of the diving skill among second-year female students.

Research Domains

1. **Human Domain:** Second-year female students at the Faculty of Physical Education and Sports Sciences.
2. **Spatial Domain:** The swimming pool of the Faculty of Physical Education and Sports Sciences.
3. **Temporal Domain:** 2024 – 2025.

Definition of Terms

Psychological Hesitation:

An internal emotional state in which the student feels insecure about her abilities, characterized by lack of self-confidence and fear of failure or making mistakes, leading to slowness in decision-making or avoidance of performance in situations requiring a motor or skill response.

Research Methodology and Procedures

The researcher adopted the descriptive analytical approach in this study due to its suitability to the nature and objectives of the study. This approach allows for describing the psychological phenomenon – namely "psychological hesitation" – as it occurs in the field setting, and then analyzing it using appropriate statistical methods to reveal the relationship between the level of psychological hesitation and the quality of diving skill performance. This approach was used as it is among the most suitable for psychological studies aiming to understand phenomena as they occur in their natural context without experimental intervention. The research sample consisted of second-year female students at the Faculty of Physical Education and Sports Sciences, University of Baghdad, for the academic year (2024-2025) who are studying the course (Swimming - including the diving skill). The research sample was purposefully selected from students who regularly participate in practical diving lessons. Sample size was (30) students with ages ranged between (19-21) years. All of them were physically and mentally fit and had no chronic disease or psychological problems that could affect performance, according to a medical report of the health monitoring unit of the college.

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Research Instruments

In order to achieve the aims of the study, the researcher used the following instruments:

1- Psychological Hesitation Scale Modified for the Sports Environment

The Psychological Hesitation Scale adapted to the educational environment in swimming lessons was used. It was developed based on psychological literature (Weinberg & Gould, 2023; Vealey, 2020) and previous scales of sports psychology. The scale consists of (50) items distributed over three dimensions.

Anxiety and Fear of Failure dimension (23 items)

- Lack of Self-Confidence dimension (14 items)
- Hesitation in Motor Decision-Making dimension (13 items)

Each item is answered using a five-point Likert scale (from 1 = Does not apply to me at all to 5 = Applies to me completely). The total score of the scale is calculated as a general indicator of the degree of psychological hesitation of the student.

Validity of the scale was checked by presenting it to a panel of specialists in sports psychology. The reliability of the scale was measured by the test-retest method on a pilot sample of (10) female students who were not part of the research sample, and the reliability coefficient was (0.85), which indicates a high degree of internal consistency.

2- Diving Skill Performance Evaluation Form

In order to measure the technical performance of the diving skill from the edge of the pool, the researcher designed a specific observation form. University swimming course education was the basis for the evaluation criteria. The form contained the following indicators:

- Motor preparation (body position before the jump)
- Execution of the jump (takeoff, balance, angle)
- Water entry (streamlining, straightness, lack of hesitation)
- Overall movement evaluation (control, coordination, apparent hesitation)

Performance was evaluated by a committee of three expert judges specializing in swimming instruction. The final score was calculated as the average of their scores.

3- Introductory Questionnaire

The researcher developed a simple questionnaire to collect preliminary data on the characteristics of the sample (age, health status, number of years of swimming practice, level of fear of water). The questionnaire has been used to help describe the sample and to analyze the relationship between some of these psychological and skill characteristics.

Field Procedures

- Formal approvals were sought from the college administration
- The sample was informed of the objectives of the study before the start.
- The Psychological Hesitation Scale was given to the students on the first day.
- Following this, the judging committee scored the students' performance in dive

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execution.

• The scale was administered again after two weeks to check for consistency.

• Data were collected through SPSS and statistical analysis of data was done by using SPSS tofind out means, standard deviations and correlation coefficients (Pearson).

Results

SPSS v26 was used to analyze data through appropriate statistical methods to achieve the research objectives. The emphasis was on:

1. Describe the level of psychological hesitation of the students.
2. Explains the level of skill execution in diving.
3. Studying the correlation between psychological hesitation and skill performance level

. **First: Descriptive Statistics of Psychological Hesitation Level**

Arithmetic means and standard deviations were calculated for three dimensions of Psychological Hesitation Scale and total score of the scale.

Table1. Shows the Descriptive Statistics of the Study Variables

Dimension	Arithmetic Mean	Standard Deviation	Maximum Possible Score	Level of Hesitation
Anxiety and Fear of Failure	24.10	3.45	35	High
Lack of Self-Confidence	20.80	3.10	30	Medium
Hesitation in Motor Decision-Making	26.25	2.90	35	High
Total Score	**71.15**	**6.35**	**100**	**Relatively High**

Interpretation: The results indicated that the dimension of "Hesitation in Motor Decision-Making" was the highest of the dimensions, meaning that students have difficulty in making decision at the time of diving.

Second: Descriptive Statistics of Skill Performance Level

The arithmetic means and standard deviation of the scores of the skill performance evaluation given by the judging committee were calculated.

Table2. Shows the mean, standard deviation, maximum score attained, and performance level of the study variables.

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Skill Indicator	Arithmetic Mean	Standard Deviation	Maximum Score	Performance Level
Motor Preparation	6.80	1.25	10	Medium
Jump Execution	7.10	1.40	10	Medium
Water Entry	6.00	1.70	10	Low
Overall Evaluation	6.65	1.55	10	Medium
Total Score	**26.55**	**4.30**	**40**	**Medium, tending toward low**

Interpretation: The results showed that in general the diving performance of the students was at the medium level, with a significant weakness in the phase of entering the water which often requires a high degree of confidence and precise timing**.**

Third: Analysis of the Relationship between Psychological Hesitation and Skill Performance

The association between the total score of psychological hesitation and the total score of skill performance was analyzed using Pearson correlation coefficient.

Table3. Shows the Correlation Coefficients Between the Study Variables.

Variables	Correlation Coefficient (r)	Significance Level (Sig.)	Relationship Type
Psychological Hesitation × Skill Performance	**-0.721**	**0.001**	**Statistically significant inverse relationship**

Interpretation: There is a strong statistically significant negative relationship between psychological hesitations and skill performance. In other words, the higher the psychological hesitation level, the lower the diving skill performance level.

Fourth: Relationship between Psychological Hesitation Dimensions and Performance

For accurate analysis, separate correlation coefficients were obtained for each dimension of psychological hesitation with skill performance.

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Table4. Shows the Correlation Coefficients Between the Study Variables

Dimension	Correlation Coefficient with Performance	Statistical Significance	Interpretation
Anxiety and Fear of Failure	-0.618	0.003	Strong inverse relationship
Lack of Self-Confidence	-0.549	0.006	Moderate inverse relationship
Hesitation in Motor Decision-Making	-0.684	0.001	Very strong inverse relationship

Discussion of Results

The results of this study showed different aspects of the relationship between psychological and skill variables in female students of the second year, especially in sensitive technical skills such as diving. Psychological hesitation is a trait that affects performance significantly especially when combined with factors of anxiety, lack of self-confidence and fear of failure. A detailed analysis of the results is given according to the tables presented before.

First: Discussion of the Level of Psychological Hesitation

The results showed a relatively high degree of hesitation in the study sample, with the total mean score of the Psychological Hesitation Scale being 71.15 out of 100. This finding is in line with previous literature in sport psychology which has found that skills associated with risk or danger – such as diving from a height – are often associated with high degrees of hesitancy (Vealey, 2020; Weinberg & Gould, 2023).

The highest score among the three dimensions was “Hesitation in Motor Decision-Making” with a mean of 26.25, which showed that most of the students have clear difficulty to take a decisive decision at the crucial moment of the dive. This kind of hesitation is usually due to inadequate or insufficient psychological preparation or to the lack of previous mental imagery of the movement. It may also be a consequence of previous negative experiences such as failure or embarrassing situations which results in what is called ‘emotional freezing’ at the time of performance.

The dimension of “Anxiety and Fear of Failure” also got a high mean which means that students were relatively psychologically unstable before or while performing a skill. The reasons for this could be various academic and environmental factors such as fear of teacher evaluation, anxiety about peer perception, or low self-efficacy. Many researchers

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in similar studies in the field have discussed these issues (Martens, 2019; Jones & Hardy, 2021).

Second: Discussion of Skill Performance in Diving

The performance of skills achieved an average total score of 26.55 out of 40, approximately 66.4%, with a performance of "medium tending to low". “Water entry” was identified as the weakest indicator of performance, with a mean of only 6.00 out of 10.00, which deserves attention.

The poor performance of the students in the water entry phase could be a direct mirror of the hesitation state before the execution moment. To enter the water effectively, the motion must be stable, and the balance must be accurate and instantaneous. These qualities are difficult to attain under disturbed or hesitant psychological conditions. In their work on the relationship between psychological factors and the perceptual-motor execution of fine skills, Abernethy and Hanrahan (2017) have shown that psychological readiness has a clear influence on complex motor skills.

This result can also be interpreted from the perspective of environmental education. Students may not be adequately trained to develop confidence and mastery, especially in skills related to an unfamiliar aquatic environment. Inadequate psychological preparation programs and lack of stepwise instructional progression may reinforce the fear of diving, particularly during the early stages of learning.

Third: Discussion of the Relationship between Psychological Hesitation and Skill Performance

The most important finding of this study was a strong negative relationship between psychological hesitation and the level of skill performance with a correlation coefficient of ($r = -0.721$) and a statistically significant negative correlation ($p = 0.001$). This means that with increase in psychological hesitation in a student her performance in the diving skill decreases and vice versa.

This relationship can be explained by the “anxiety-performance” model proposed by Yerkes and Dodson (1908) which states that optimal performance is achieved with a moderate level of anxiety, whereas higher anxiety or psychological hesitation leads to a degradation of motor performance, particularly in open or risky skills.

The results show that the highest negative correlation was found with the dimension “Hesitation in Motor Decision-Making” ($r = -0.684$) which is in accordance with the nature of the diving skill that requires a decisive and rapid decision in a very short time. Any delay at this point may disturb motor behavior and result either in an incomplete execution or in a complete withdrawal of performance. "“Fear of failure” also showed a high negative correlation ($r = -0.618$). This means that many students can either fail to dive or dive tensely for fear of making a mistake, which would be negatively evaluated or even physically injured. This factor is considered as one of the most important obstacles to performance in

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high-performance sports and those that involve direct confrontation with oneself and the environment.

Conclusions

1. The second-year female students have a clear psychological hesitation in the process of executing the diving skill, especially in the dimension of "hesitation in motor decision-making." It shows the real psychological obstacles for the correct implementation of the skill.
2. A sensitive indicator of technical performance, the "water entry" indicator, often negatively affected by the absence of confidence and psychological readiness, showed noticeable weakness.
3. It has been proven that hesitation has a negative effect on the quality of technical skill execution in diving. A strong and statistically significant inverse correlation is established between psychological hesitation and skill performance ($r = -0.721$).
4. Among the dimensions, "hesitation in decision-making" had the most effect on performance, followed by "anxiety and fear of failure". These aspects require special attention in educational and training programs.
5. The low level of performance of the skill in general suggests a lack of adequacy in the psychological aspect, but perhaps also in the training or teaching methods used for this skill.
6. The lack of psychological programs in combination with skill instruction may be the prime reason for the psychological hesitation and failure of the student to overcome feelings of fear or anxiety.

Recommendations

1. Design and implement psychological training programs simultaneously with the instruction of the diving skill and focus on the building of self-confidence, reduction of anxiety and training students on rapid decision-making during motor performance.
2. Use mental imagery and visualization techniques as effective strategies to reduce psychological hesitation and increase self-efficacy feelings before performance.
3. Offer a supportive, non-threatening educational environment with emphasis on positive encouragement, avoiding harsh evaluation, particularly during the learning stages of complex and dangerous skills.
4. Gradually introduce skill learning, beginning with simple, controlled situations and progressing to full dives, giving students time to psychologically and skill-wise adapt.
5. Introduce periodic testing of psychological hesitation levels within educational assessments to identify cases that need additional psychological support and continuous follow-up.
6. To increase the awareness of the importance of the psychological aspect in teaching sports skills through specialized workshops and training courses for the students in physical education and sports sciences faculties.

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7. Use experimental designs to conduct future studies to test the effectiveness of specific psychological interventions to reduce psychological hesitation and improve skill performance.

Summary

From the above, it can be concluded that the psychological hesitation is a determining factor in the performance of the diving skill of the second-year female students. The study revealed that a higher level of this hesitation, especially in the dimension of decision-making, negatively affects all indicators of technical performance. The results also indicated the pressing need for more integrated psychological and educational support programs that take into account individual differences and promote self-confidence and mental imagery before and during the performance of aquatic skills.

Appendix (1): Questionnaire

No.	Statement	Applies to me completely	Applies to me	Applies to me sometimes	Does not apply to me	Does not apply to me at all
1.	I hesitate when I feel weakness in the skill I am about to perform.					
2.	My willpower motivates me to perform well.					
3.	I hesitate when I practice a sport I do not like or desire.					
4.	I hesitate in performing sports movements if I feel they may cause me injury.					
5.	I possess previous experience and trials that make me not hesitate in practicing sports.					
6.	My feeling of exhaustion and fatigue makes me hesitate in practicing sports exercises and games.					
7.	I hesitate when others mock me.					
8.	My self-confidence makes me not hesitate in performing the skill.					
9.	The presence of assistive devices and assistants makes me not hesitate in performing sports.					
10.	My poor relationship with the teacher makes					

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	me hesitate in performing the skill.					
11.	I possess vitality and activity that help me perform the sports skill.					
12.	Having high psychological preparation enables me to practice sports skills without hesitation.					
13.	My courage makes me not hesitate in performing sports movements.					
14.	The degree of equipment restriction and movement difficulty makes me hesitate in performing them.					
15.	When I know the purpose of the game, I do not hesitate in performing it.					
16.	I hesitate when I feel a sense of failure.					
17.	I do not hesitate when I am calm and psychologically stable.					
18.	I feel hesitation in performing the game when I do not receive moral incentives.					
19.	My practical and theoretical experience makes me not hesitate in performing sports.					
20.	I hesitate when I expect my level will not be up to the required standard.					
21.	My feeling of fear of the skill or equipment causes me hesitation in performing sports.					
22.	My feeling of boredom distances me from practicing sports.					
23.	I worry about performing the activity.					
24.	I do not care about the final outcome of the performance.					

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25.	I hesitate when my pulse rises before matches.					
26.	My personality is the reason for my hesitation.					
27.	When asked to make a certain decision, I am slow in making it.					
28.	The importance of the competition makes me participate in it.					
29.	Sudden change in daily habits makes me not want to play sports.					
30.	My exposure to stress makes me hesitate in performance.					
31.	I hesitate when asked to compete against a player with a high reputation and level.					
32.	I hesitate when asked to participate in high-level championships.					
33.	My discomfort with some referees makes me hesitate in performing the assigned activity.					
34.	I am optimistic.					
35.	My shyness is the reason for my hesitation.					
36.	Repeated failure causes me hesitation in performing sports activity.					
37.	My poor physical preparation causes my hesitation in performance.					
38.	My feeling of confusion and instability makes me hesitate in practicing the assigned sports.					
39.	I cannot control my nerves in embarrassing situations.					
40.	My body type makes me hesitate in performing the game.					

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41.	When I do not feel good, I do not want to play sports.					
42.	I possess high morale that makes me a non-hesitant player.					
43.	I hesitate when I am frustrated.					
44.	I hesitate when I hear words that imply treachery or defamation.					
45.	The poor quality of equipment I appear in during sports competitions makes me hesitate in performing sports activities.					
46.	Weather conditions make me hesitant.					
47.	I do not feel hesitation in performing the activity when I possess a spirit of hope for victory.					
48.	I hesitate when I encounter frustration.					
49.	My perseverance does not make me hesitant in performance.					
50.	I feel hesitation in performing an activity or exercise when I see a large audience.					

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Comparing the maximum strength of the static and eccentric pectoral muscles of the quadriceps as an indicator of injury in professional football players

Ismael Hameed Saleh1[1], Ismael Saleem Abed2[2], Shatha Hussein Salman3[3], Jaafar Abdul-Muttalib Hafiz4[4]

[1,] 1University of Baghdad, College of Political Science.
2,4University of Baghdad, College of Physical Education and sports Science
3, Ministry of Education

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Abstract

The aim of this study was to predict the risk of hamstring (posterior quadriceps) muscle injury associated with weakness in eccentric muscle strength. The Prone ISO and Nordic tests were performed using the NordBord system from VALD to compare isometric and eccentric contractions of the same muscle group, namely the hamstring muscles, in professional soccer players competing in the Iraqi Stars League. The mean value of the Prone ISO test, which represents maximal isometric contraction, was 353.8 N, whereas the mean value of the Nordic test, which represents maximal eccentric contraction, was 288.6 N. This difference indicates a potential risk factor related to insufficient eccentric contraction capacity of the hamstring muscles. The findings demonstrated weakness in the eccentric contraction phase of the hamstring muscles. This weakness may be explained by several factors, including insufficient eccentric training of these muscles using specific exercises such as the Nordic exercise, Romanian deadlift (RDL), or other exercises designed to develop eccentric contraction capacity. If the players already perform these exercises, it is possible that they do not perform them with maximal effort against body-weight resistance, or that they require additional external loads to increase eccentric contraction capacity. The researcher recommends the use of modern testing methods, including those used in the present study, to identify optimal muscular performance and contraction capacity. Emphasis should also be placed on exercises that develop eccentric

[1] University of Baghdad, College of Political Science
ismail.h@copolicy.uobaghdad.edu.ia,
[2] University of Baghdad, College of Physical Education and sports Science
Ismail.Abd@cope.uobaghdad.edu.iq
[3] Ministry of Education
shatha.hussein1104b@cop.uobaghdad.edu.iq
[4] University of Baghdad / College of physical education and sports science
Jaafer.abdulmutalib@cope.uobaghdad.edu.iq

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contraction of the hamstring muscles to protect them from potential injury during high-speed running and to improve their functional performance.

Keyword: Hamstring, Concentric contraction, Eccentric contraction, ISO Pron Test, Nordic Test

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Introduction

The study of injury risk factors has developed markedly in recent years owing to scientific and technological advances that have improved methods of testing, measurement, training, and monitoring. These advances aim to preserve player availability, reduce injury risk, and manage injuries as effectively as possible. The collection, analysis, and application of data have revolutionized the design of sports-performance programs over the past decade and have become fundamental to training-program development. Consequently, coaches no longer prescribe a single program or exercise that fits all players; instead, training is designed according to each player's strengths, weaknesses, and individual needs. This approach helps reduce injury risk, improve athletic performance, and achieve peak performance more effectively than before. Sports clubs and training centers differ in their use of advanced devices and tools for identifying injury risk according to their financial capacity and human resources. This variability may lead to a lack of effective tests, measures, and data for identifying the risk factors that affect individual players. Sports injuries in soccer are diverse.

Studies have indicated that muscle injuries are among the most common injuries in soccer. In a squad of 25 players, approximately 15 to 18 muscle injuries may be expected during a season; among these, approximately three occur in the quadriceps, five to six in the groin/adductor region, two to three in the calf muscles, and seven in the hamstring muscles. In addition, 96% of hamstring (posterior quadriceps) injuries occur without contact, meaning that they are indirect injuries (Ekstrand et al., 2011). Although other injuries have decreased substantially, hamstring injuries have increased in recent years and now account for 24% of all injuries in professional UEFA leagues (Ekstrand et al., 2022).

Multiple factors contribute to hamstring injury. Some are non-modifiable, including age, previous injury, and genetic factors, whereas modifiable external factors include physical capacities and the player's skill level. Muscle strength is one of the most important physical qualities that, together with other factors, helps protect players from indirect injuries and contributes to the development of technical and tactical performance (Timothy., 2016). Muscles produce and express force through different forms of muscle action: isometric, concentric, and eccentric. Force production is regulated by several principles, including the length-tension relationship and the force-velocity relationship. These relationships explain how muscles generate and express force, enabling coaches and specialists to select appropriate tests and exercises to develop muscle contractions optimally. The importance of the present study lies in identifying and comparing isometric and eccentric contraction capacities of the hamstring muscles to predict the possibility of injury during high-speed running. Most hamstring injuries occur during high-speed running, particularly at the end of the swing phase, when the hamstring muscles are contracting eccentrically.

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Function of the hamstring muscles during high-speed running and risk of injury

The relationship between sprinting and the hamstring muscles can be described as a love-hate relationship: sprinting may either damage the hamstrings or make them stronger. The high muscular force and mechanical stress generated by eccentric hamstring contraction during sprinting create a suitable environment for hamstring injury. However, proper development of eccentric contraction can substantially reduce injury risk and improve strength and performance. Eccentric training strengthens the hamstring muscles while they are actively lengthening, which is particularly important during high-speed running. During sprinting, the hamstrings act primarily as brakes; they contract eccentrically to decelerate forward leg swing. As running speed increases, the terminal swing phase becomes shorter, increasing angular velocity at both the hip and knee (Agre, 1985). This requires the hamstrings to generate greater torque.

Greater eccentric hamstring strength can improve sprinting performance by increasing both stride rate and stride length (Bourne et al., 2020). Conversely, as running speed increases, weak hamstrings may have difficulty generating sufficient torque at longer muscle lengths during eccentric contraction, which may increase injury risky.

Mechanism of hamstring injury during high-speed running

Several mechanisms have been proposed for hamstring injury, including bending to collect the ball at high speed, landing from a jump with the knee hyperextended, kicking movements, high-speed technical movements, and high-speed running during acceleration, deceleration, and sudden changes of direction (cutting). All of these movements may contribute to injury in soccer (Al-Sulaiman, 2018, pp. 73-81). During running, in the second part of the swing phase (mid-swing), the hamstrings begin to contract eccentrically to absorb energy from the swinging limb before the foot contacts the ground. When these muscles contract eccentrically, a large change in muscle length is required (Askling et al., 2002; Brooks et al., 2006; Ekstrand & Gillquist, 1983; Verrall et al., 2005; Woods et al., 2004). This may cause muscle damage and tears according to the concept of mechanical strain (Bramah et al., 2024). Several analytical studies have also confirmed that injury occurs during the terminal swing phase, when the hamstring muscles are contracting eccentrically (Heiderscheit et al., 2009; Schache et al., 2012; Thelen, 2005).

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Materials and methods

Participants

Forty-seven soccer players occupying defensive, midfield, and attacking positions from 18 clubs in the Iraqi professional league participated in the study during the 2024-2026 seasons. The players were selected purposively according to the classification proposed by McKay et al. (2021). The participants were classified as Level 3 (highly trained/national level) and Level 4 (elite/international level). The sample selection criteria were as follows: (1) the player had a history of hamstring injury, including recurrent tears, strains, or discomfort during training or competition in the 2024-2026 seasons, confirmed by medical examination; (2) the player had completed the preparation periods for the 2024-2026 seasons and had not undergone any surgery involving the musculoskeletal system; and (3) the player was healthy and had not sustained an injury before data collection during the 2024-2026 season.

Experimental procedure

The Prone ISO test (Figure 2) and the Nordic test (Figure 3) were performed to compare isometric and eccentric hamstring contractions according to the following procedures:

The same testing devices were used for all players.

All players were tested before the training session to reduce the effect of fatigue.

Testing was conducted after confirming that the player was at the lowest possible level of neuromuscular fatigue.

All players performed a warm-up before the tests.

After the warm-up, all players performed a familiarization trial on the device to simulate the actual testing method and ensure that they understood how to use the device correctly.

After completing the warm-up and familiarization, each player performed three repetitions of the Prone ISO test and three repetitions of the Nordic test.

To ensure full readiness and reduce the influence of fatigue and stress from the first test (Prone ISO), the Nordic test was performed after a 5-minute rest interval following the first test.

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Materials

The NordBord system from VALD Performance (Figure 1) was used. The device is widely used for the assessment, monitoring, and training of the hamstring muscles. It includes six test types: three isometric tests at multiple knee-joint angles (0 degrees, 30 degrees, and 60 degrees), two eccentric tests including the Nordic and Razor tests, and a custom test that can be used according to the design and needs of the player and coach.

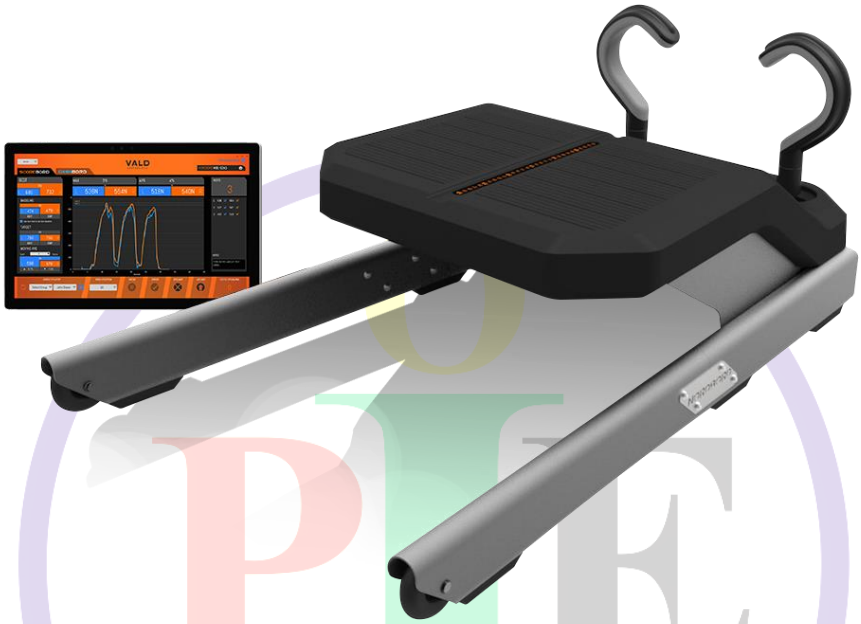

Figure 1. NordBord device

Research tests

The following tests were used:

Prone ISO test

Purpose of the test: to measure maximal isometric hamstring strength at a knee-joint angle of 0 degrees.

Equipment and tools: NordBord device, iPad, and a 30-cm-high box.

Testing procedure:

1. The player lies prone on the NordBord device in an extended position, as shown in **Figure 2**.
2. The player places both legs inside the hooks and pulls upward with maximal effort for three repetitions.
3. The rest interval between repetitions is 30 seconds.
4. Maximal force is calculated from the highest value recorded across the three repetitions

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Figure 2. Prone ISO test

Nordic test

***Purpose of the test*:** to measure maximal eccentric hamstring strength.
***Equipment and tools*:** NordBord device, iPad, and 5-cm-thick foam.
Performance procedure:

1. The player places both legs inside the hooks and positions both knees at an equal distance on the device platform.

The player places the hands on the chest at the beginning of knee extension and descent toward the floor.

The player attempts to resist the downward movement toward the floor as much as possible before extending the hands to receive the body on the floor.

The rest interval between repetitions is 1 minute.

Maximal force is calculated from the highest value recorded across the three repetitions.

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Figure 3. Nordic test

Results

The maximal force values of the isometric and eccentric contractions were compared (Tables 1 and 2, Figure 4).

Table 1. Descriptive statistical analysis for the Prone ISO and Nordic tests

Variable	n	Mean (N)	SD	Min	Max
Prone ISO	47	353.8	54.9	214.5	455.25
Nordic	47	288.6	54.2	180.75	404

Table 2. Difference test (independent t-test

Comparison	t-value	p-value	Result
Prone ISO vs Nordic	6.2	<0.001	Highly significant difference

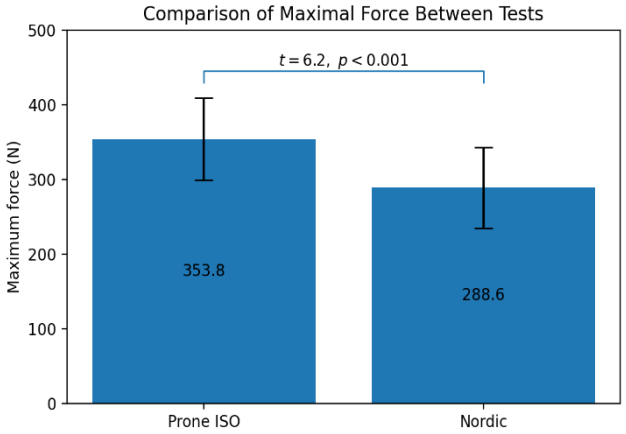

Figure 4. Results and statistical differences between the Prone ISO and Nordic tests

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Discussion

Tables 1 and 2 and Figure 4 show differences between isometric and eccentric hamstring contractions. After testing, maximal eccentric force in the Nordic test was lower than maximal isometric force in the Prone ISO test (Table 1). This finding contradicts the principles of force production and previous studies indicating that force production is typically greater during eccentric contraction because of the contribution of non-contractile connective tissues (Chapman et al., 2014; Herbert & Hoang, 2007; Kolmerer & Labeit, 1995; McGinnis, 2013; Neumann, 2017; Nishikawa, 2012, 2021). The present results indicate that the study sample showed a pattern similar to that reported in prospective studies in groups identified as being at increased risk of hamstring injury (Opar et al., 2021; Timmins et al., 2015). Reduced maximal eccentric force compared with isometric force may indicate an imbalance in muscle contraction capacity that requires preventive intervention. However, confirmation of a causal relationship requires prospective follow-up studies. Preventive intervention should focus on developing eccentric strength in these muscles. Eccentric training is highly effective for preventing hamstring injuries. Randomized trials have shown that training using the Nordic exercise reduced hamstring injury risk by 70% (Goode et al., 2015). In addition, a meta-analysis including 8,459 athletes found that injury-prevention programs incorporating the Nordic exercise reduced hamstring injury risk by approximately half (van Dyk et al., 2019). Several possible mechanisms may explain how eccentric training reduces hamstring injury risk. Eccentric training shifts the force-length relationship to the right, allowing the hamstrings to generate greater torque and absorb greater negative eccentric energy at long muscle lengths (Brockett et al., 2001). This adaptation strongly supports the terminal swing phase during high-speed running. Eccentric training also increases fascicle length in the long head of the biceps femoris, making the muscle less susceptible to damage during high-force eccentric contractions (Andrews et al., 2025; Bourne et al., 2017). Furthermore, short-term training produces rapid improvements in eccentric hamstring strength. Although the evidence is mixed, higher levels of eccentric hamstring strength may reduce injury risk, particularly among older players and players with a previous injury history, which corresponds to the target group of the present study (Opar et al., 2021; Timmins et al., 2015). Strong eccentric hamstrings may also help balance stress distribution between active and passive force-generating structures, thereby reducing the risk of injury caused by excessive stretching during the final phase of leg swing in high-speed running.

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Conclusions

1. There were differences in maximal force values between isometric and eccentric muscle contractions.
2. Maximal eccentric force in the Nordic test was lower than maximal isometric force in the Prone ISO test.
3. Players may be exposed to injury risk because of weakness in eccentric contraction, which is related to one of the mechanisms of hamstring injury during the terminal swing phase of high-speed running.
4. It was not possible to determine the specific threshold targeting eccentric contraction accurately because of limited availability of advanced devices, such as the NordBord, that can identify such thresholds.
5. Insufficient eccentric training was used to improve eccentric contraction efficiency.
6. If body-weight eccentric exercises are used, players may already have reached maximal adaptation to body-weight loading; therefore, additional external loads may be required to push adaptation further.
7. Sports clubs lack the data needed to detect injury risk in players and to compare obtained values with normative values according to sport, playing position, and age category.

Recommendations

1. It is necessary to identify the target threshold for the relevant tissue and for each type of muscle contraction (concentric, isometric, and eccentric). Training load should not be controlled only by repetitions, sets, or the apparent quality of exercise performance, such as the level of control displayed by the athlete. This approach would save time and accelerate tissue development toward improved muscle strength and tissue efficiency.
2. Modern devices should be provided to prescribe training doses according to the player's threshold level. The player may then be loaded approximately 2% to 10% above that threshold using the NordBord device and according to competition demands, to avoid overuse injuries related to excessive competitive intensity and training load during performance development.
3. Advanced technological devices should be used to detect injury risk by identifying differences in maximal force among the main types of muscle action: concentric, isometric, and eccentric. When maximal eccentric force is lower than maximal isometric force, this should be considered a risk factor according to muscle-contraction principles and the relevant scientific literature.

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The Effect of Skill Exercises Using The (Fit Light) Technique on Attentional Control and Performance of the Corner Kick and Penalty Kick Skills in Football

Fareeq Abdulla Hazaa [1], Safa Liwaa Kareem [2]

[1] University of Baghdad, Department of Student Activities.
[2] College of Alsalam, Department of Physical Education and Sport Sciences.

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Abstract

The aim of the research was to construct an attentional control scale in football for fifth-grade secondary school students, design skill exercises using Fitlight technology, employ them in practical physical education football lessons, and identify the effect of these exercises on attentional control and the performance of corner kick and penalty kick skills. The researcher hypothesized that there would be statistically significant differences between the pre- and post-test results of both the experimental and control groups in attentional control and in the performance of the corner kick and penalty kick skills in football, as well as statistically significant differences between the post-test results of the experimental and control groups in the same variables. The experimental method was adopted using a design with two groups (experimental and control). The research population consisted of fifth-grade secondary school students in the morning study at Al-Jawahiri Secondary School during the academic year (2024–2025), totaling 180 students, all intentionally selected using the comprehensive enumeration method (100%) from this population. The sample was distributed as follows: 10 students for the pilot experiment, 110 students for constructing the attentional control scale in football, and the remaining 60 students were selected as the main experimental sample representing the experimental and control groups. The researcher developed a new specialized attentional control scale in football for this category of students by following several field procedures and statistical analyses. Skill exercises using Fitlight technology were designed and applied to the experimental group for eight weeks at a rate of one lesson per week. After completing the experiment, the research results were analyzed using the SPSS statistical system. The conclusions indicated that the attentional control scale in football is suitable for fifth-grade secondary school students and possesses acceptable scientific foundations and coefficients. The use of skill exercises with Fitlight technology within football teaching in practical physical education lessons was found to be appropriate for fifth-grade secondary students and helped improve attentional control as well as the performance of corner kick and penalty kick skills in

[1] University of Baghdad, Department of Student Activities.
fareek@cope.uobaghdad.edu.iq
[2] College of Alsalam, Department of Physical Education and Sport Sciences.
safa.l.kareem@alsalam.edu.iq

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football among the students who practiced them compared with their peers who studied without them. The study also recommended adopting cognitive measurement in physical education lessons, particularly measuring each student's level of attentional control to support the improvement of football skill performance, avoiding excessive intensity or levels of lighting when using Fitlight technology, and emphasizing practice and repetition in the practical application of skill exercises when designing motor programs for football skill performance.

Keywords: Skill exercises, Fit Light technique, attentional control, corner kick, penalty kick, football

Introduction

Students need to enhance their ability to effectively select stimuli that require directing their attention and to control this attention with full mental awareness in order to manage the executive details of the skill to be performed. This is essential for meeting the requirements of various educational situations, particularly when learning football skills during practical physical education lessons. Such processes enable students to become aware of the stimuli present within the lesson and regulate their behavior through controlling attentional processes toward these stimuli. Therefore, it becomes necessary to provide support and facilitation for students by employing modern technological tools in teaching, which also take into account individual differences among learners. Educational technology represents a comprehensive revolution built upon information technology, which is the result of integrating three types of technologies: computer technology, software technology, and communication technology. This integration has the ability to enhance scientific productivity both quantitatively and qualitatively and includes instructional aids, multimedia, and educational resources (Fawzi & Rabhi, 2018, p. 29). Furthermore, there exists an integrative relationship between teaching methods, learning styles, and instructional media. This becomes evident through the teaching process and the procedures followed to achieve predetermined objectives, whereby instructional media form an essential component of the educational environment. They represent tools provided by the teacher, who ensures their suitability for use and effectiveness in influencing students, thus facilitating classroom learning and reinforcing it when used appropriately (Al-Suleiti, 2015, p. 23).

One of the modern technological tools used in education is Fitlight technology, which consists of instructional aids designed to attract attention and increase learners' interest in lesson topics. These tools provide sensory experiences that give meaning to the teacher's explanations by embodying ideas through tangible teaching aids, thereby facilitating understanding and forming visual images in learners' minds in the form of light stimuli that help guide their responses (Abdul Aziz, 2015, p. 3). Light has also been used considerably in research to study how the brain works and improve cognitive performance,

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as stimulating the brain using light can also enhance motor responses and thus increase the speed of neural response (Marder & Bucher, 2019, pp. 38–43). When visual images focus on retinal cells, they stimulate them and produce electrical currents that pass through nerve fibers toward the back of the eye, where they combine to form the optic nerve that transmits signals to the brain (Goldberger & Gurney, 2013, p. 21). Stimuli may either be organized into a cognitive schema or transmitted directly to appropriate response areas in the brain with minimal processing (Al-Fadhli & Al-Bayati, 2010, p. 105). Neural stimulation plays a crucial role in activating nerves, and consequently the strength and speed of the mechanical work of muscles depend on this stimulation, which requires biological energy to continue. When stimulation ceases, the chemical processes responsible for releasing muscular energy also stop (Guyton, 2010, p. 232). The neuron remains in a stable electrochemical state until it is stimulated by a signal transmitted from a neighboring neuron. When this signal arrives, the receiving neuron allows approximately one hundred million positive ions per second to enter, changing its charge from negative to positive and forcing the signal to travel along the axon toward the next neuron before returning to its resting state (Al-Masha'lah, 2010, p. 32).

Attentional systems directed toward goals are located in the frontal areas of the brain and are referred to as the anterior attentional system, which is governed by expectations, knowledge, and current goals, contributing to executive performance through voluntary attentional control (Eysenck et al., 2007, p. 337). The researcher believes that teaching the accuracy and performance of corner kicks and penalty kicks in football requires perceptual abilities based on attention and concentration when estimating fixed distances, observing the goalkeeper's movement, and dealing with environmental changes associated with these open skills. Thus, skill performance becomes closely linked to the student's attentional control ability. Attentional control is defined as a higher-level cognitive process that is organized and planned to help individuals select meaningful stimuli and ignore unrelated ones. It is also described as a conscious cognitive attentional system representing the ability to select and execute appropriate responses in conflicting situations and is associated with self-regulation mechanisms (Abdul-Hafiz, 2016, p. 17). Attentional control reflects the outcome of the limited capacity of the information-processing system; according to Broadbent's theory, the surrounding world consists of thousands of sensations that cannot all be processed simultaneously. Therefore, a filtering mechanism directs attention toward certain information while ignoring others (Al-Zughoul & Al-Zughoul, 2014). Attentional control also refers to focusing attention on specific behavioral aspects in terms of frequency and intensity, as individuals cannot regulate their actions unless they are aware of them. Self-monitoring thus becomes a process through which individuals observe their behavior to enhance their ability to regulate it (Zakeya, 2010, p. 60). Attentional Control Theory (ACT): Eysenck and colleagues (2007) elaborated further on the concept of attentional control, referring to it as a number of complex cognitive processes responsible for a wide variety of behaviors and executive

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performance during information processing. These processes include attentional focusing, attentional shifting, and flexible attentional control (Eysenck et al., 2007, pp. 336–353). The attentional control system operates by selectively detecting sensory events relevant to behavior, particularly when such events are salient, while goal-directed and stimulus-driven attentional systems interact in a balanced manner (Kennedy, 2015, p. 23). However, learners' brains may experience a state of cognitive fatigue due to excessive stimuli or mental exhaustion, which negatively affects information-processing memory. Activating this memory increases learners' perceptions and facilitates the reception, storage, and retrieval of information, leading to the required responses. Such activation depends on the type and intensity of the stimulus received by the learner, and psychological studies indicate that activation may occur either voluntarily or externally, although effective responses cannot be forced; instead, the educational environment should provide appropriate conditions for activation without coercion (Nazer, 2010, p. 325).

Avoiding monotony and boredom is one of the most important requirements for stimulating excitement and motivation in teaching football skills. Fitlight technology can serve multiple purposes in practical teaching, which depends on attention, understanding, and the application of purposeful exercises. It can be used to deliver instructions and provide feedback while also contributing to improvements within the lesson, provided that its integration with instructional exercises does not disrupt or distract from skill performance. Based on the researcher's academic experience in teaching methods of physical education, particularly football, a noticeable weakness was observed among fifth-grade secondary school students in performing corner kick and penalty kick skills. There is also a need to measure the level of attentional control required when performing these skills. Therefore, this research aims to construct an attentional control scale in football for fifth-grade secondary school students, design skill exercises using Fitlight technology and integrate them into practical football lessons in physical education, and identify the effect of these exercises on attentional control and on the performance of corner kick and penalty kick skills. The researcher hypothesized that there would be statistically significant differences between the pre- and post-test results of the experimental and control groups in attentional control and in the performance of corner kick and penalty kick skills in football, as well as statistically significant differences between the post-test results of the two groups in the same variables.

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Methods and Procedures

The research problem required the adoption of the experimental method using a design of two equivalent groups (experimental and control) with strict control through pre- and post-tests. The research population consisted of fifth-grade secondary school students enrolled in the morning study at Al-Jawahiri Secondary School, which belongs to the formations of the Rusafa Directorate of Education/2 during the academic year (2024–2025). The total number of students in this population was 180, who were naturally distributed equally across six classes. All students were intentionally selected using the comprehensive enumeration method (100%) from this population because they represent the target population of the research problem and meet the research objectives and requirements. In addition, the availability of a regulation-size football field at the school facilitated the implementation of the experimental procedures.

Initially, ten students were randomly selected from Class (A) to represent the pilot study sample, constituting 5.556% of the total population. In addition, 110 students from Classes (A), (B), and (C) were selected to represent the sample for constructing the attentional control scale in football, accounting for 61.111% of the research population. This selection was based on the rule of allocating five participants for each item of the scale. The other two classes comprised of 60 students, or 33.333% of the population who served as the primary application sample. These students were balanced across the two classes, either being randomly allocated to the experimental group (Class E) or to the control group (Class F).

The educational research problem emphasizes the need to introduce a tool for measuring attentional control in football among the fifth-grade secondary school students directly within their educational environment, which in this case was practically exercising physical education lesson. Thus, the researcher created a paper-and-pencil scale according to scientific methods relevant in this particular context. The need for the construction of attentional control high was based on the factthat this research focused on such a specific area as age and football teachingmethods during practical lessons of physical education.

The researcher also analyzed the common characteristics of the research population. The participants belonged to the same educational level and age group, and they shared similar academic conditions. Moreover, the measurement context was limited to the educational environment of the practical football lesson in physical education, which excluded variables related to different social environments and ensured that the measurement focused specifically on the research context.

In constructing the scale, the theoretical framework presented in the introduction of the research served as the main reference for defining the concept of attentional control in football and for formulating the scale items. The items in the scales create three dimensions of attentional control which were: Attentional Focus, Attentional Shifting and Attentional Flexibility with his educational environment practical football lesson.

The initial preparation of the scale items followed the standard procedures for paper-and-pencil scales. Each item was phrased according to three response options: (Always applies

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to me), (Sometimes applies to me), and (Does not apply to me). Scoring was based on a 1 to 3 Likert-type scale (weights of (3, 2, 1), respectively.

The scale face and logical validity was checked via a team of professionals to ensure the scale's conformity. A questionnaire was designed and sent to 17 specialists, in addition to a copy of the scale, to evaluate their attitude about items being fit for use as well as the general organizational structure of scale. There was 100% consensus between the experts to keep everything as is. During this process, from Wednesday (18/9/2024) to Thursday (26/9/2024), the face and logical validity of the scale was confirmed.

Afterward, the first pilot study of the attentional control scale was conducted. The scale was administered to ten students at Al-Jawahiri Secondary School on Sunday (29/9/2024). The purpose of this pilot study was to identify any potential difficulties or obstacles that might arise during the main experiment and to determine the average time required to complete the scale. The results indicated that the average time required for answering the scale items was nine minutes.

First: Discriminatory power of the scale

The researcher adopted the extreme groups method. Item scores were arranged in descending order and multiplied by 27% to determine the number of participants in the upper and lower groups, resulting in 29.7 students in each group, which was rounded to 30 students. Statistical analysis was then performed using the t-test for independent samples to determine the differences between the two extreme groups for each item of the scale, as presented in Table (1).

Table 1. Discriminatory Power of the Scale Items

Item No.	Group	N	Mean	SD	t-value	Sig.	Significance	Item Discrimination
1	Upper	30	2.43	0.504	5.676	0.000	Significant	Discriminating
	Lower	30	1.73	0.450				
2	Upper	30	2.33	0.479	11.886	0.000	Significant	Discriminating
	Lower	30	1.10	0.305				
3	Upper	30	2.63	0.490	11.758	0.000	Significant	Discriminating
	Lower	30	1.23	0.430				
4	Upper	30	2.40	0.498	12.187	0.000	Significant	Discriminating
	Lower	30	1.10	0.305				
5	Upper	30	2.53	0.507	8.142	0.000	Significant	Discriminating
	Lower	30	1.47	0.507				
6	Upper	30	2.70	0.466	16.858	0.000	Significant	Discriminating
	Lower	30	1.07	0.254				
7	Upper	30	2.70	0.466	12.665	0.000	Significant	Discriminating
	Lower	30	1.23	0.430				
8	Upper	30	2.67	0.479	16.155	0.000	Significant	Discriminating
	Lower	30	1.07	0.254				
9	Upper	30	2.57	0.504	9.349	0.000	Significant	Discriminating
	Lower	30	1.37	0.490				

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10	Upper	30	2.60	0.498	12.540	0.000	Significant	Discriminating
	Lower	30	1.17	0.379				
11	Upper	30	2.63	0.490	13.697	0.000	Significant	Discriminating
	Lower	30	1.13	0.346				
12	Upper	30	2.83	0.379	10.320	0.000	Significant	Discriminating
	Lower	30	1.87	0.346				
13	Upper	30	2.53	0.507	8.142	0.000	Significant	Discriminating
	Lower	30	1.47	0.507				
14	Upper	30	2.73	0.450	12.121	0.000	Significant	Discriminating
	Lower	30	1.30	0.466				
15	Upper	30	2.87	0.346	19.416	0.000	Significant	Discriminating
	Lower	30	1.13	0.346				
16	Upper	30	2.97	0.183	23.433	0.000	Significant	Discriminating
	Lower	30	1.17	0.379				
17	Upper	30	2.83	0.379	16.089	0.000	Significant	Discriminating
	Lower	30	1.20	0.407				
18	Upper	30	2.40	0.498	9.707	0.001	Significant	Discriminating
	Lower	30	1.23	0.430				
19	Upper	30	2.90	0.305	12.642	0.000	Significant	Discriminating
	Lower	30	1.53	0.507				
20	Upper	30	2.93	0.254	22.990	0.000	Significant	Discriminating
	Lower	30	1.13	0.346				
21	Upper	30	2.97	0.183	21.700	0.000	Significant	Discriminating
	Lower	30	1.20	0.407				
22	Upper	30	2.37	0.490	10.608	0.000	Significant	Discriminating
	Lower	30	1.17	0.379				

Item discrimination criterion: The item is considered discriminating when Sig. ≤ 0.05 at the significance level (0.05) and degrees of freedom (58).

Second: Internal Consistency of the Scale

To verify the second requirement of construct validity, namely internal consistency, the scores of the students in the scale construction sample were statistically analyzed using the Pearson simple correlation coefficient. This analysis aimed to determine the correlation between the score of each item and the total score of the scale. The purpose of this procedure was to identify the degree to which each item contributes to measuring the overall concept of attentional control in football and to ensure that the items of the scale are internally consistent with the total score of the scale. The results of this statistical analysis are presented in Table (2).

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Table 2. Internal Consistency Between Each Item and the Total Score of the Scale

Item No.	Correlation with Total Score	Sig.	Item No.	Correlation with Total Score	Sig.
1	0.523*	0.000	12	0.665*	0.000
2	0.542*	0.000	13	0.616*	0.000
3	0.652*	0.000	14	0.445*	0.000
4	0.565*	0.000	15	0.698*	0.000
5	0.451*	0.000	16	0.551*	0.000
6	0.602*	0.000	17	0.584*	0.000
7	0.476*	0.000	18	0.497*	0.000
8	0.514*	0.000	19	0.611*	0.000
9	0.628*	0.000	20	0.483*	0.000
10	0.604*	0.000	21	0.659*	0.000
11	0.633*	0.000	22	0.732*	0.000

* Item consistency criterion: The item is considered consistent when Sig. ≤ 0.05 at degrees of freedom (108) and significance level (0.05).

Verification of the Reliability of the Attentional Control Scale in Football

The researcher verified the reliability of the scale by statistically analyzing the scores obtained from applying the scale to the scale construction sample in this study. The Cronbach's Alpha coefficient was used to determine the reliability level of the scale. The results showed that the reliability coefficient reached 0.905 at 108 degrees of freedom and a significance level of (0.05), which indicates a high level of reliability and confirms the stability of the scale for measuring attentional control in football.

Verification of the Normal Distribution of the Attentional Control Scale in Football

Statistical analysis was performed on the scores obtained from the construction sample to ensure that the scale was appropriate for the target sample, and the normal (Gaussian) distribution of data. This process sought to confirm the distribution of the scores was normally distributed, as this is a prerequisite for utilizing parametric statistical analyses. Table (3) presents the results of this analysis.

Table 3. Final Statistical Indicators and Normal Distribution Values of the Scale

Scale Name	Construction Sample Size	Number of Items	Total Score	Mean	Standard Deviation	Skewness
Attentional Control in Football	110	22	66	33.7	2.745	0.22

The distribution is considered normal (moderate) when the skewness value falls within ±1.

After completing the construction procedures and statistical analyses on the scale construction sample, the scale reached its final form (Appendix 1) with a total score ranging

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from 22 to 66 and a hypothetical mean of 44. This means that the higher the student's score, the higher the level of the desired phenomenon, namely attentional control in football, for the responding student.

To measure the performance of the corner kick and penalty kick skills in football, the researcher adopted a performance evaluation form for each tested participant during the skill tests without considering accuracy. The performance was recorded through video and later evaluated by experts to determine the technical performance score. The score distribution was as follows: the preparatory phase was assigned 3 points, the main phase was assigned 5 points, and the final phase was assigned 2 points.

In order to implement the skill exercises using Fitlight technology within the practical component of the physical education lesson while teaching the corner kick and penalty kick skills to the students of the experimental group, the researcher followed several procedures. First, the technological system was prepared so that the teacher could electronically control the device through an integrated system of LED lighting used to guide movement paths and supervise the learning process. The system consisted of several components, including ground LED lights placed on the field surface with three daylight colors, in addition to four colored lights placed at the corners of the goal. Care was taken not to exaggerate the intensity of lighting or color levels when using the Fitlight technology so as not to distract students from performing the skills. The system also included a remote control device powered by a dry battery, which allowed the teacher to control the color type and the level of light intensity, in addition to the necessary electrical wiring connecting the system components.

The researcher relied on the fundamental operational principle of Fitlight technology, which is based on the stimulus–response concept derived from the behavioral psychology theory of B. F. Skinner, where correct performance is associated with following the rapid light path provided by the Fitlight system. These included Thorndike's Law of Exercise with the Sense of Effect and Immediate Reinforcement to help strengthen connections between a stimulus and a response to facilitate learning corner kick and penalty kick skills in football. In this way, the implementation of these procedures was carried out based on the psychomotor objectives of Bloom's taxonomy in accordance with age and gender characteristics of fifth-grade secondary school students by means of visual reinforcement signals and light paths addressed to a football field.

The researcher completed the preparation of the measurement tools required for each of the three dependent variables as well as designing skill exercises in distinctive ways using Fitlight technology, then executed a second pilot experiment on Sunday morning (6/10/2024) at (the football field of Al-Jawahiri Secondary School. The pilot experiment was performed on 10 students who were not representative of the main research sample, and there were no severe challenges encountered at this stage.

The researcher also studied the most popular exercises at practical physical education lessons of football for Al-Jawahiry secondary school. In the skill exercises, which were developed using Fitlight technology, lights were installed along the paths of movement

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followed by the football during executing both studied skills with guidance from their teacher. A remote control device was used to manage the repetitions and pauses for each teaching condition Appendix (2).

The skill exercises based on Fitlight technology were implemented during the main part of training for a total duration of 30 minutes out of the entire physical education (45-minute) football lesson. The main portion of the session consisted of a combination of 5 minutes of instruction followed by 25 minutes dedicated to practicing the Fitlight-based exercises. Four 5-min long exercises were performed with a 1-min break partitioned on the four exercises. All parts of the lesson other than that (which involved the researcher) were left in control of physical education teacher, including preparatory phase (10 min) and cooling down period (5 min).

The practical lessons were implemented over a period of eight weeks, with four lessons allocated for each skill. The lessons were conducted at a rate of one lesson per week, scheduled every Tuesday.

The research experiment started with the pre-testing of the dependent constructs for both research groups and 60 students. This involved distributing the attentional control scale and executing the skill performance tests for corner kick and penalty kick on Monday (7/10/2024). Skill tests were video recorded at the school after which three experts reviewed the recordings to determine if the technical performance met criteria stipulated by testing requirements.

The Fitlight-based skill exercises (Appendix 2) were then applied to the students of the experimental group from Tuesday (8/10/2024) until Tuesday (25/11/2024), while the control group continued to perform the traditional educational exercises normally used in their lessons without researcher intervention. Both groups received the same number of lessons and time duration for learning the corner kick and penalty kick skills. The experiment concluded with conducting the post-tests on Wednesday (26/11/2024) by reapplying the attentional control scale and the two skill performance tests under the same conditions as the pre-tests.

After completing the experiment, the results were statistically processed using the SPSS statistical software to calculate percentages, arithmetic means, standard deviations, Levene's test for homogeneity of variance, the independent samples t-test, and the paired samples t-test.

Results

Table 4. Results of the Pre-tests Between the Two Research Groups

Dependent Variables (Unit of Measurement)	Group (N)	Mean	SD	Levene's Test	Sig.	t-value	Sig.	Difference
Attentional Control in Football (Score)	Experimental (30)	34.17	2.653	0.996	0.322	0.507	0.614	Not Significant
	Control (30)	33.80	2.941					
Corner Kick Skill Performance (Score)	Experimental (30)	2.73	1.143	1.58	0.214	0.646	0.521	Not Significant
	Control (30)	2.53	1.252					

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Penalty Kick Skill Performance (Score)	Experimental (30)	2.83	1.392	0.015	0.904	1.401	0.167	Not Significant
	Control (30)	2.33	1.373					

Table 5. Results of the Pre- and Post-Tests for Both Research Groups

Dependent Variables	Group (N)	Comparison	Mean	SD	Mean Difference	SD of Difference	t-value	Sig.	Difference
Attentional Control in Football (Score)	Experimental (30)	Pre-test	34.17	2.653	22.267	2.84	42.947	0.000	Significant
		Post-test	56.43	1.135					
	Control (30)	Pre-test	33.80	2.941	11.90	3.745	17.405	0.000	Significant
		Post-test	45.70	3.385					
Corner Kick Skill Performance (Score)	Experimental (30)	Pre-test	2.73	1.143	5.067	1.143	24.286	0.000	Significant
		Post-test	7.80	0.407					
	Control (30)	Pre-test	2.53	1.252	2.60	1.567	9.089	0.000	Significant
		Post-test	5.13	0.900					
Penalty Kick Skill Performance (Score)	Experimental (30)	Pre-test	2.83	1.392	4.467	1.332	18.365	0.000	Significant
		Post-test	7.30	0.651					
	Control (30)	Pre-test	2.33	1.373	3.10	1.213	13.993	0.000	Significant
		Post-test	5.43	1.040					

The differences are considered statistically significant when Sig. < 0.05 at 29 degrees of freedom for each group.

Table 6. Results of the Post-tests Between the Two Research Groups

Dependent Variables (Unit of Measurement)	Group (N)	Mean	SD	t-value	Sig.	Difference

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Attentional Control in Football (Score)	Experimental (30)	56.43	1.135	16.466	0.000	Significant
	Control (30)	45.70	3.385			
Corner Kick Skill Performance (Score)	Experimental (30)	7.80	0.407	14.794	0.000	Significant
	Control (30)	5.13	0.900			
Penalty Kick Skill Performance (Score)	Experimental (30)	7.30	0.651	8.332	0.000	Significant
	Control (30)	5.43	1.040			

The differences are considered statistically significant when Sig. < 0.05 at 58 degrees of freedom.

Discussion

A review of the results presented in Table (5) indicates that students in both the experimental and control groups demonstrated improvements in attentional control and the performance of corner kick and penalty kick skills in football in the post-tests compared with the pre-tests. This suggests that the instructional activities and continuous practice provided during the lessons contributed to enhancing students' learning outcomes in these skills. Furthermore, the results in Table (6) show that the students in the experimental group outperformed their peers in the control group in improving attentional control as well as in performing the corner kick and penalty kick skills in football during the post-tests. The researcher attributes these findings to the application of skill exercises using Fitlight technology, which helped students organize stimuli through improving their level of attentional control. This improvement enabled them to better perceive the details of skill performance and accurately determine the correct movement paths of the ball when performing corner kicks and penalty kicks.

In addition, the element of stimulation and excitement provided by Fitlight technology contributed to focusing students' thinking on how to perform the targeted skills, which created cognitive space in the brain for better estimation and allowed students to explore information about the practical performance themselves through increased interaction and participation during the lesson. The application of these skill exercises also enhanced students' inclination toward practical engagement when performing the two football skills, both of which require directing sensory perception toward evaluating correct performance by comparing it with the visual light paths and points provided by the system. This process facilitated the encoding of movement patterns in the brain, which supported the activation of memory and real-time information processing during various learning situations related to the required skill performance. The exercises were structured through repeated practical application of each instructional task.

The researcher also ensured that the skill exercises designed with Fitlight technology considered individual differences among students, provided a fair distribution of tasks, and activated each student's role within the physical education lesson in an atmosphere

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characterized by freedom and enjoyment. Moreover, care was taken not to exaggerate the intensity or number of lights used, which helped maintain control over the stimuli that enhance attentional control while reducing distraction that might hinder students' perception of the technical details of corner kick and penalty kick performance. These results may also be attributed to the role of Fitlight-based exercises in transforming students from passive recipients into active participants exploring the learning environment, encouraging self-reliance in executing motor programs consistent with the model of skill performance phases and appropriate repetitions required to achieve correct performance with fewer errors. This occurred through linking attentional processes with the required motor responses by preparing and guiding the learner's mind—essentially pre-planning the performance through attentional focus, attentional shifting, and attentional flexibility, which were organized through the use of Fitlight technology in the practical applications of these exercises.

It has been noted that repetition in its natural form may become monotonous for learners; therefore, the use of motivational elements and stimulating tools becomes necessary to maintain engagement and encourage continued practice (Sewell & George, 2018). In addition, motor skill learning cannot occur without organized knowledge of performance that relies on the brain's interpretation of stimuli through cognitive processes that help construct motor programs in memory according to the learner's abilities. Practical application thus directs learning toward improving existing capabilities and developing motor programs that correspond to the desired performance model through the comparison mechanism in motor control, which reflects the principle of learning through action and practical experience (Al-Bayati, 2023; Al-Aboudi, 2025).

Research also indicates that light stimulation can influence the motor system, which plays a role in controlling movement, motor coordination, and motor learning and memory (Kim & Lee, 2015). Learners must be capable of regulating their attentional processes to focus on relevant stimuli and make appropriate decisions without being affected by irrelevant distractions (Gharib, 2018, p. 5). Moreover, light-based stimulation techniques can enhance brain activity and improve learning and memory processes through the use of colored lights or rapid light pulses (Ronald, 2017). Furthermore, with respect to attentional control skills, they help learners manage the level of stimuli to which they are necessarily exposed and processed in an effective manner, permitting dynamic cognitive processing of information regardless of whether the stimuli are visual or auditory (Theeuwes & van der Burg, 2007; Abdulkareem et al., 2025).

In addition, attentional control enhances the cognitive resources available in working memory and enables students to address more cognitive representations conducive to learning and processing knowledge provided during lessons (Furley & Wood, 2016; Salahub, 2021; Yousif, 2023). Conversely, repeated presentation of stimuli can stimulate attention and this teaches us that training be innovative in its approach to avoid fatigue along with ensuring that whatever is being presented has different geopolitical locations alongside needing to ensure differences in intensity as well as also novelty (Melhem, 2016, p. 204).

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Simulation motor sports skills must also be constantly evaluated and feedback given where performances are assessed in conjunction with constructive learning for improved motor and technical skills. Methods of active learning promote systematic thinking that will lead to analytical and critical thinking skills (through the use of activities, learn by doing, Learn from mistakes) (Mustafa, 2019:127) Hence to the modern day teaching has moved focus from solely based on giving knowledge to arranging a classroom that defined as an effective learning environment by promoting thinking, openness and participation. It means that the teacher is not the only source of knowledge in these so-called environments, but instead they become one of several sources from which to generate knowledge together with learners and encourage inquiry and discussion (Adas, 2015, p. 31).

Finally, the interaction between stimuli and responses requires effective attentional control, as the attentional control system operates by selectively detecting sensory events related to behavior (Abdul-Hafiz, 2016, p. 43). In motor skill learning, students benefit from observing a skill, analyzing its execution, and then attempting to perform it themselves through repeated practice within small groups and practical activities (Brooker & Butterworth, 2019; rda, 2024). These principles collectively support the interpretation of the results obtained in this study and explain the superiority of the experimental group that practiced skill exercises using Fitlight technology.

Conclusions

1- The attentional control scale in football is appropriate for fifth-grade secondary school students and is suitable for the purpose for which it was developed, as it possesses acceptable scientific foundations and psychometric properties.
2- The use of skill exercises employing Fitlight technology within the teaching content of football skills in practical physical education lessons is appropriate for fifth-grade secondary school students.
3- The application of skill exercises using Fitlight technology contributes to improving the level of attentional control in football among students who are taught using this method compared with their peers who are taught without it.
4- The application of Fitlight-based skill exercises contributes to improving the performance of the corner kick skill in football among students who practice them compared with those who do not use this technology.
5- The application of Fitlight-based skill exercises contributes to improving the performance of the penalty kick skill in football among students who practice them compared with their peers who learn through traditional methods.

Recommendations

1- It is necessary to adopt cognitive measurement in physical education lessons, particularly measuring the level of attentional control for each student, in order to support the improvement of football skill performance.

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2- It is recommended to avoid excessive intensity or levels of lighting when using Fitlight technology, while emphasizing practice and repetition in the practical application of skill exercises when designing motor programs for football skill performance.
3- It is recommended to conduct similar studies using Fitlight technology in teaching tactical aspects of football.

Appendix 1. Attentional Control Scale in Football

No.	Scale Item Statements	Always Applies to Me	Sometimes Applies to Me	Does Not Apply to Me
1	I can block distracting thoughts during my football skill performance in the physical education lesson.			
2	I focus on my football skill performance regardless of the level of noise during the physical education lesson.			
3	I can regain my performance of the specified skill sequence when I receive feedback about my football skill performance in the physical education lesson.			
4	I remain mentally alert to receive information related to the details of my football skill performance during the physical education lesson.			
5	I select the movements necessary to perform football skills during the physical education lesson.			
6	I can identify stimuli related to the transitions between the stages of performing football skills during the physical education lesson.			
7	I can easily alternate my thinking between two ideas that support the motor program when performing football skills during the physical education lesson.			
8	I maintain my attentional focus at the same level even when my peers interrupt my football skill performance during the physical education lesson.			
9	I can complete the motor program by isolating distracting stimuli from my thinking while performing football skills during the physical education lesson.			
10	I can develop strategies to focus my attention on important details when performing football skills during the physical education lesson.			
11	I feel capable of quickly shifting my attention while performing football skills during the physical education lesson.			
12	I can direct my senses toward the most important aspects required for performing football skills during the physical education lesson.			
13	I can exclude irrelevant thoughts that accompany my performance of football skills during the physical education lesson.			
14	I believe that shifting my attention becomes more effective while performing football skills during the physical education lesson.			
15	I can easily recall ideas that improve my performance of football skills during the physical education lesson.			
16	I can distribute my attention by focusing on the most important aspects while performing football skills during the physical education lesson.			

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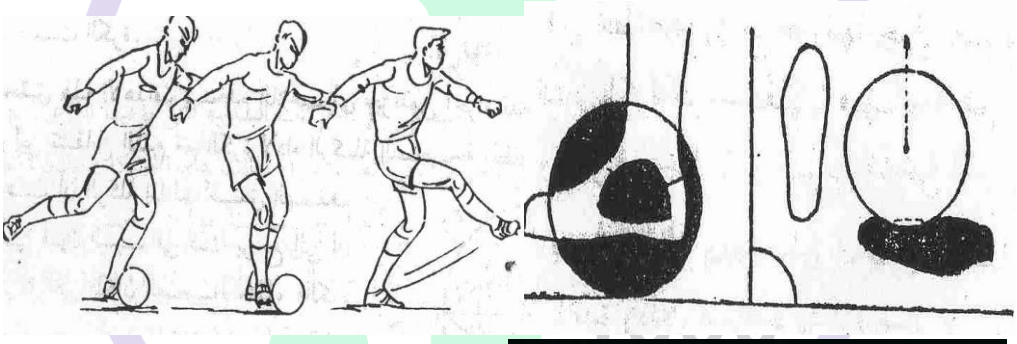
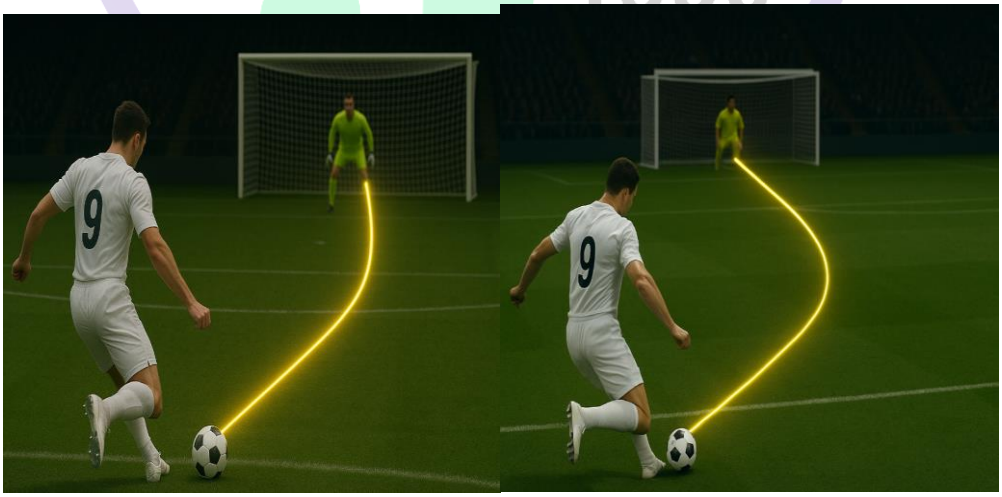
17	I can control the speed of my performance when executing football skills during the physical education lesson.
18	I control my attention according to the neural signals required for the timing of each phase of football skill performance during the physical education lesson.
19	I can control the amount of force required for muscle contractions in each movement phase when performing football skills during the physical education lesson.
20	I focus my attention on producing smooth and aesthetic movements without hesitation while performing football skills during the physical education lesson.
21	I strive to be the best in paying attention to the details of football skill performance during the physical education lesson.
22	I can control the movements of different parts of my body during rapid transitions while performing football skills during the physical education lesson.

Appendix 2. A Sample Model of Skill Exercises Using Fitlight Technology





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The effect of specific exercises based on visual scanning on handling accuracy in under-17 football players

mohammed. qasem Fadel[1] Falih Hashim Fenjan[2] wamed_shamil **kamil[3]**

[1,2,3] University of Baghdad, College of Physical Education and Sport Sciences.

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Abstract

This research aims to enhance specific exercises grounded in visual scanning and to identify their effect on enhancing the passing accuracy of under-17 football players. The researcher used an experimental design with two groups: an experimental group and a control group, and conducted pre- and post-tests. The research sample comprised 25 under-17 players from the Baghdad Municipality Club, selected purposively and divided into two equivalent groups. The experimental group underwent exercises based on visual scanning, while the control group continued with traditional training. The researcher used pre-developed tests to measure passing Precision based on visual scanning, and the data were statistically analyzed using a paired-samples t-test. The findings showed statistically significant differences in favor of the experimental group in all research variables, demonstrating the effectiveness of the proposed exercises in improving passing accuracy. The researcher infers that incorporating visual scanning exercises into training programs effectively enhances the skill performance of young players. The researcher emphasizes the importance of adopting these exercises within training curricula and conducting similar studies on different age groups and training levels.

Keywords: visual scanning, handling, Precision, football, visual perception, decision-making.

[1] University of Baghdad, College of Physical Education and Sport Sciences.
mohammed.qasem1801b@cope.uobaghdad.edu.iq
[2] University of Baghdad, College of Physical Education and Sport Sciences
faleh.sultan@cope.uobaghdad.edu.iq
[3] University of Baghdad, College of Physical Education and Sport Sciences
wamed_shamil@yahoo.com

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introduction

Football is a major sport that occupies a large space in the sports community and attracts the attention of a huge number of sports fans. This has led those interested in football to conduct many studies and research to improve the game in terms of tactics, skills, speed of play, and exploiting opportunities through effective passes, especially those based on visual scanning. If we compare what is happening now with the past, we find a significant difference in terms of team and individual play, the tactics employed, and the nature of skills. In the past, most players would look at the field and their teammates after receiving the ball, which was a successful method at the time. Now, in the era of speed, we see the necessity of looking at the field, teammates, and opponents before receiving the ball. This contributes effectively to the speed of decision-making and the building of play. Football is characterized by being a dynamic game that requires a high level of integration between physical, technical, and mental skills to reach the highest levels. Because visual scanning requires combining visual information with motor decisions in a fraction of a second (as fast as possible), the better a player's visual scanning ability, the greater the likelihood of making correct and quick decisions, which is reflected positively in the level of technical performance and the success of the tactical aspect as well. Conversely, poor scanning performance leads to slower decision-making, increased errors in performance accuracy, or a reliance on passive play, such as playing backwards, especially in situations characterized by high defensive pressure or limited space. For those under 17, the stage of motor development and learning is in its early stages, necessitating the use of effective exercises and methods to properly develop fundamental skills. Incorporating visual scanning into specific training exercises is a progressive approach aimed at enhancing effective handling, which can be a decisive factor in matches, as well as motor response and accuracy. It also enhances other fundamental skills such as shooting and dribbling, contributing to the overall development of the game. The under-17 age group was chosen because they represent the fundamentals for future development, possessing flexibility and a capacity for learning at this age. They are at the beginning of their careers and possess a great deal of enthusiasm and energy to learn new techniques. The researcher substantiates focusing on the technical aspect over the tactical aspect in this research by stating that the emerging player (under 17) first needs to be professional in basic technical skills (receiving, passing, controlling, and shooting) under simple conditions, with frequent visual scanning incorporated during performance. Once the technical skills become automatic (with the use of visual scanning), the player is ready. Field observations and review of some matches involving under-17 teams revealed weaknesses in passing accuracy and delays in decision-making during and after receiving the ball, which slow down the game because the player does not collect adequate information about the positions of teammates, opponents, and the surrounding environment. He acts after missing the opportunity due to his lack of prior awareness of the field and the movement of

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teammates. There is also a decrease in passing or shooting accuracy due to not accurately determining the direction, distance, or position of the goalkeeper and defenders. There is also a weakness in positioning and movement off the ball, confusion during high-pressure or high-speed play due to a limited view of the entire situation, and poor shooting accuracy as a result of players looking at the ball without looking at the position of the goalkeeper or defenders. If we want to develop players, especially in basic skills, we need to give attention and scan the field repeatedly so that the athlete can exploit the available spaces and play into them to be more effective and take advantage of opportunities during building play and counter-attacks Regardless of the great efforts made by coaches, there is a weakness in this aspect, which leads players to play incorrectly or intercepted passes and slow in decision-making do to not knowing the right place. The researcher believes that employing exercises to develop skills with visual scanning can be a tool for success in this important and necessary aspect of football, further to the target group of the research, through which the researcher aims to build a base that uses this type of exercise to develop the game. The research aims to develop specific exercises based on visual scanning and determine the effect of the exercises on supporting the accuracy of passing skills in football for players under 17 years old.

Previous studies

In this context, Asaad B. (2025) confirmed the emergence of strong relationships between mental and visual skills and between them and motor skills.

Similarly, a study by Kazem (2025) confirmed that specific exercises based on visual scanning increase players' visual awareness of their surroundings, thus enhancing their ability to make effective decisions in less time.

A study by (Amer, 2023) confirmed that the correct scientific method and the gradual increase in difficulty helped the experimental group reach the desired goal.

Similarly, (Sabah, 2024) prepared combined exercises for the skills of shooting accuracy and passing and receiving accuracy for young footballers and concluded that a high rate of development was achieved in favor of the experimental group.

The study by (Taha, 2025), which prepared exercises using assistive devices to teach some basic football skills to junior players, concluded that the use of manufactured educational tools with a performance-enhancing effect in learning some of the skills under investigation plays an effective role in raising the skill level of junior football players.

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Method and Material

The researcher applied the experimental method as it was appropriate for the nature of the research. The experimental and control groups were designed with pre- and post-measurements. The experimental group underwent the training program introduced by the researcher, while the control group continued with the traditional training program followed by the coach without any intervention from the researcher. Since the selection of the sample is a cornerstone of scientific research, as it demonstrates the original population or model on which the researcher conducts his entire work, the research population will contain the youth players of the Baghdad Municipality Football Club participating in the Iraqi Football League under (17 years) for the 2025-2026 season, numbering (25) players according to the records, who were selected purposively.

Tests Used in the Research;

1. Visual Scanning Passing Test

Test Name: Visual Scanning Passing

Test Objective: To assess the visual scanning passing fidelity of young football players.

Equipment Used: Football field, 6 small goals, whistle, stopwatch, football, measuring tape.

Performance Description: The player stands in front of three small targets 10 meters away, and behind them are three more small targets 10 meters apart, with a distance of 3 meters between each target. After hearing the whistle from the coach, the player prepares to receive the ball inside a designated 3-meter square. At the same time, the two defending players move in front of the back targets, each randomly occupying a specific target, leaving one target vacant. Each defender positions themselves at a target as the ball leaves the passing player's goal. This demands the player to perform repeated visual scans from the moment they establish to receive the ball to locate the vacant target (free of defenders). The player then passes the ball towards the forward target opposite the vacant back target as quickly as possible, as illustrated in Figure

Scoring: The player is given three attempts, and the best one is selected.

❖ The player receives 0 points if they receive the ball inside the square and pass it in the wrong direction.

❖ The player receives 1 point if they receive the ball inside the square and pass it in the correct direction, but it does not enter the goal. Two (2) points are allocated if the ball is received inside the designated area, passed correctly, and enters the target.

Years are awarded if the ball is received outside the designated area and the tester fails to control it.

Note: The score is determined according to the formula: Score (Accuracy Score) / Time (Test Time). Test Time = The time from the moment the tester obtained the ball until the ball crosses the straight line of the small targets.

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Figure1. illustrates handling according to the rear optical scan

Visual Scanning Passing Test;

Test Name: Right Lateral Visual Scanning Passing

Test Objective: To evaluate the visual scanning passing precision of young football players

Equipment: Football field, 6 small goals, whistle, stopwatch, football, measuring tape.

Performance Description: The player being measured stands with three small goals 10 meters to their right and three small goals 10 meters to their left, with a distance of 3 meters between each goal. Two players move around the goals to the right of the player. Upon hearing the whistle, the player prepares to obtain the ball. Each of the two players stands in front of a goal, leaving one goal vacant. Each defensive player stands in front of a goal as the ball leaves the passing player. The player must execute a quick visual scan from the moment they prepare to receive the ball to locate the vacant goal (free of defenders) on the right side. The player then kicks the ball towards the goal opposite the vacant one on the opposite side as quickly as possible. As shown in Figure 2

Scoring: The test subject is given (3) attempts, and the best one is filtered.

❖ The test subject receives (0) points if they receive the ball inside the square and pass it in the wrong direction.

❖ The test subject obtains (1) point if they receive the ball inside the square and pass it in the correct direction, but it does not enter the target.

❖ The test subject receives (2) points if they receive the ball inside the square, pass it in the correct direction, and it enters the target.

❖ The test subject receives (0) points if they receive the ball outside the square and do not control it.

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Note: The score is determined according to the formula: Score (Accuracy Score) / Time (Test Time).
Test Time = The performance time is assessed from the moment the test subject obtains the ball until the ball crosses the straight line of the small targets

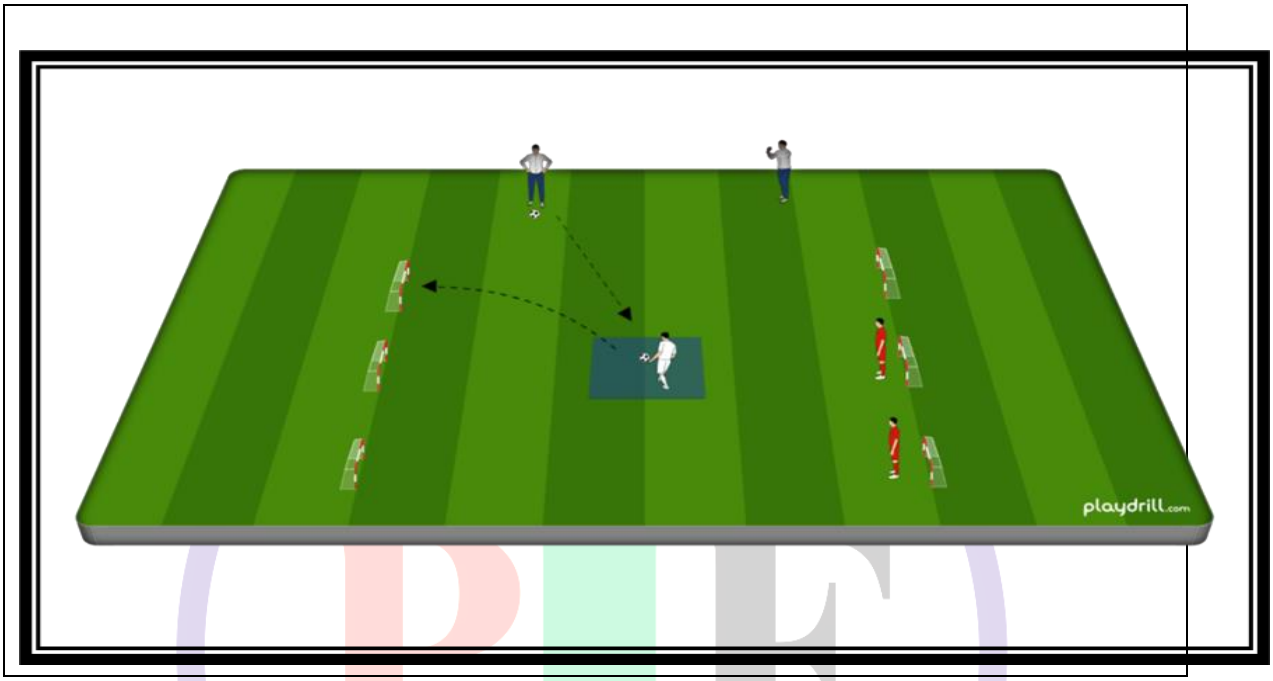

Figure2.handling accuracy according to the visual scan of football players.

3. Passing Test Based on Visual Scanning
Test Name: Passing Based on Right Side Visual Scanning
Test Objective: To assess the passing precision of young football players based on visual scanning.
Equipment Used: Football field, 6 small goals, whistle, stopwatch, football, measuring tape.
Performance Description: The player being measured stands with three small goals 10 meters to their right and three small goals 10 meters to their left, with a distance of 3 meters between each goal. Two players move around the goals to the left of the player being tested. immediately hearing the whistle, the player being tested prepares to obtain the ball. Each of the two players stands in front of a goal, leaving one goal vacant.
...Each defensive player stands in front of a goal as the ball leaves the passing player's position. This demands the player being tested to perform a quick visual scan from the moment they procedures the ball to locate the vacant goal (free of defenders) on the left side. The player then kicks the ball towards the goal opposite the vacant one on the other side as quickly as possible, as shown in Figure 3.

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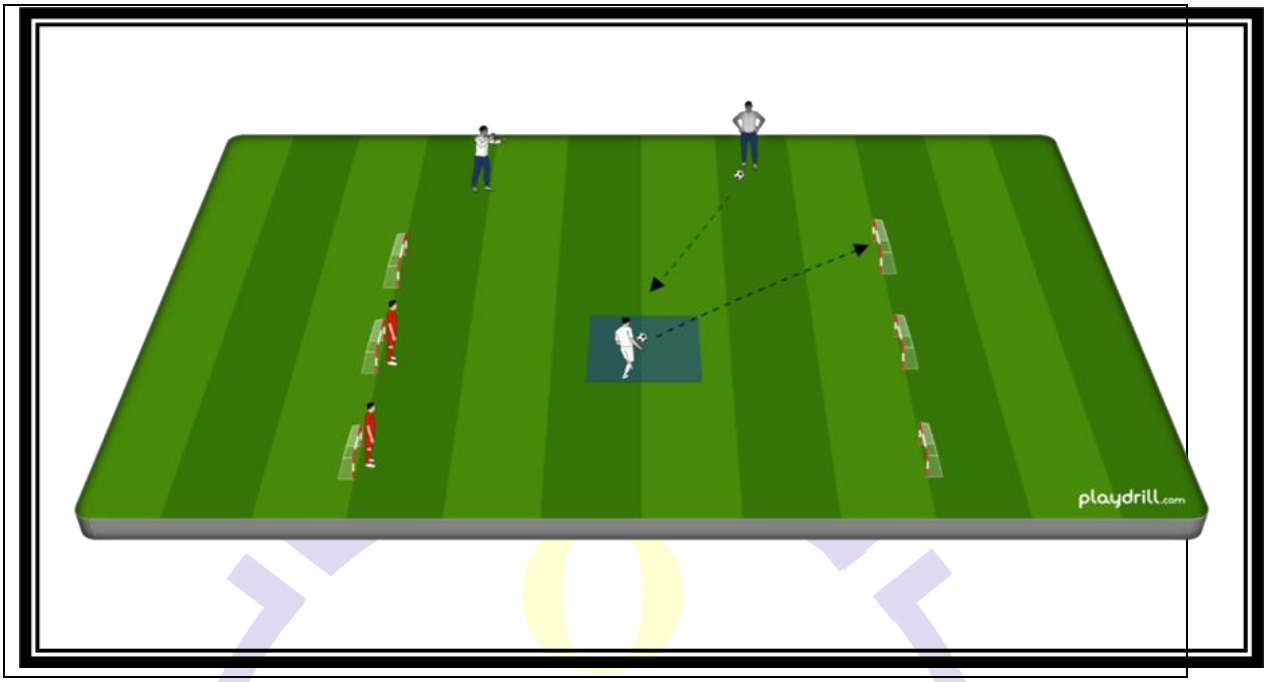

figure3. Handling according to the right lateral optical scan.

Scoring: The test subject is given (3) attempts, and the most effective one is selected.

❖ (0) points are awarded to the test subject if they obtain the ball inside the square and pass it in the wrong direction.

❖ (1) points are awarded if they obtain the ball inside the square and pass it in the correct direction, but it does not access the target.

❖ (2) points are awarded if they receive the ball inside the square, pass it in the correct direction, and it enters the target.

❖ (0) points are awarded to the test subject if they receive the ball outside the square and do not control it.

❖Note: The score is determined according to the formula: Score (Accuracy Score) / Time (Test Time). Test Time = The performance time is evaluated from the moment the test subject receives the ball until the ball crosses the straight line of the small targets.

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Pilot Study:

The researcher administered a pilot study on a sample of players from the Baghdad Municipality under 17 years of age to verify the validity and applicability of the research instruments and to assess the suitability of the procedures for the main study. If the pilot study highlighted that the instruments used were suitable or unsuitable in terms of their formulation and the time needed, this would help the researcher make any necessary adjustments before proceeding with the main study.

Pre-tests:

The researcher performed pre-tests on the research sample after recognizing the tests specific to the research variables and taking into account the conditions associated to the tests in terms of time, place, equipment and tools used, method of implementation, and the improving team, to ensure their availability in the post-tests. This took place on Tuesday, November 11, 2025.

Main Experiment:

Implementation of the Prepared Exercises, Appendix No. (1): -

The researcher implemented the prepared exercises on the members of the research sample in the experimental group, taking into account the type of training units given to the members of the control group by the coach.

Particular exercises were constructed within the framework of the training program of the Baghdad Municipality Football Club for under-17s, considering the available resources and the general level of the research sample. These exercises were based on the scientific principles of sports training and some scientific sources and references. The exercises, as visually assessed, emphasized enhancing motor response speed and some basic football skills.

❖ The researcher implemented the exercises at the Baghdad Municipality Club's field on Palestine Street, as the vital training equipment was available, along with ample space for full freedom of movement.

❖ The duration of the units was 8 weeks, with 3 units per week.

❖ The researcher exercised high-intensity interval training (HIIT) when implementing the exercises.

❖ The exercises were implemented from November 16, 2025, to January 9, 2026. ❖ The work-to-rest ratio fluctuates (2:1) throughout all exercises.

❖ The researcher adopted the principle of fluctuation (80-85-90) in high-intensity interval training and (90-95-100) in repetitive intensity training during the training units. This is the intensity adopted in high-intensity, repetitive interval training.

❖ The duration of the exercise ranges from approximately (30-35) minutes within the main session.

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❖ The maximum performance time for each player was used to standardize the training intensity used in each exercise during the training units. All players obtained similar arithmetic means

An average test was conducted after the end of the fourth week and before the start of the fifth week, after the application of 12 training units, to measure the extent of enhancement and to standardize the intensity used in each exercise

.

Post-tests:

The researcher administered post-tests after eight weeks under the same circumstances and facilities as the pre-tests. The main aim was to gather data on the players for statistical analysis and to determine the importance of specific exercises for wider dissemination and application. The post-tests were administered on Sunday, January 11, 2026, at the Baghdad Municipality Club's under-17 football field.

Table No. (1) Shows the values of the pre-test and post-test results, the t-value, the percentage, and the consequence of the handling variables consistent with the visual survey of the experimental group.

Variables	Unit of measurement	Pre-test		Pos-test		Different	Different	T	SIG	Significance
		mean	SD	mean	SD	mean	SD			
A		**0.447**	**0.295**	**0.714**	**0.138**	**0.267**	**0.068**	**3.909**	**0.004**	**Significant**
B	**M/S**	**0.541**	**0.373**	**0.820**	**0.222**	**0.279**	**0.083**	**3.361**	**0.008**	**Significant**
C		**0.588**	**0.307**	**0.851**	**0.301**	**0.263**	**0.045**	**5.842**	**0.000**	**Significant**

Table (1) shows that the sig value for the research (experimental) group is less than the value of the consequence level of (0.05) in the variables, as the statistical results for the experimental group demonstrated a substantial and significant improvement in all the variables under study.

The researcher characteristics that the enhancing achieved cannot be understood apart from the nature of the special exercises based on the visual survey that aimed to link decision-making and skill execution within the framework of training situations that simulate the real playing environment for the members of the research sample in the experimental group who underwent special exercises prepared by the researcher, and that the training age of the members of the research sample was less than (17) years, and this helped to improve quickly and contributes effectively to learning skills because this group is moving toward obtaining skills. Moreover, the researcher subjected the exercises of the target group to the scientific foundations (training loads).

Visual scanning, as recent studies demonstrate in many research papers, is not merely a random eye movement by the player, whether through or before obtaining the ball. Rather, it is a selective, organized, and sequential cognitive process that is in

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agreement with the type of skill, the location of the ball, and the proximity of opposing players to the player using visual scanning. Through it, the most relevant information to the competitive situation is detected and then converted into appropriate motor decisions of great importance in creating an attack on the opposing team, making a decisive pass to a teammate, or relieving pressure on players by changing the player's direction in the safest area. This is done through acceptable scanning without alerting the opposing team to the direction of the pass or the location of the ball (Williams and Hodges, 2005, pp. 637–650).

Schmidt and Lee (2019) validated that training involving diverse and rapidly changing visual stimuli leads to improved information processing speed and attenuated cognitive latency. This skill requires high speed in its execution and very short times, in fractions of a second, in order to complete at maximum speed. Consequently, there is a high guarantee of attaining positive passes that effectively contribute to building play and moving into empty spaces, thus reducing the number of negative or ineffective passes.

When evaluating skills using posterior and lateral visual scanning in the experimental group, the principle of systematic repetition of situations requiring multidirectional visual scanning can be relied upon, leading to the development of decision-making speed. These skills needed high repetitions to achieve automatic mastery with visual scanning

Magill and Anderson (2021) believe that training in conditions similar to real-life performance enhances what is known as qualitative information coding or realistic interpretation of the opponent's movement or the direction of a teammate's movement according to the course of the game. That is, the brain learns to differentiate between motor and visual patterns applicable to the situation, so decision-making becomes faster and less resource-intensive.

Conclusions

1. The development in post-test scores denotes the effectiveness of the researcher's exercises in enhancing the speed and accuracy of visual performance.
2. The improvement in the experimental group's motor skills indicates the positive effect of the exercises on developing the skills related to motor performance.
3. The decrease in motor reaction time in the experimental group is an indicator of enhanced neuromuscular efficiency and faster decision-making.
4. The improvement in the experimental group is linked to the effectiveness of the scientific exercises and not solely to growth factors or routine training.
5. Significant differences in dribbling skills were measured between the two groups, indicating the similarity in the impact of traditional training on this specific skill. Dribbling is an important skill and the primary method of ball movement on the field.
6. Improved visual scanning directly impacted the validity and speed of executing basic skills and improved decision-making speed.

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7. Exercises concentrated on developing visual scanning and other variables contributed to improving integrated (cognitive-motor) performance indicators, not just secluded skill performance. This reflects the comprehensive nature of the exercises.
8 .The study findings confirm the importance of integrating visual aspects with skill training in football player development programs across different age groups.

Recommendations

1. Implemented the proposed exercises into enhanced training curricula for developing visual and motor skills, given their statistically and practically proven effectiveness.
2. Integrate visual scanning exercises into regular training units and do not restrict them to traditional skill training, as these exercises have a direct effect on improving response speed and the accuracy of skill performance.
3. Accentuating the link between visual and skill training when designing training programs to ensure the extensive development of the neuromuscular system
4. Carry out similar studies on different age groups and performance levels to verify the generalizability of the study's findings.
5. Multiply the use of standardized tests to measure visual and perception-related abilities when evaluating training programs to ensure the accuracy and objectivity of the assessment.
6. Utilize the study's findings in developing rehabilitation programs to improve players' motor response speed, especially in sports requiring rapid decision-making.
7. Execute future studies comparing different types of visual-motor programs to determine which are most effective in enhancing performance.

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(1) Appendx

A model of the training units used is shown

First training unit: (First week)

Training session duration: Total session time :32 to 35 minutes

The aim of the unit :is to improve the skill aspect and motor response according to visual scanning

The exercise	Intensity	Volume	Rest between groups	Total exercise time	Transition time between exercises
M1	80%	2x3	90S	6.41m	2m
M2	80%	2X3	60S	3.54m	1.5m
M3	80%	2 X3	60S	4.48m	1.5m
M4	80%	2X 3	90S	6.16m	2m
M5	80%	3 X 3	60S	5.39m	

Training unit two: first week

Training session duration: Total session time:32 to 35 minutes

This unit aims to improve the skill and motor response capabilities based on visual scanning

Transition time between exercises	Total exercise time	Comfort between groups	Volume	Intensity	The exercise
1M	3.24m	60 S	2x 3	85%	**M6**
1M	5.39M	60S	3x3	85%	**M7**
1.5M	6.45M	60S	2X2	85%	**M8**
1.5M	5.54M	45S	3X3	85%	**M9**
	8.3M	60S	2X4	85%	**M10**

Third training unit: first week

Training session time: total session time:32 to35 minutes

The aim of this unit is to improve the skill and motor response capabilities based visual scanning

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Transition time between exercises	Total exercise time	Rest between groups	Size كمX	Intensity	The exercise
M 1	M 7.51	S 45	3X4	%95	M11
M 1.5	M 5.45	S 45	2X4	% 95	M12
M 1	4.33M	S 45	2X3	%95	M13
M 1.5	M 5.21	S 90	3X3	%95	M14
	M 6.27	S 60	2X3	%95	M15

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Female College Students' Attitude towards Physical Activity

Marwa Husein Ali [1]

[1] University of Baghdad, College of Physical Education and Sports Sciences.

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Abstract

This study sought to identify the range to which female university students are tended to towards physical activity, and to demonstrate the level of their attitudes and the variables associated with them. The explanatory survey method was adopted as it was appropriate for the nature of the issue. The research sample comprised of (150) first-year female students from the University of Baghdad College of Physical Education and Sports Sciences recruited purposively.

The researcher developed a special scale to measure attitudes towards physical activity, which in its final form consisted of (30) items. The findings of the statistical analysis showed that the scale had a high degree of validity and reliability, with Cronbach's alpha coefficient reaching (0.851). All elements also showed discriminatory power and statistical significance at the (0.05) level.

The findings suggest a significant difference between the arithmetic mean (115.965) and the hypothetical mean (90), in favor of the arithmetic mean, which indicates that the students have a positive attitude towards physical activity. The study advocated capitalizing on this trend by designing supportive university programs to transform this positive attitude into a sustainable practice.

Keywords: attitudes, physical activity, healthy attitudes.

[1] University of Baghdad, College of Physical Education and Sports Sciences.
marwa.hussain@cope.uobaghdad.edu.iq)

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introduction

Physical activity is a foundation of preserving physical, mental, and social health. It promotes to improved physical fitness and the avoidance of many chronic diseases, additionally to its role in promoting psychological well-being and social interaction. In the university environment, the significance of physical activity is particularly evident as a major factor in shaping students' personalities and enhancing their motor and cognitive abilities, especially for students in faculties of physical education and sports science, who are expected to be more aware of and inclined towards physical activity than other students.

Attitudes are important psychological variables that impact an individual's behavior, indicating a state of mental and psychological readiness that directs an individual's response to a particular subject, either accepting or rejecting it. Researchers reinforce that positive attitudes toward physical activity are a significant criterion of the likelihood of continuing to engage in it, while negative attitudes may hinder active participation in sports activities (Gareb & Ahmed, 2022).

In this context, a study published in the Journal of the College of Physical Education and Sports Sciences at the University of Baghdad indicated that students generally demonstrate positive attitudes toward physical activity, with no significant differences attributable to demographic variables. This indicates the importance of the educational environment in fostering these attitudes (Mahmood, 2023). p have also previous studies shown that physical education students exhibit positive attitudes toward modern educational and sports activities due to their impact on improving interaction, cognitive achievement, and skills development (Yasir et al., 2025).

In contrast, studying students' attitudes toward physical activity necessitates the use of precise scientific measurement tools. The value of developing psychological scales to measure attitudes in the sports field has been emphasized, given their role in diagnosing the level of these attitudes and identifying the factors influencing them, thus guiding educational and training programs toward fostering positive attitudes (Gareb & Ahmed, 2022). Furthermore, some studies have shown that the level of students' attitudes toward physical activity may range from moderate to positive, necessitating further research to determine the nature of these attitudes within the university environment (Radi, 2025).

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Regardless of the importance of this topic, there is a critical need for analytical studies focusing specifically on female students in the College of Physical Education and Sports Sciences, given the unique characteristics of this group in terms of the nature of their specialization and the social and cultural challenges that may impact their level of physical activity and their attitudes towards it. Hence, the importance of this study depends in analyzing students' attitudes towards physical activity, with the aim of identifying the level of these attitudes and providing scientific indicators that promote to the development of educational and training programs within the college.

Although female students the University of Baghdad College of Physical Education and Sports Sciences are anticipated to have positive attitudes toward physical activity due to their field of study, the reality is that there is a disparity in these attitudes and the level of actual participation. This highlights the need to identify and scientifically analyze the nature and attitudes of female students toward physical activity. The research problem is addressed by the following question: What are the attitudes of female students in the College of Physical Education and Sports Sciences toward physical activity?

The research aimed to: construct a scale for the orientation of female university students to engage in physical activity for female students of the College of Physical Education and Sports Sciences. To identify the orientation of female university students to engage in physical activity for female students of the College of Physical Education and Sports Sciences.

The following is a similar study: The study by Mahmood (2023) adopted a descriptive survey methodology, deemed suitable for the nature of the problem. A questionnaire was administered to measure students attitudes toward physical activity.

The studs conducted by Abdal Karim (2022) adopted a descriptive-analytical approach to examine students attitudes toward physical activity.

The study sample comprised students from the University of Baghdad College of Physical Education and Sports Sciences. A questionnaire, based on an attitude scale was used as the primary data collection instrument, and the collected data were analyzed using the Statistical Package for the Social Sciences and appropriate statistical Method.

In a study by Hassan (2021), the researcher adopted a descriptive approach using correlational methods to examine the relationship between attitudes and certain psychological variables. Data were collected using a standardized scale and analyzed using correlation coefficients and statistical tests.

The study (Al-Tamimi, 2020) used a descriptive survey methodology, allocating a questionnaire to a sample of students from the College of Physical Education. The data were analyzed using arithmetic means, standard deviations, and the t-test.

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Methodology and Tools

1-2Research Methodology

The researcher used the observational survey method as it is suitable for the nature of the research problem. It is regarded as one of the most appropriate methods for studying and analyzing attitudes across the research sample.

2-2Research Sample

The research sample was recruited purposively from female students of the College of Physical Education and Sports Sciences. The sample comprised of (150) first-year students from the academic year (2025-2026). They were divided into (3) samples: a pilot study sample of (5) students, a construction sample of (75) students, and a final application sample of (70) students.

3-2Field Research Procedures:

Scale of Attitudes concerning Physical Activity Among Female Students of the College of Physical Education and Sports Sciences:

After reviewing various sources and studies associated to the research topic, as well as some pertinent previous studies, the researcher proposed (30) statements, as shown in Table:(1)

Table1. shows the items of attitudes towards physical activity among female students

Strongly disagree	Disagree	Neutral	agree	Strongly agree	Statements	ت
					I believe that physical activity is important for maintaining my health.	1
					Be aware that physical activity reduces the risk of developing diseases.	2
					I believe that engaging in physical activity improves physical fitness.	3
					I am aware of the psychological benefits of physical activity.	4
					I believe that physical activity helps improve daily energy levels.	5
					I believe that engaging in physical activity contributes to improving quality of life.	6

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	I feel happy when I engage in physical activity.	7
	Enjoy participating in physical activities	8
	I feel psychologically relaxed after engaging in physical activity.	9
	I love trying new physical activities	10
	I feel excited when I think about engaging in physical activity.	11
	I feel good about myself when I do physical activity.	12
	I intend to engage in regular physical activity in the future.	13
	I try to make time for physical activity.	14
	Make sure to participate in physical activities whenever possible.	15
	I'm looking for ways to increase my daily physical activity.	16
	I strive to engage in regular physical activity.	17
	I participate in sports activities inside or outside the university.	18
	My friends encourage me to engage in physical activity.	19
	The university provides an environment that encourages physical activity.	20

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	Family support increases my desire to engage in physical activity.	**21**
	Group participation encourages me to engage in physical activity.	**22**
	Having role models in the community encourages me to be physically active.	**23**
	University activities motivate me to participate physically.	**24**
	Lack of time prevents me from engaging in physical activity.	**25**
	I feel tired, which hinders my ability to engage in physical activity.	**26**
	I can't find suitable places to engage in physical activity.	**27**
	Lack of motivation prevents me from engaging in physical activity.	**28**
	Being preoccupied with my studies reduces my physical activity.	**29**
	I feel embarrassed when doing physical activity in front of others.	**30**

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Pilot Test

After finalizing the development of the scale and its instruction form, and before implementing it to the main sample, a pilot test must be performed with a number of individuals from outside the main research sample. This pilot test was carried out on September 22, 2025, to assess the clarity of the instructions, the response time, and to identify any difficulties or problems that could be addressed during application (Salah, 2023, p. 9).

Scientific Foundations of the Scale:

First: Item Discriminatory Power: The objective of analyzing the items is to maintain the items with high discrimination, which are the good items in the scale (Al Shafee, 2019, p. 8), as shown in Table.(2)

Table 2. Show Scale Items Analysis for the Physical Activity Orientation Scale among Female Students at the University of Baghdad College of Physical Education.

Item No.	Lower group		Upper group		Calculated (t) value	Significance	Result
	Mean	SD	Mean	SD			
1	3.1579	.71759	5.0000	.00000	-15.824	0.000	Significant
2	2.8421	.75431	5.0000	.00000	-17.635	0.000	Significant
3	3.3684	.85174	5.0000	.00000	-11.808	0.000	Significant
4	2.3158	.90360	5.0000	.00000	-18.312	0.000	Significant
5	2.7619	.69175	5.0000	.00000	-20.968-	0.000	Significant
6	2.3810	.76357	5.0000	.00000	-22.229-	0.000	Significant
7	2.4048	.70051	5.0000	.00000	-24.010-	0.000	Significant
8	2.652	0.663	5.0000	.00000	21.837	.000	Significant
9	3.020	0.691	5.0000	.00000	20.367	.000	Significant
10	2.716	0.612	5.0000	.00000	27.736	.000	Significant
11	2.652	0.663	5.0000	.00000	21.837	.000	Significant
12	2.777	0.841	5.0000	.00000	17.436	.000	Significant
13	2.879	0.516	5.0000	.00000	17.827	.000	Significant
14	2.775	0.782	5.0000	.00000	30.467	.000	Significant
15	2.591	.887	5.0000	.00000	18.234	.000	Significant
16	2.530	.615	5.0000	.00000	28.345	.000	Significant
17	2.711	.753	5.0000	.00000	21.983	.000	Significant
18	3.202	.749	5.0000	.00000	18.544	.000	Significant
19	3.102	.984	5.0000	.00000	12.247	.000	Significant
20	3.1053	.98061	5.0000	.00000	-11.911	0.000	Significant
21	3.3947	1.00107	5.0000	.00000	-9.885	0.000	Significant
22	3.2368	.85216	5.0000	.00000	-12.754	0.000	Significant
23	3.2105	.87481	5.0000	.00000	-12.610	0.000	Significant

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24	3.1842	.80052	5.0000	.00000	-13.983	0.000	Significant
25	2.7895	.104385	5.0000	.00000	-13.054	0.000	Significant
26	3.0263	.82156	5.0000	.00000	-14.809	0.000	Significant
27	3.1842	.83359	5.0000	.00000	-13.428	0.000	Significant
28	3.1053	.79829	5.0000	.00000	-14.631	0.000	Significant
29	2.591	.887	5.0000	.00000	18.234	.000	Significant
30	2.530	.615	5.0000	.00000	28.345	.000	Significant

Degrees (73) of freedom

Second: Internal consistency coefficient: Internal consistency aims to verify the degree of homogeneity and reliability of the statements in the study of the phenomenon under study (Raheem, 2025, p7). All statements seemed consistent: because they were higher than the significance level (0.05), as shown in Table.(3)

Table3. showing item-correlation coefficients of scale item.

Result	Significance	Item -total correlation	Item No.
Significant	0.000	0.606**	1
Significant	0.000	0.573**	2
Significant	0.000	0.749**	3
Significant	0.000	0.962**	4
Significant	0.000	0.493**	5
Significant	0.000	0.574**	6
Significant	0.000	0.692**	7
Significant	0.000	0.466**	8
Significant	0.000	0.841**	9
Significant	0.000	0.673**	10
Significant	0.000	0.557**	11
Significant	0.000	0.543**	12
Significant	0.000	0.452**	13
Significant	0.000	0.708**	14
Significant	0.000	0.745**	15
Significant	0.000	0.651**	16
Significant	0.000	0.588**	17
Significant	0.000	0.770**	18
Significant	0.000	0.564**	19
Significant	0.000	0.685**	20
Significant	0.000	0.531**	21
Significant	0.000	0.958**	22
Significant	0.000	0.779**	23
Significant	0.000	0.598**	24

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Significant	0.000	0.674**	25
Significant	0.000	0.943**	26
Significant	0.000	0.796**	27
Significant	0.000	0.785**	28
Significant	0.000	0.745**	29
Significant	0.000	0.651**	30

Third: Scale Reliability: The researcher verified the scale's reliability using Cronbach's alpha coefficient, which was found to be 0.851. This is deemed a high reliability value at a significance level of 0.05.

Scale Application: Following the above procedures, the researcher administered the scale to the research sample of 70 female students from November 15, 2025, to December 20, 2025.

Results: Table (4) shows the arithmetic mean, hypothetical mean, standard deviation, calculated t-value, true significance, and type of difference.

Table 4. Showing, Hypothetical Mean, Standard Deviation, Calculated t-Value, (p-value), and the Type of Difference

Type of difference	significance	Calculated (T)value	Standard deviation	Means	Variables
Significant	0.000	10.325	8.587	115.965	**The scale**
	90			**Hypothetical mean**	

Discussion

In light of the findings showing significant positive variations in female university students' attitudes toward physical activity, these findings can be analyzed within the framework of psychological and behavioral orientations associated with implementing healthy lifestyles. This finding indicates that the students possess a positive attitude and an intrinsic readiness to engage in physical activity, indicating a high level of health awareness and cognitive understanding of the importance of physical activity in improving physical and mental health.

This finding aligns with the literature indicating that a positive attitude is a key behavioral determinant of physical activity.

Ajzen, in his theory of intended behavior asserts that positive attitudes regarding a behavior directly contribute to creating the intention to engage in it which in turn is a strong predictor of the behavior actually occurring (Ajzen, 1991, p. 181). This suggests that female students with a positive attitude are more likely to participate in physical activity both within and outside the university environment. These findings can also be explained by the role of health knowledge in shaping attitudes.

Dishman et al. (2004, p. 45) state that individuals who are conscious of the health and psychological benefits of physical activity are more willing to implement it as part of their daily lifestyle. accordingly, the positive attitudes among female students may show a

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higher level of awareness of the significance of physical activity in eliminating disease and enhancing physical fitness and psychological well-being. In contrast a supportive social environment within the university can promote to fostering these positive trends. Sallies et al. signify that social support from friends and educational.

institutions is a significant factor in promoting and maintaining physical activity (Sallies et al., 2015, p. 152). This corresponds with the nature of the university environment which offers opportunities for group participation and structured activities thus enhancing motivation and increasing the likelihood of engaging in physical activity. These findings can also be explained in light of intrinsic motivation theory where Deci & Ryan assert that feelings of competence and connection enhance intrinsic motivation to engage in healthy behaviors, including physical activity (Deci & Ryan, 2000, p. 233).

Therefore, the students' positive attitudes may reveal intrinsic motivation stemming from a desire for self-improvement and personal acceptance.

Overall, the results indicate that female university students possess a positive attitude base that can be created based on in designing awareness and sports programs within the university, which contributes to transforming this positive attitude into a sustainable actual behavior.

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Conclusions:

Discriminating

•Female university students indicated a positive attitude towards physical activity, demonstrating their cognitive, emotional, and behavioral awareness of its relevance in improving public health and quality of life.

•The existence of positive attitudes among female students indicates an internal psychological preparedness to engage in physical activity when the suitable conditions are met .

•The findings suggest that the university environment can be a supportive factor in promoting physical activity if accurately utilized.

•The findings show that cognitive and emotional elements contribute to shaping students' intention to participate.

•A positive attitude does not necessarily translate into real participation, indicating the possibility of organizational or environmental barriers that inhibit translating this attitude into actual behavior.

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Recommendations:

•Utilize on the positive attitude of female students by designing university sports programs that encourage the real practice of physical activity.

. • Improve the university's role in offering a supportive environment for physical activity through regular sports activities and events.

•Promote ongoing health consciousness about the significance of physical activity in avoiding health and psychological problems.

•Incorporate physical activity into extracurricular university programs to promote sustainable involvement.

•decrease barriers that limit physical activity such as time constraints or absence of suitable facilities.

•support teamwork and collaborative sports activities as these impact in strengthening motivation to participate.

•conduct future studies that link positive attitudes with the actual level of physical activity.

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A comparative study of some physiological variables among players of the Sports Talent Center in football aged (14-15) years before and after the implementation of the training units' program for a period of one month

Yousif kadhim abed[1] Mahdi Zeidan Hmmood[2] Safwan Abdalghani Hamid[3]

[1,2,3] **University of Baghdad, College of Physical Education and Sports Sciences.**

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Abstract

This study sought to identify specific physiological variables in football players aged 14–15 years at the Sports Talent Center and to compare the values of these variables before and after one month of training sessions conducted at the center. The study's significance resides in providing accurate scientific indicators of the players' physiological state and the degree of change during the training period thus promoting to the scientific evaluation and observing of training programs for emerging age groups.

The researcher used a observational comparative approach, as it was appropriate for the nature and objectives of the study. Measurements of specific physiological variables were taken for the players at the Sports Talent Center using a physiological scale. Measurements were taken before the start of the follow-up period and repeated after one month of regular training sessions at the center. The study involved a range of physiological variables related to body composition and the players' functional status.

The findings demonstrated a discrepancy in the values of some physiological variables between the pre- and post-measurements, revealing the changes that emerged in the players during the study period. The findings also confirmed the importance of implementing physiological measurements in observing layers' state and evaluating training programs, as these measurements supply objective information that helps coaches in proper planning and direction of the training process.

The researcher advocated the necessity of applying periodic monitoring of the physiological variables of young players in sports talent centers, and incorporating the results of modern measurements in assessing training loads and developing programs

[1] University of Baghdad, College of Physical Education and Sports Sciences.
Youssef.Kazem1104b@cope.uobaghdad.edu.iq
[2] University of Baghdad, College of Physical Education and Sports Sciences
mahdi.zeidan@cope.uobaghdad.edu.iq
[3] University of Baghdad, College of Physical Education and Sports Sciences
safwan.abdulghany@cope.uobaghdad.edu.iq

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designed for this age group in addition to conducting similar studies on other variables and age groups.

Keywords: Physiological scale, physiological variables, skeletal muscle mass, calories burned, body fat.

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introduction

Football is a sport that demands high levels of physical and physiological efficiency to attain optimal performance particularly in the early age stages which denote the foundation in building the player in the future, and can also be used in recruiting and choosing players.

Football has always been and is still considered the world's number one sport in terms of enjoyment, organization, and excitement. Furthermore training methods continue to expand through the introduction and development of new playing styles and the innovation of modern tactical approaches. This has resulted in a game characterized by power, speed, skillful play and tactical maneuvers that add to the beauty of matches and create a high level of excitement and enjoyment. All of these elements are directly associated to the quality of the player, comprising their natural talent and physiological characteristics. This is where the variations between players become apparent. Previously a player's physiological potential was revealing by their performance level, such as their capacity to play for extended periods or their ability execute new skills – what we call the improvement of their technical and physical abilities. Today, however it is possible to monitor the physiological changes that exist in players using modern equipment that provides more precise data than the experience of the coach themselves. While the coach's expertise in examination is still valued, and we don't want to reduce the role of training specialists, the data provided by this equipment offers a more comprehensive understanding of the game. The specialist is a quantitative data that more accurately and profoundly illustrates the shape of development and change in the body's physiological functions.

Sports talent facilities are important institutions that aim to identify and nurture athletic talent founded in sound scientific principles. Assessing physiological variables is important scientific method for establishing the level of functional adjustment of different body systems in athletes. These variables assist to identifying physical and functional capabilities and directing training programs to align with the growth and developmental characteristics of the target age group.

Hence came the idea of researching the use of a physiological medical scale which would measure these variables to monitor the development and progress of players especially for the targeted age groups, as they are in the growth stage with the aim to give a clear indicator to the specialized coach to monitor his players more deeply and also to know the level of his training program if it is advantageous to his players. In addition the medical scale can be an advance warning device that alerts the coach to injuries before they arise if the player is weak or if the player's level is slow in development, so that he can make modifications to the training program to serve his work. From this viewpoint we note that many studies have concentrated on measuring some physiological variables as one of the basic measures to identify the body's reaction to the training load, such as the study of Mahmoud Abdel Fattah and Omar Bin Saeed (2018, pp. 22-40) on the differences in some

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physiological variables and body composition between players of the Premier League and the First Division, and the study of Ahmed Youssef Hussein (2021, pp. 112-129) on the influence of body mass index and its components on the explosive power of the lower limbs in junior volleyball players. The study by Mohammed Hassan Al-Obaidi et al. (2019; pp. 45-58) used the InBody 770 device to measure the percentage of fat, muscle mass, and water distribution in the body. The study by Laila Bint Saleh Al-Hashem (2022; pp. 210-225) monitored the hydration status (water balance) and body composition during the general preparation period. The study by Ibrahim Sayed Tawfiq (2020; pp. 301-330) investigated the effect of a recommended training program on some biochemical and physiological variables and body composition of volleyball players.

Nevertheless the aforementioned studies studied the physiological variables as a single unit and did not distinct each variable for a deeper understanding, which is somewhat of a weakness that needs more detail. This is where our research comes in to provide professionals with a more precise and clearer view of the effect of training load on players.

The 14-15 age group is important stage in the physical and physiological development of football players. However many training programs are implemented without depending on accurate scientific data that clarifies the level of physiological variables in these players. Furthermore the scarcity of studies focusing on this age group within sports talent centers necessitates understanding the fact of certain physiological variables among them. Therefore the research issue is defined as an attempt to identify and scientifically examine the level of certain physiological variables in football players aged 14-15 at sports talent centers.

Hence, the significant of studying some physiological variables among the players of the Sports Talent Center in football, aged (14-15) years and comparing them before and after a month of training units at the center is highlighted, as it provides scientific indicators that help coaches and researchers in developing the training process and raising the level of sports performance.

The study also aims to:

.1 determining the values of some physiological variables among the players of the Sports Talent Center in football aged (14-15) years before implementing the training units program.

.2 Identifying the values of some physiological variables among the players of the Sports Talent Center in football aged (14-15) years after applying the training units program for a month.

.3 contrast between the results of the pre- and post-measurements of some physiological variables among the players of the Sports Talent Center in football aged (14-15) years.

.4 identifying impact of the training unit program implemented at the Sports Talent Center on the development of some physiological variables in players.

Method and Tools

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Research Methodology: The researchers implemented the illustrative approach with a comparative study method, as the research sample was selected purposively. "The selection of the research participants is associated with the population from which it is taken as the sample is that part of the population on which the tests are carried out under scientific rules and methods so that it accurately represents the population" (Abbas; 2012). The research population was (20) players from the sports talent schools teams in Baghdad. The research sample was selected intentionally because of their resemblance in some physical features such as height, weight and age in order to start with one starting line during the experiment, and their number was (8) players which represents 40% of the original population. The experiment was conducted by conducting two tests, pre and post, in order to monitor the physiological developments that occurred during training.

Methods of Data Collection

The researchers depended on measurements taken using a physiological medical scale for some of the targeted variables in the research as the primary method for gathering information to guarantee accuracy in data extraction for the research sample.

Tools and Equipment Used in the Research:

.1Physiological scale for tracking certain physiological variables.

.2Measuring tape.

.3A modern mobile instrument for installing the specialized application for the physiological scale to directly extract data.

.4The application particular to the instrument used in the research.

Measurements:

.1A physiological scale was used to calculate operational indicators via its dedicated application. The scale's operation is explained in Appendix(1).

.2A measuring tape was used to accurately determine the players' heights for data entry into the device's software within the mobile application before the empirical study began.

.3Skeletal muscle mass, caloric intake and body fat percentage were reported for each player.

.4Initial data for the players, including age, weight, and height, was recorded throughout the preliminary phase of the research to enable comparisons between players during the measurement of physiological variables, as shown in the table below.

Table1. shows the ages, weights and heights of the players.

ت	Age	Weight	Tallness
1	14	47	160
2	14	49	161
3	15	54	162
4	14	49	159
5	14	51	157

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6	15	55	166
7	15	54	164
8	15	56	168

Pilot Study:

The pilot study was carried out on (4) players from the original community at the Sports Talent Center for Football. They were consequently excluded due to their differences from the sample in terms of training age, weight and height to guarantee a single starting point for the research sample. This took place on Sunday February 1, 2026, at the Sports Talent Schools fields in Baghdad at 5:00 PM. During the pilot study the device used in the research was tested and the players' data was entered to determine any barriers before starting the main experiment. This pilot study (is a preliminary experimental study executed by the researcher on a small sample before applying the main experiment) (Jumah, 2014).

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Main Experiment

The main experiment began on Tuesday, February 3, 2026, at 5:00 PM. The team educated four times per week at the Al-Mawhiba Sports Complex in Baghdad. Each training session continued between 90 and 120 minutes, with the fifth session comprising of a match. Physiological variables were measured throughout the first week for monitoring purposes. These variables involved skeletal muscle mass calorie expenditure, and body fat percentage during physical activity within each training session for each player in the sample. The data was preserved via a committed program installed on a mobile application (pre-test). The data was then entered into specific forms for analysis by the researchers after the target period (30 days). A second measurement and follow-up (post-test) was conducted to identify differences and identify the extent to which the research objective was achieved. Table 2 shows the initial pre-test measurements for the research sample. (Abd et al., 2025) state that this work enables coaches to monitor individual player reactions during different training periods, thus helping to improve performance efficiency. Physical and reducing the risk of fatigue resulting from overexertion".

Table2. showed the pre-physiological measurements.

Sequence	Lean muscle Mass (kg)	Skeletal muscle (%)	Calories consumed	Fat%	Fat (kg)
1	26.4	32.4	1402.4	6.5	3.9
2	23.5	30.1	1329.4	5.0	2.8
3	28.6	29.8	1660.5	10.8	7.3
4	27.1	31.5	1512.1	6.4	4.0
5	32.3	33.6	1786.7	11.4	8.5
6	26.6	30.9	1570.2	10.3	6.7
7	25.1	28.7	1603.2	11.3	7.0
8	28.1	27.5	1642.1	13.2	9.2

Statistical Analysis of Data

The researchers used the Statistical Package for the Social Sciences (SPSS) software to process the data extracted from the medical scale by implementing the following statistical tests:

.1The t-test for matched samples to compare variations between physiological variables.

.2The arithmetic mean to calculate the average of the physiological values documented during the training sessions.

.3The standard deviation to measure the variance between the values logged for the players.

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Results

Table3. showed the post-test physiological variables.

Sequence	Lean muscle Mass (kg)	Skeletal muscle (%)	Calories consumed	Fat%	Fat (kg)
1	27.3	33.1	1430	6.0	3.7
2	24.4	31.0	1355	4.7	2.7
3	29.7	30.7	1692	10.2	7.1
4	28.2	32.2	1545	5.9	3.8
5	33.6	34.4	1822	10.7	8.2
6	27.8	31.8	1605	9.6	6.4
7	26.3	29.5	1635	10.6	6.7
8	29.4	28.3	1678	12.4	8.8

Table4. showed the means standard deviations and calculated t-values between the variables identify the statistical differences using the t-tset.

Variable	Test	Arithmetic mean	Standard deviation	Value (t)	Significance	Type of differences
Lean muscle	**post**	**26.63**	**2.58**	**11.45**	**0.000**	**Significant**
Mass (kg)	**Pre**	**27.83**	**2.76**			
Skeletal	**post**	**30.65**	**1.94**	**7.54**	**0.000**	**Significant**
muscle (%)	**Pre**	**31.35**	**1.91**			
Calories	**post**	**1563.3**	**143.2**	**10.22**	**0.000**	**Significant**
consumed	**Pre**	**1595.2**	**147.2**			
Fat%	**post**	**9.36**	**2.77**	**6.84**	**0.000**	**Significant**
	Pre	**8.76**	**2.17**			
Fat (kg)	**post**	**6.13**	**2.21**	**5.42**	**0.001**	**Significant**
	Pre	**5.92**	**2.16**			

The significance level was set at degree of freedom (7) and an error level of 0.05 the tabulated t-value was 2.36 .

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Discussion

Before progressing with the discussion, the researchers intend to clarify the importance of using the device as one of the modern tools for measuring non-traditional physiological variables, i.e.. it does not depend on the usual pattern such as medical analyses and others but rather the work of the medical physiological scale is based on safe multi-frequency bioelectrical resistance technology. It emerged through the results acquired by the researchers using the medical scale that it provides a detailed and precise view of the distribution of body masses, and this allow the researchers to monitor the level of change that transpired in the research sample and each player individually. Khalifa (2026) indicates that the use of devices (makes the exercises more challenging and encourages the sample to achieve the goals specified in each training unit).

The significance of this device lies in its capacity to identify net skeletal muscle mass and the allocation of fluids, muscle tissue, and fat. This is important for football players in their growth years, as it enabled us to confirm that the increase in the players' weight was a "qualitative" (muscular) augmentation not a "quantitative" (fat) one. Moreover supplying researchers with data on the rate of calorie consumption facilitated to understanding the efficiency of internal energy burning in the sample making the device used an indispensable diagnostic tool in designing modern training programs and confirming that the training process proceeds according to sound physiological principles, away from guesswork.

By providing the results in Table No. (4), it became clear that there were statistically significant differences between the pre-test and post-test in favor of the post-test in all physiological variables. The computed value of (t) for net muscle mass was (11.45), for the percentage of calories consumed was (10.22), and for the percentage of fat was (6.84). These values are greater than the tabulated value, which confirms the effectiveness of the training units developed by the technical staff.

Here, the researchers would like to explain some key points regarding the positive development achieved in the research sample:

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.1 The age of the target group in the research, as these ages are characterized by accelerated growth and response to training. This is supported by the figures shown through countries (4) of muscle development and the amount of calorie consumption through the significant change and the appearance of development results in a remarkable way. Nahla Obaid and Shahd Jassim (2024) indicate that "training affects the physical abilities and performance of skills among young football players in specialized schools who are between 14 and 16 years old directly and effectively," (the increase in net muscle mass and skeletal muscle indicates the investment of natural growth energy and directing it towards muscle building through specialized sports training (Ahmed, 2010)).

.2 The impact of regular training units, which were suitable to the age group and thus the training program facilitated to bringing about physiological development. This explains the significant difference between the pre-test and post-test, which is involved in countries (3 and 4) in the amount of calories consumed by the research sample, which was extracted through the medical scale device.

.3 The relationship between the variables: increasing the level of skeletal muscle by a significant percentage necessarily led to an enhancement in the body mass index and general ability, which is reflected positively on the physical and skill performance of football players. (Abdul Saheb; 2025) indicates that "exercises greatly help in getting rid of excess weight by reducing the percentage of fat in the body," and this is what the results showed in Table No. (4), where the calculated value of (t) became.(6.84)

.4 Changes in body composition: We examine a decrease in body fat percentage accompanied by an increase in muscle mass suggesting "body reshaping." The training did not cause to random weight loss but rather improved body quality by increasing muscle tissue and decreasing fat tissue.

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Summary of the Discussion:

These findings confirm that daily training sessions have attained their objectives in the physiological changes of the players.

(Abd et al., 2025) stated, "These studies will facilitate to a deeper understanding of the physical factors affecting performance as well as the design of specialized training models and programs based on scientific data." Furthermore, physiological measurements using a medical balance device have proven their ability to more accurately track these changes providing coaches and researchers with a precise means of assessing the physical condition of players.

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Conclusions

.1The valuable biological response through the four weekly training sessions resulted in a significant physiological response leading to a substantial improvement in the players' physical improvement during the research period.

.2The efficiency of modern technology revealed by the use of a medical scale as an accurate tool for identifying and tracking subtle physiological changes makes it a necessary alternative to traditional measurements.

.3Improved muscle development as the results demonstrated an increase in skeletal muscle mass indicating the effectiveness of the training load in promoting muscle tissue in young athletes (aged 14-15).

.4Improved metabolic efficiency as the sample measured a significant increase in basal metabolic rate a physiological indicator of increased bodily activity and the vitality of internal systems resulting from regular training

Recommendations

1. Continuous tracking of athletes' physiological balances by coaches at sports talent schools on a regular basis for two months to monitor muscle mass development and ensure the lack of physical strain.

2. preserving the training intensity. Since the athletes have shown a good response to four training sessions it is suggested to maintain this intensity and gradually increase the number of training sessions in the upcoming phases to achieve maximum technical and physiological benefits.

3. performing future studies that link these physiological variables to physical abilities in general.

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Transfer of Learning Between Selected Defensive Skills in Handball Among Third-Year Students

Ruqia Abdulredha Muhsin[1]
[1] University of Baghdad, College of Physical Education and Sports Sciences

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Abstract

This research objectives to study the transfer of learning between some basic defensive skills in handball among third-year students at the College of Physical Education and Sports Sciences. The researcher implemented an experimental design with two groups (control and experimental), where the sample comprised of (40) students randomly assigned to (20) groups. An educational program was implemented over (8) weeks, with one training unit per week. The defensive block in one direction and various defensive movements were tested before and after the experiment. The results showed the superiority of the experimental group, which applied targeted training, in achieving positive transfer of learning between the two defensive skills. This demonstrates the prospective for leveraging skill integration to accelerate the learning process. The research recommends adopting educational strategies based on the principle of transfer of learning in teaching and instructing defensive skills in handball, and employing them to develop students' performance more effectively.

Keywords: Handball, transfer of learning, defensive skills, third-year student

[1] University of Baghdad, College of Physical Education and Sports Sciences.
Roqia.Muhsin0904@cope.uobaghdad.edu.iq

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Introduction:

Handball is a fast-paced team sport that necessitates the integration of offensive and defensive skills to ensure optimal team performance. The defensive aspect is regarded as one of the most significant elements of success in matches, as it helps to limit the effectiveness of the opponent's attack and increases the chances of controlling the ball and organizing counter-attacks (Schmidt & Lee, 2020). Among the most crucial defensive skills in handball are the defensive block and varied defensive movement. Achievement in executing these skills relies on speed of response, the ability to position correctly, and motor coordination between different parts of the body. Modern scientific research in physical education focuses on understanding how motor skills are acquired and enhanced using scientific principles such as the principle of transfer of learning, which refers to the impact of learning a specific skill on learning other associated skills (Gillet, Leroy, & Calmels, 2021). Positive transfer of learning is a vital tool for teachers and coaches to accelerate the process of acquiring skills and developing athletic performance, while negative transfer can hinder learning and lead to repeated errors during training and competition (Raab & Araújo, 2022).

Studies show a kinematic correlation between certain defensive skills, such as the defensive block and varied defensive movement, where learning and training in one skill can enhance performance in the other (Wagner, Finkenzeller, & Würth, 2023). This underscores the importance of understanding and incorporating transfer of learning into the design of educational programs for university students, especially since this age group is characterized by its ability to learn quickly and adapt to modern teaching and training methods. Furthermore, studies have shown that learning and training defensive skills in a structured and guided manner can facilitate increasing players' efficiency and improving their performance in matches (Fasold, Houseman, Noël, & Klatt, 2021). On the other hand, some university students exhibit an associated weakness in mastering basic defensive skills despite regular practice, indicating a knowledge gap that requires scientific research to explain and improve practical solutions to address it.

Therefore, it is necessary to study the transfer of learning impacts between defensive skills in handball scientifically and systematically to establish the extent to which learning a specific skill benefits the development of another skill, and how to design educational programs that attain the highest possible efficiency for students. Hence lies the importance of research into the effect of learning transfer between defensive skills for the selected sample.

Modern literature in motor learning reveals that the transfer of learning is a fundamental principle contributing to improved acquisition of athletic skills. Learning a specific skill influences the speed and efficiency with which other skills with similar motor characteristics are learned. This principle is specifically important in team sports like handball, which depend on the integration of defensive and offensive skills during a match.

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Current studies have established that using educational programs based on the motor connection between skills contributes to faster performance improvement and development of motor abilities in students and players compared to traditional learning and training methods (Schmidt & Lee, 2020; Raab & Araújo, 2022). Notwithstanding the significant importance of defensive skills in handball, university students often struggle to master specific defensive skills, such as the defensive block and varied defensive movement. This is attributable to several factors, one of them a lack of scientific understanding of how to learn several skills, poor motor coordination, and the use of traditional teaching methods that do not utilize the principles of transfer of learning (Schmidt & Lee, 2020). Field observations by the researcher, a handball instructor, indicate that some students require a significant amount of time to master defensive skills despite regular attendance at classes. This reflects a gap between practical application and desired outcomes. Moreover, current educational programs often focus on teaching each skill individually, neglecting the potential for transferring learning between related motor skills. This approach can lead to wasted time and effort and reduce learning effectiveness. Therefore, the research problem lies in the need to study the impact of transferring learning between defensive skills in handball and to determine whether learning and training in one skill can positively contribute to learning another. This will support the design of more effective educational and training programs for university students. The research also helps in designing effective educational and training programs that leverage the transfer of learning between defensive skills, thus shortening the time and effort spent on learning and training and increasing student efficiency during lessons. It also contributes to reducing motor errors and improving coordination between different defensive skills.

To address the research problem, the researcher establishes multiple objectives: to ascertain the effect of the training program on the transfer of learning between the two skills; and to contrast the two groups (control and experimental) in the post-test.

The research hypotheses state that there are statistically significant differences between the pre-test and post-test scores in favor of the post-test scores in the experimental group. There are also statistically significant differences in the post-test scores between the two groups, favoring the experimental group.

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Methodology and Tools:

The research employed an experimental design with two groups (experimental and control). The educational program was implemented with the experimental group, while the control group continued with its traditional program. This approach was chosen for its ability to measure the impact of the educational program on the transfer of defensive skills with scientific accuracy (Schmidt & Lee, 2020).

Sample and Research Population:

The research cohort was intentionally recruited from students of the College of Physical Education and Sports Sciences. A random sample was then selected from third-year students at the College of Physical Education and Sports Sciences, University of Baghdad, for the 2024-2025 academic year. This sample comprised students from sections (K) and (L), aged between 22 and 24 years. Twenty students from section (K) were selected as the experimental group, and the same number from section (L) as the control group, using a lottery system to guarantee equal opportunities. It should be noted that randomness in sample selection does not imply spontaneity or accidental selection, but rather relies on meticulous organization and deliberate procedures aimed at attaining a realistic representation of the research population and ensuring the neutrality of the outcomes (Allam, 2010, p. 19).

The researcher administered a pilot study with six students outside the sample to administer the specific tests. The sample was selected based on student availability and willingness to participate, ensuring that all students had basic experience in handball to guarantee that the results reflected the effect of the educational program rather than prior experience. Afterwards, the researcher verified the homogeneity of the research sample in some basic variables (age, height, weight) before starting the experiment by calculating the arithmetic mean, standard deviation, and skewness coefficient to ensure that the sample followed a normal dispersion and that there were no significant differences between its members.

Methods of data collection and the equipment and tools used in the research:

-Methods of data collection:

1. Observation and experimentation.
2. Personal interviews.
3. Tests and measurements.
4. The internet.

- Tools and equipment used in the search:

1. Measuring tape.
2. Whistle.
3. Beacons.
4. Stopwatch.
5. Laptop calculator (Dell brand).
6. Handball court

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Tests Used in the Research:

- Selected Defensive Skills: (Abd, 2009)

1- One-Way Defensive Block Test:

- Purpose of the Test: To evaluate the player's ability to perform the block frequently and consistently.

- Equipment Used: Handball court, handball suspended from a post at a height of 260 cm, measuring tape, tape, timer.

- Performance Specifications: A mark is placed with tape on the 6-meter line. The test subject stands above the mark, facing the suspended ball, which is fixed to the post at the 9-meter line. Upon receiving the signal, the test subject moves forward, jumps upwards, and performs the block, touching the suspended ball with both hands. The test subject replicates the action as many times as possible for ten seconds.

- Performance Requirements: Each time the test subject jumps to perform the defensive block, they must touch the ball with both hands. The test subject must start from the mark above the 6-meter mark and repeat the action until signaled to end the allocated time for the test. The test subject's movement must be equivalent to the defensive movement for blocking shots on goal from a jump, especially the arm position, the distance between them, the hands, and the forward direction of the palms to face the ball.

-Scoring: The number of effective attempts made by the test subject within the allocated 10 seconds is recorded.

Testing various defensive moves:

- The purpose of the test:

To assess the speed of performing defensive movements to the side, backwards with a tilt, and forwards with a tilt.

Tools used:

Handball court, adhesive tape, measuring tape, stopwatch.

Performance specifications:

Three marks are drawn on the ground with adhesive tape, two of them (A, B) on the (6m) line, and one of them on the (9m) line, so that the three marks form an isosceles triangle with a side length of (3m).

Method of performance:

The examiner stands above mark (A), and when the start signal is given, he moves to the side to mark (B), then he moves to mark (C), and finally returns to point (A) by moving backwards at an angle. The performance is repeated as many times as possible for (30) seconds. The student's movement is identical to what he does throughout the competition in terms of the position of the arms and legs. He must reach the drawn marks (A, B, C) and touch them with his feet. The examiner must repeat the performance until he is given a signal to end the time specified for the test. Any performance contrary to the

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previous circumstances will not be counted as part of the number performed by the tester during the time specified for the test.

Recording grades:

Each correct attempt is valuable three points, one point for reaching any mark, meaning a total of 3 points.

The number of correct attempts made by the tester within (30) seconds is recorded. If the tester does not follow any of the test variables when moving on the drawn marks, one mark is subtracted for each mistake he makes in reaching the drawn marks and touching them with his feet.

- If the time allotted for the test expires and the test-taker does not complete the attempt, i.e., does not reach one of the marks, such as reaching (A, B) and not reaching (C), the marks are collected and added to the marks of the correct attempt.

Pilot Study:

On Monday, January 20, 2025, the researcher administered a pilot study with (6) students from outside the sample to administer the special tests. The aim of the pilot study was to identify the testing methods used by the support team, the effectiveness and validity of the tests, and the time required to administer them.

Pre-tests:

The researcher administered pre-tests on (40) students on Tuesday, January 21, 2025. The defensive stance test and the defensive lateral movements test were administered to students in sections (K) and (L), whose ages ranged between (22 and 24) years. (20) students from section (K) were selected as the experimental group, and the same number from section (L) as the control group, and the tests were administered to them.

The main experiment:

The educational curriculum that contains defensive skills was implemented, and the researcher developed a set of exercises for defensive skills from Tuesday, January 28, 2025, until Tuesday, March 25, 2025, for a period of (8) weeks. One lecture was conducted per week for each group (experimental and control), and the total lecture time was (90) minutes. The experimental group, section (K), implemented the educational curriculum for defensive skills within the main section of the educational unit, while the control group, section (L), implemented the curriculum followed by the subject teacher.

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-Post-tests:

The researcher conducted the post-tests on the sample on Tuesday, April 1, 2025, using the same procedures as the pre-tests for the experimental and control groups.

-Statistical methods:

Statistical computer programs (SPSS) were used to process the data and test the hypotheses to ensure the accuracy of the findings and reduce statistical biases during the analysis (Gillet, Leroy, & Calmels, 2021).

- The arithmetic mean.
- Standard deviation.
- T-test for correlated samples.
- Independent samples t-test.
- Pearson's correlation coefficient.

Torsion coefficient

Results: - Presentation, analysis, and discussion of the research sample results:

Table 1. shows the differences between the pre-test and the post-test for the experimental group.

Test	Experimental group				Value T	significance
	mean Pre	sd Pre	mean post	sd pre		
Test wall	6.92	0.74	8.45	0.62	6.42	0.000
Variety of movement test	7.18	0.70	9.10	0.58	7.15	0.000

At a degree of freedom of (19), and a significance level of (Sig = 0.000), which is less than the significance level of(0.05) .

Table No2. shows the differences between the pre-test and post-test for the control group

Test	Control group				T Value	Significance
	mean Pre	sd Pre	mean post	sd pre		
Wall test	6.80	0.76	7.12	0.71	2.11	0.041
ting the variety of movement	7.05	0.72	7.68	0.65	2.34	0.030

At a degree of freedom of (19), and a significance level of (Sig = 0.000), which is less than the significance level of(0.05) .

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Table 3. shows the differences between the experimental group and the control group in the post-test for both groups.

Test	Number	mean experim	SD experim	mean Control	SD Control	T	Significance
Wall test	20	8.45	0.62	7.12	0.71	3.87	0.000
Variety of movement test	20	9.10	0.58	7.68	0.65	4.26	0.000

At a degree of freedom of (38), and a significance level of (Sig = 0.000), which is less than the significance level of.(0.05)

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Discussion:

The research findings demonstrate that the tailored educational program considerably contributed to enhancing students' defensive skills. This reflects a positive transfer of learning between the two studied defensive skills: the defensive block and various defensive movements. This corresponds with the findings of Schmidt (2020) regarding the ability of kinesthetically associated skills to positively affect each other's learning, as well as with recent studies that have confirmed the effectiveness of targeted teaching and training in enhancing the defensive performance of handball players (Gillet B., 2021) (Wagner, 2023). The significant superiority of the experimental group is attributed to the educational program's focus on strengthening the connection between defensive skills through repetition in match-like contexts. This support improves reaction speed, correct positioning, and consistency in executing defensive skills. The results also indicate that the control group, which continued with the traditional program, achieved relatively limited improvement. This highlights the importance of using scientifically based educational programs that utilize the principle of transfer of learning to reduce the time needed to master skills and attain optimal results.

These results also indicate that learning defensive skills holistically, rather than in isolation, enhances overall team performance. This can be practically implemented in designing educational and training units for students and sports teams over several age groups. Furthermore, the present study confirms that adopting the principle of transfer of learning in teaching defensive handball skills promotes faster skill acquisition and improved motor performance among students. Integrated training that connects similar motor skills also helps create additional effective educational programs compared to traditional training methods that rely on learning skills distinctly.

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Conclusions:

1. The customized educational program facilitated supporting students' performance in the selected defensive skills.
2. An effective transfer of learning occurred between the blocking skill and various defensive movements, reflecting the efficacy of the targeted training.
3. The experimental group significantly surpassed the control group in all post-tests.
4. Utilizing the principles of transfer of learning in designing educational and training programs to contribute to increased learning and training efficiency and reduce the time needed to master skills.
5. Implementing educational strategies according to the principle of transfer of learning to enhance defensive and offensive skills in handball.
6. Implementing the same educational programs among different age groups, grade levels, and teams to verify the effectiveness of the results.
7. Designing multi-skill educational programs that include all components of the game to enhance the overall performance of teams.
8. Conducting ahead studies to evaluate the effect of transfer between defensive and offensive skills in handball.

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Appendix (1)

Sample learning unit

Learning unit duration : 90 minutes — Week 1and 2

Unite objective: to learn the blocking wall And various blocking movement — Educational units one and two

Unit sections	Time	Details of the learning unit and exercises	Duplicates	Notes
section: Educational aspect	60- 20 د	iation and demonstration of defensive skills, specifically .the blocking wall and various defensive movements		sis should be placed on ing, demonstrating, and ..applying skills to learners
Practical aspect	40-	1. alls on stands one meter high. Assign colors to each he learner is asked to jump and hit the ball over the stand, .then return and repeat the exercise	3×5	sis on explaining and - trating the exercises by the and practicing the exercises .by all learners
		2. rner takes lateral steps for 3 meters, then moves l with short, quick steps. They stop and take lateral steps After another 3 meters, they step back to begin the .defensive movement again	3×4	ng feedback during and - fter practicing the exercises eriods should be taken - n repetitions and between .sets
		3. rner moves laterally from the wing area to touch the ie ball, then moves forward, jumps, and performs a ve block. They then step back and then to the side, g the medicine ball each time they move forward and then .fter completing the set, the learner runs to stand behind .the set on the other side	3×4	
		4. rner moves forward to touch the medicine ball with ands, then steps back diagonally to touch a ball licular to the circumference of the circle. They then move .laterally and repeat the exercise	3×5	

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Aspects of the Six Sigma Method and its Role in Improving the Quality of Recreational Services According to the Vision of the Arab Republic of Egypt 2030

Dina kamal Mahmoud[1]

[1] King Saud University - College of Sport Sciences and Physical Activity- Kingdom Saudi Arabia.

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Abstract

The current research aims to identify the role of the Six Sigma approach in improving the quality of recreational services in accordance with the Arab Republic of Egypt's Vision 2030. This research aims to identify the aspects of diagnosing the support and commitment provided to improve the quality of recreational services Areas of availability and analysis of management information systems as an entry point for upgrading recreational services, aspects of improving human capital management to upgrading recreational services, achieving the material capabilities and infrastructure necessary to develop the quality of recreational services, areas of measuring and evaluating the nature of work in recreational activities, obstacles to developing the quality of recreational services in light of the vision of the Arab Republic of Egypt The researcher used the descriptive approach (survey studies method) with its steps and procedures due to its suitability to achieve the research objectives. The research community consists of employees of Egyptian sports clubs in the Arab Republic of Egypt, represented by the clubs' boards of directors, members of the general assembly, the executive director, the financial director, sports specialists, The researcher selected the research sample using the stratified random method from the research community, which consisted of (488) individuals. The researcher used the questionnaire on the role of the Six Sigma method in improving the quality of recreational services according to the vision of the Arab Republic of Egypt 2030 as a data collection tool. One of the most important results was that the Six Sigma method has an important role in improving the quality of recreational services if it is properly applied according to the vision of the Arab Republic of Egypt 2030 One of the most important recommendations was to provide statistical software and the latest versions of Six Sigma programs and facilitate training on them.

Keywords: Six Sigma method, quality, service, recreational services, vision of the Arab Republic of Egypt.

[1] King Saud University - College of Sport Sciences and Physical Activity- Kingdom Saudi Arabia.
Dmahmoud.c@ksu.edu.sa

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Introduction

Six Sigma is one of the most well widely management concepts in the world of Total Quality Management. It appeared in the American company Motorola in the early 1980s and quickly attained widespread adoption with major international companies beginning to implement it across their various administrative procedures. Six Sigma is used to achieve excellence, improve profits, satisfy customers and discard barriers to submission into the competitive arena (Mohammed Al-Naami, 2009: 14). As a management system Six Sigma is a highly structured and integrated administrative framework designed to improve various operational activities. It supplies leaders with the analytical methods and tools necessary to solve problems and elevate processes to their highest potential. Six Sigma combines effective leadership with employee participation and engagement. Furthermore the benefits of Six Sigma extend beyond increased profits. Employees at all management levels within organizations implementing Six Sigma find that working towards customer satisfaction, clear performance processes, precise measurement, and tool development makes their work more effective and rewarding both materially and morally. (Momen Taha, 2016: 24) Six Sigma is known in many organizations as simply a measure of quality that strives for perfection as much as possible. Six Sigma is a control for data movement and a methodology for removing defects (pushing towards six standard deviations between the mean and the nearest limit specifications in any process) (Mohammed Al-Nuaimi, Rateb and Suwaiss, 2008: 48).

The Six Sigma system depandes on the continuous analysis of gathered data and statistics to identify weaknesses and defects in processes or products. This facilitates for their ongoing correction and aims to reduce errors to zero whenever possible. Six Sigma is according to fundamental principles: defining processes then measuring and analyzing their performance, followed by improvement and ultimately achieving the highest levels of quality control in processes and production (Perzikop & Penelope, 2008: 78). Carrying out Six Sigma requires analyzing the gap between ongoing performance levels and the desired or expected levels in both the short and long term. Six Sigma operates based on a precise and flexible system of matrices and procedures allowing its adopters to adapt and reshape it to fit the objectives of any organization. It uses a variety of approaches, pathways and tools. There are multiple tools that are most commonly used when applying the Six Sigma methodology and these vary depending on whether the organization is a production or service-oriented organization. There are also tools that are used less commonly. For production-oriented organizations the tools used contain: defect rate, time to customer complaint, number of customer complaints and the production process. In service-oriented organizations the tools used comprise: brainstorming, mapping, diagrams, root cause analysis, control charts, measurement, Pareto analysis and change management tools. (Zainab Al-Sharifi: 2014) Six Sigma uses the DMADV methodology to generate new processes or products or to enhance existing processes or products to the Six Sigma quality level. DMADV stands for Six Sigma.

1. Define (Diagnosis) and define the goal of sports clubs that are compatible with the club's members and the goals of the Ministry of Youth.
2. Measurement: This includes identifying the distinctive characteristics that have a decisive impact on quality and the efficiency of the production process.
3. Analyze (analyze) the process options improve several designs and choose the best one
4. .Design (Improvement): Designing the process to meet the requires of club visitors.

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Verify the validity of the performance design and its capacity to meet customer needs. The Six Sigma system depandes heavily on statistical methods to decrease defects and measure quality. It improves process performance reduces deviations and preserves consistent quality in production outputs. This leads to fewer defects continuous improvement in product quality (the service provided by the club)and ultimately, customer satisfaction. (Abdullah Al-Zahrani, 2017: 56) Quality is one of the most important management indicators. To guarantee effective management of the organization, continuous improvement is essential not only in quality but also in production volume and costs. High quality requirements have become integral to all stages and processes of production as they directly and completely impact the organization's performance and reputation. The notion of quality can be defined from the perspectives of both the producer and the customer From the producer's viewpoint quality is measured based on pre-established specifications, i.e..the standards set by the organization when improving the service (product). From the customer's perspective the meaning of quality is more comprehensive. Customers are related with quality from two perspectives. The first is the tangible quality of the product or service in terms of (continuity, safety and ease of use). The second is the customer's concern for the quality of service in terms of (accuracy, responsiveness and continuity) in promoting the product, i.e., after-sales service. Quality is also defined as the ability of a product to meet the needs and desires of the consumer. The American Society for Quality Control defines it as "the set of characteristics of a product or service that affect its ability to satisfy" "Explicit and implicit needs," and thus product quality is linked to its characteristics resulting from its components as well as to the services accompanying it. (Bilal Al-Satarneh, 2018: 17) The relationship between Six Sigma and quality is crystallized in the following points: In the past, quality programs focused on meeting customer needs at any cost and these companies were able to generate high-quality products despite the inefficiency of their internal processes. The prevailing concept was that quality costs a lot of effort, money, and time and that the emergence of Six Sigma is merely a natural extension of quality efforts. Therefore Six Sigma is regarded initiative for quality development. Six Sigma is a performance objective implemented to each element of quality, not to the product at the lowest cost. Six Sigma cannot operate in isolation from quality as Six Sigma quality management provides the necessary tools and applications to bring about cultural changes and process enhacement within management.

Six Sigma is not about quality for quality's sake, but rather about delivering greater value to customers, employees and investors. (Anbari, FT, 2014: p45) A sports club has principle that constitute its identity and distinguish it generally from other civil society organizations, as well as specifically from other clubs and youth centers that may share similar objectives. These concepts also provide a clearer picture of what a sports club should be as an organization that is responsive to political, economic and social changes that may impact its direction. Sports clubs are a prime example of sports institutions, established solely by the members of the general assembly, without direct intervention from the state or any of its executive bodies. They aim to utilize the leisure time of their members through sports activities as a primary pursuit. (Kamal El-Din Darwish & Ashraf Abdel-Moez, 2000: 30) Sports clubs are recreational sports institutions that aim to contribute positively to the athletic and social development of community members, addressing their needs and desires, thus contributing to the realization of the state's philosophy. (Amani Salim, 2003: 24) Based on the above, the researcher found that the Six Sigma methodology is considered a modern field in management sciences due to its capacity to help sports clubs face challenges, both in their internal work environment through the necessity of optimal and efficient use of available resources and capabilities and in their external work environment and participation at the local, regional and international levels. It has become essential for sports clubs that wish to improve the level of their sports activities to adopt the Six Sigma methodology. Furthermore all service institutions need the Six Sigma methodology because they face numerous logistical problems that require an effective Six Sigma approach to help them develop their

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service level and achieve a competitive advantage in the sports market. Through her review of the recreational services provided by Egyptian sports clubs the researcher found several shortcomings in the services offered to club members, such as bureaucracy and red tape in the paperwork required for club membership, requesting specific services, or registering for a particular sport. Additionally, the security and safety measures at the sports clubs are inadequate and the facilities do not meet the needs and requirements of club visitors, nor is there adequate maintenance. A periodic review of the club's fields and facilities. The researcher recored that many sports club websites generally lacked detailed explanations of club operations, working hours, and fees for facility use. This prompted the researcher to consider and attempt to implement a modern service quality system to present sports clubs in a positive light online and to those interacting with the club. The obgective was also to uncover the components of this management approach by developing an innovative scientific method to improve service levels which should present sports clubs in a distinguished manner with high-quality specifications that meet the needs of major clubs. This encouraged the researcher to explore the role of the Six Sigma methodology and its contribution to improving the quality of recreational services in accordance with the Arab Republic of Egypt's Vision 2030, which will ultimately lead to an improvement in the quality of recreational services at Egyptian sports clubs.

Research Objective: This research objectives to explain the role of the Six Sigma methodology in improving the quality of recreational services in accordance with the Arab Republic of Egypt's :Vision 2030, by identifying.

1.Diagnostic factors of support and commitment provided to enhance the quality of recreational .services

2.Areas of availability and analysis of management information systems as an method.
. to improving recreational services.

3..Aspects of improving human capital management to enhance recreational services

4.The necessary material resources and infrastructure are in place to improve the quality of .recreational services

5..Areas for measuring and examining the nature of work in recreational activities 5

6.barriers to developing the quality of recreational services in light of the vision of the Arab .Republic of Egypt

Research questions: In light of the research objective the researcher poses questions about the :nature of each of the following

1.What are the diagnostic aspects of support and commitment offered to enhance the quality of recreational services in accordance with the vision of the Arab Republic of Egypt 2030?

2.What are the areas of availability and analysis of management information systems as an approach to developing recreational services in accordance with the vision of the Arab Republic ?of Egypt 2030

3.factors of improving human capital management to enhance recreational services in **?**accordance with the vision of the Arab Republic of Egypt 2030

4.To what extent are the essential material resources and infrastructure available to develop the quality of recreational services in accordance with the vision of the Arab Republic of Egypt ?2030

What are the areas of measurement and assessment of the nature of work in recreational -5 activities according to the vision of the Arab Republic of Egypt 2030?

What are the obstacles to developing the quality of recreational services in −6 accordance with the vision of the Arab Republic of Egypt 2030?

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Research methodology: The researcher used the descriptive method (survey studies method) with its steps and procedures, as it is suitable for achieving the research objectives.

Research Community and Sample: The research community include employees of Egyptian sports clubs in the Arab Republic of Egypt, represented by: 1. Club boards of directors. 2. Members of the general assembly. 3. The executive director. 4. The financial director. 5. Sports specialists. The researcher chosed the research sample using stratified random sampling from the research community, which consists of (488) individuals.

Data collection tool: A questionnaire on the role of the Six Sigma method in developing the quality of recreational services according to the vision of the Arab Republic of Egypt 2030: This is a form created by the researcher and the following was followed in its preparation:

1.Defining the survey objective: The survey objective was defined and it was to determine the role of the Six Sigma method in improving the quality of recreational services in accordance with the vision of the Arab Republic of Egypt 2030.

2.Defining the questionnaire's themes: Based on the researcher's review of prior studies she defined a set of themes, which were as follows:

First axis: Afactor of diagnosing aspects of support and commitment provided to improve the quality of recreational services. - Second axis: Areas of availability and analysis of management information systems as an approach to improving recreational services. - Third axis: Aspects of improving human capital management to enhance recreational services. - Fourth axis: attaining the necessary material capabilities and facilities to develop the quality of recreational services Fifth axis: Areas of measuring and evaluating the nature of work in recreational activities. - Sixth axis: barriers to developing the quality of recreational services in light of the vision of the Arab Republic of Egypt.

3.The researcher presented it to a group of (7) experts in the submitted of sports management to give their opinion on its suitability. The topics that received 70% or more of the experts' opinions were selected and the following table (1) illustrates this. Table(1)

Table1. shows cores Relative Weights, and Chi-Square (χ^2) Values for the Sample's Responses to the First Dimension: Assessment of Support and Commitment for Improving the Quality of Recreational Services (N = 488).

	Statement	Response						Statement	Response Agree	Statement
		Agree		Somewhat		Agree				
		X	%	X	%	X	%			
.1	A suitable environment is provided For practicing recreational activities.	134	27.46	232	47.54	122	25.00	988	%67.49	44.77
.2	Flexibility exists in implementing the executive procedures for recreational activities	58	11.89	291	59.63	139	28.48	895	%61.13	172.04
.3	The administration is fully prepared to provide the best recreational service to beneficiaries	74	15.16	283	57.99	131	26.84	919	%62.77	143.51
.4	Outstanding employees in providing recreational services are rewarded.	52	10.66	328	67.21	108	22.13	920	%62.84	261.70

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.5	. Employees are encouraged to excel in providing recreational services. .	72	14.75	309	63.32	107	21.93	941	%64.28	201.23
.6	The necessary resources are provided to obtain the best service.	130	26.64	285	58.40	73	14.96	1033	%70.56	147.99
.7	. Decisions regarding recreational activities are made quickly based on sound information	49	10.04	275	56.35	164	33.61	861	%58.81	157.01
.8	Contracts are made with sponsoring companies to provide their recreational services.	32	6.56	192	39.34	264	54.10	744	%50.82	173.38
.9	Services are provided to beneficiaries on a regular basis.	77	15.78	366	75.00	45	9.22	1008	%68.85	384.40
.10	Beneficiary suggestions for improving recreational services are approved	79	16.19	377	77.25	32	6.56	1023	%69.88	430.41
.11	Directing staff to serve beneficiaries of recreational activities to the fullest extent.	60	12.30	387	79.30	41	8.40	995	%67.96	465.18
.12	Utilizing experts specializing in the field of recreation to enhance the quality of recreational activities.	47	9.63	152	31.15	289	59.22	734	%50.14	181.06
								11061	%62.96	

Table (1) shows that the percentage of opinions of the research sample concerning the statements of the first axis (Aspects of Diagnosing Support and Commitment Provided to enhance the Quality of Recreational Services) ranged between (50.14% - 70.56%), while the percentage for the axis reached (62.96%). There are statistically significant differences between the opinions of the research sample regarding statements (1, 2, 3, 4, 5, 6, 7, 9, 10, 11) in the direction of some agreement. There are also statistically significant discrepancy between the opinions of the research sample regarding statements (8, 12) in the direction of disagreement. The researcher characteristics this finding to the lack of sufficient diagnostic aspects of support and commitment offered to improve the quality of recreational services. There are shortcomings in diagnosing the support and commitment provided in recreational services within sports clubs. The most important of these limitations are the weak availability of a suitable environment for practicing recreational activities the absence of flexibility in implementing executive procedures for recreational areas, the lack of full preparedness on the part of management to apply the best recreational service for beneficiaries and the lack of Outstanding employees in providing recreational services are rewarded but they are not encouraged to excel in providing these services. There is also a limitation in providing the necessary resources to obtain the best service, the deficiency of speed in making decisions regarding recreational activities based on sound information and a lack of success to contract with sponsoring companies to provide their recreational services. Services are not provided periodically to beneficiaries, beneficiary recommendations for developing recreational services are not approved and employees are not directed to serve beneficiaries of recreational activities to the fullest extent. Furthermore experts specializing in the field of recreation are not utilized to improve the quality of recreational activities. This is what was revealing by the study of "Ezz El-Din Mahmoud" (2014), whose results indicated a statistically significant relationship between the criteria of (senior management support, training, encouragement and motivation of human resources, information

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systems and technology, changing organizational culture, attention to quality, work environment, attention to employees) and the application of the Six Sigma methodology and the enhancement of the quality of processes in Palestinian government hospitals.
The study of Muhammad Saleh Al-Zahrani (2010) indicated that the results of the study participants indicated that the club was ready to apply the Six Sigma method.

The answer to the second question which states: What are the areas of availability and analysis of management information systems as an approach to developing recreational services according to the vision of the Arab Republic of Egypt 2030

Table2. shows Scores Relative Weights, and Chi-Square (χ^2) Values of the Samples Responses to the Second Dimension: Availability and Analysis of Management Information Systems as an Approach to Improving Recreational Services (N = 488).

	Statement	Response						Statement	Response Agree	Statement
		Agree		Somewhat		Agree				
		X	%	X	%	X	%			
3	There is a communication network that includes all recreational services.	174	35.66	285	58.40	29	5.94	1121	%76.57	202.63
4	All new developments in online recreational services are considered and implemented when commencing activities.	38	7.79	187	38.32	263	53.89	751	%51.30	161.07
5	There is an ongoing improvement plan to update the databases of recreational service users.	39	7.99	107	21.93	342	70.08	673	%45.97	310.77
6	Strategies are being developed to manage databases related to the entertainment sector.	65	13.32	306	62.70	117	23.98	924	%63.11	197.76
7	There are plans to create and develop databases for recreational fields.	89	18.24	362	74.18	37	7.58	1028	%70.22	374.71
8	Electronic communication is maintained between beneficiaries to inform them about the recreational services offered	32	6.56	35	7.17	421	86.27	587	%40.10	615.42
9	A database is available to assist in making various decisions regarding recreational activities	38	7.79	143	29.30	307	62.91	707	%48.29	225.99
0	Information resources are accessible via the internet to assist management and beneficiaries	42	8.61	90	18.44	356	72.95	662	%45.22	351.75
1	A comprehensive database exists for beneficiaries, staff, and all those involved in recreational activities.	36	7.38	57	11.68	395	80.94	617	%42.14	499.11
2	The database is updated regularly.	39	7.99	160	32.79	289	59.22	726	%49.59	192.18

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7796	%53.25	

Table (2) shows that the percentage of opinions of the research sample regarding the statements of the second axis (areas of availability and analysis of management information systems as an approach to improving recreational services) ranged between (40.10%: 76.57%), and the percentage of the axis reached .(%53.25)

There are statistically significant differences between the opinions of the research sample regarding statements (13, 16, 17) demonstrating some agreement and statistically significant differences between the opinions of the research sample concerning statements (14, 15, 18, 19, 20, 21, 22) revealing disagreement. The researcher attributes this finding to the limited availability of management information systems examination as an approach to developing recreational services. This is due to a lack of a comprehensive network encompassing all recreational services, a lack of attention to and application of new online recreational services when initiating activities, the absence of a continuous improvement plan for updating databases of recreational service users, the absence of strategies for managing recreational databases, and the absence of plans for creating and developing such databases. Furthermore there is a lack of electronic communication among users to inform them about the available recreational services, the absence of a database to support decision-making regarding recreational services, and the failure to direct online information resources to assist management and users. There is limited database for beneficiaries, employees and all factors of the recreational fields and the database outdated regularly. This demands that sports club officials rely on the availability and analysis of management information systems as an approach to improving recreational services. This plays important role in providing the necessary data for decision-makers and understanding the trends and activities that members of the general assembly wish to engage in within the field of recreational activities. This was highlighted in the study by Mohammed Hamad Salem (2011), whose results indicated the need to provide statistical programs and the latest versions of Six Sigma software, and to facilitate training on its use.

The answer to the third question, which states: What are the components of improving human capital management to enhance recreational services according to the Arab Republic of Egypt's Vision 2030?

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Table3. shows Scores, Relative Weights, and Chi-Square (χ^2) Values for the Sample's Responses to the Statements of the Third Dimension: Aspects of Improving Human Capital Management to Enhance Recreational Services (N = 488).

	Statement	Response						Statement	Response Agree	Statement
		Agree		Somewhat		Agree				
		X	%	X	%	X	%			
.23	Experts in the field of recreation are appointed to manage the recreational activities provided	52	10.66	160	32.79	276	56.56	752	%51.37	154.30
.24	Training programs on recreational service quality are provided for personnel involved in recreational activities	16	3.28	67	13.73	405	82.99	587	%40.10	549.52
.25	Developmental and innovative programs are designed to ensure the delivery of high-quality recreational services to beneficiaries.	21	4.30	263	53.89	204	41.80	793	%54.17	195.77
.26	A suggestion box is available to collect proposals for improving the quality of recreational services.	30	6.15	85	17.42	373	76.43	633	%43.24	417.25
.27	Experts in recreation and quality management are invited to share their expertise in the delivery of recreational activities.	19	3.89	76	15.57	393	80.53	602	%41.12	499.21
.28	An organizational structure is in place to monitor the recreational services provided to beneficiaries.	16	3.28	99	20.29	373	76.43	619	%42.28	429.13
.29	A specialized quality assurance unit is established to develop quality standards and evaluate the suitability of recreational services.	28	5.74	77	15.78	383	78.48	621	%42.42	455.05
.30	Employees' ideas and suggestions aimed at improving the quality of recreational services are welcomed and encouraged.	46	9.43	128	26.23	314	64.34	708	%48.36	231.85
.31	Beneficiaries' opinions are considered and submitted to the administration for implementation whenever appropriate.	25	5.12	81	16.60	382	78.28	619	%42.28	453.25
.32	There is consistency between administrative decisions and the actual needs related to the recreational activities provided.	17	3.48	386	79.10	85	17.42	908	%62.02	474.15
								6842	%46.74	

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The crucial chi-square value at a significance level of 0.05 = 5.99 as shown in Table (3): The percentage of the research sample's opinions on the statements of the third axis (Aspects of Improving Human Capital Management to Enhance Recreational Services) ranged between 40.10% and 62.02%, while the percentage for the axis as a whole reached 46.74%. Statistically significant differences exist between the research sample's opinions on statements (25 and 32) demonstrating some agreement and statistically significant differences exist between the research sample's opinions on statements (23, 24, 26, 27, 28, 29, 30, and 31), indicating disagreement. The researcher qualities this result to limitations in the aspects of improving human capital management to enhance recreational services. There is inadequate attention given to developing human resource management as experts in the field of recreation are not appointed to manage the activities provided, and training programs on the quality of recreational services are not available for those working in these activities. Developing and implementing innovative programs to provide quality services to beneficiaries is lacking as is a suggestion box for improving recreational service quality. Furthermore, recreation and quality experts are not invited to distribute their experience in delivering activities. An organizational structure for tracking recreational services is also absent, as is a dedicated quality control department responsible for setting quality standards and testing appropriate recreational services. Ideas from staff aimed at improving service quality are not accepted and beneficiary opinions are not regarded or presented to management for implementation. There is also a disconnect between management decisions and the actual needs for recreational activities. Therefore sports club boards must prioritize the human element, as it is the central driver for developing administrative work and recreational activities within sports clubs,magor to increased quality and participation in these activities. This was highlighted in a study by Ibrahim Othman Ibrahim Awad (2012)which indicated a significant difference in opinions among study participants regarding management's commitment to the quality concept and the feasibility of using Six Sigma in banks. In the study there is important difference between the opinions of the study groups regarding human resources strategies and the possibility of using Six Sigma in banks.

The answer to the fourth question which states: To what extent are the necessary material resources and infrastructure available to develop the quality of recreational services?

Table4. shows Score Relative Weight, and Chi-Square (χ^2) Values for the Sample's Responses to the Statements of the Fourth Dimension (Availability of Physical Resources and Infrastructure Required for Improving the Quality of Recreational Services) (N = 488).

	Statement	Response						Statement	Response Agree	Statement
		Agree		Somewhat		Agree				
		X	%	X	%	X	%			
.33	Financial support is allocated to improve the quality of recreational activity services.	33	6.76	282	57.79	173	35.45	836	%57.10	191.56
.34	The equipment and tools required for participating in recreational activities are easily accessible.	127	26.02	296	60.66	65	13.32	1038	%70.90	175.75
.35	The facilities and sports fields used for recreational activities are	26	5.33	398	81.56	64	13.11	938	%64.07	515.13

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	capable of development and improvement.									
.36	The sports fields and facilities are sufficient to accommodate the largest possible number of participants in recreational activities.	92	18.85	359	73.57	37	7.58	1031	%70.42	364.75
.37	Safety and security measures are available in equipment and storage rooms.	110	22.54	348	71.31	30	6.15	1056	%72.13	336.41
.38	The storage areas allocated for equipment and tools are adequate, appropriate, and secure.	15	3.07	442	90.57	31	6.35	960	%65.57	720.30
.39	An information system containing all data related to storage facilities, equipment, and sports fields is available and regularly updated.	56	11.48	138	28.28	294	60.25	738	%50.41	179.72
.40	Safe equipment and materials are available for use in recreational activity areas.	115	23.57	343	70.29	30	6.15	1061	%72.47	322.09
.41	Senior management provides the necessary funding for new ideas that contribute to improving the quality of recreational services.	55	11.27	146	29.92	287	58.81	744	%50.82	168.00
.42	A sufficient number of support service staff (e.g., attendants) are available during the implementation of recreational activities.	129	26.43	299	61.27	60	12.30	1045	%71.38	1486.03
.43	Financial allocations are appropriately directed toward improving the quality of recreational services.	123	25.20	316	64.75	49	10.04	1050	%71.72	233.64
								10497	%65.18	

The tabulated value of (Ka) at a significance level of (0.05) = 5.99. It is clear from Table (4): The percentage of opinions of the research sample regarding the statements of the fourth axis (achieving the essential material capabilities and infrastructure to improve the quality of recreational services) ranged between (50.41%: 72.47%) and the percentage of the axis reached (65.18%). There are statistically significant differences between the opinions of the research sample regarding statements (33, 34, 35, 36, 37, 38, 40, 42, and 43) some demonstrtingagreement. Conversely, there are statistically significant differences between the opinions of the research sample regarding statements (39 and 41), indicating disagreement. The researcher attributes this finding to the absence of essential material resources and infrastructure to sufficiently develop the quality of recreational services. The areas of emphsis on recreational activities and programs have not acquired sufficient attention within sports clubs. Therefore officials must prioritize the enhancement of recreational activities and strive to fulfill the aspirations and desires of the club's general assembly members. This is due to a lack of allocated financial support to enhance the quality of recreational activities, difficulty in requier the

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necessary equipment and tools the absence of facilities and fields suitable for development and improvement, insufficient fields and facilities for the largest possible number of participants, inadequate safety and security measures in equipment storage areas, and insufficient and unsuitable storage space for equipment and tools. And securing them. There is also no information system and all data associated to stores, equipment and playgrounds that is constantly updated. Furthermore, there are no safe tools and materials available for use in activity areas, and senior management lacks the necessary funding for any new ideas that would improve the quality of recreational services. There is also an insufficient number of support staff (female workers) throughout the implementation of recreational activities, and financial allocations are not directed towards improving the quality of recreational services. This is what was indicated by the study by Sina Ahmed Al-Rawi (2011), whose results indicated a statistically significant influnce of Six Sigma standards senior leadership support, feedback, continuous improvement, processes and systems and human resources on the quality of internal auditing in private hospitals that won the Quality and Excellence Award in Amman.

The answer to the fifth question, which states: What are the areas of measurement and assessment of the nature of work in recreational activities according to the vision of the Arab Republic of Egypt 2030?

Table5. shows Score Score, Relative Weight, and Chi-Square (χ^2) Value for the Sample's Responses to the Statements of the Fifth Axis (Areas of Measuring and Evaluating the Nature of Work in Recreational Activities) (N = 488).

	Somewhat	Somewhat		Somewhat		Somewhat		Somewhat	Somewhat	Somewhat
		Somewhat		Somewhat		Somewhat				
		Somewhat	Somewhat	Somewhat	Somewhat	Somewhat	Somewhat			
.44	A committee is established to evaluate the performance of personnel involved in recreational activities.	27	5.53	105	21.52	356	72.95	647	%44.19	363.37
.45	Specialized offices are available to assess administrative performance.	45	9.22	101	20.70	342	70.08	679	%46.38	306.20
.46	The administration conducts regular follow-up to ensure the efficient implementation of recreational activities.	85	17.42	328	67.21	75	15.37	986	%67.35	252.37
.47	Continuous communication is maintained between the administration and staff to ensure ongoing performance evaluation.	77	15.78	309	63.32	102	20.90	951	%64.96	199.38
.48	Standards are established to identify and measure any deficiencies that may arise during the delivery of recreational services to beneficiaries.	104	21.31	347	71.11	37	7.58	1043	%71.24	327.13
.49	Changes to the administrative structure are permitted when necessary to ensure	28	5.74	21	4.30	439	89.96	565	%38.59	704.29

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	effective performance evaluation.									
.50	Performance evaluation is conducted by specialists in administrative performance assessment.	82	16.80	144	29.51	262	53.69	796	%54.37	102.80
.51	The results of performance evaluations are utilized to update programs and activities for subsequent years.	89	18.24	346	70.90	53	10.86	1012	%69.13	313.92
.52	The evaluation process contributes to identifying weaknesses in the implementation of recreational activities.	110	22.54	348	71.31	30	6.15	1056	%72.13	336.41
.53	Seminars and workshops are organized to evaluate performance and improve the quality of recreational services provided.	40	8.20	148	30.33	300	61.48	716	%48.91	209.77
.54	Clear and well-defined standards are available for evaluating the performance of recreational services.	130	26.64	308	63.11	50	10.25	1056	%72.13	214.44
								9507	%59.03	

The tabulated value of (Ka) at important level of (0.05) = 5.99. Table (5) shows that the percentage of opinions of the research sample regarding the statements of the fifth axis (areas of measuring and inspection the nature of work in recreational activities) ranged between (38.59%: 72.13%) and the percentage of the axis reached (59.03%). There are statistically significant differences between the opinions of the research sample concerning statements (46, 47, 48, 51, 52, 54), indicating some agreement. In contrast there are statistically significant differences between the opinions of the research sample concerning statements (44, 45, 49, 50, 53), indicating disagreement. The researcher attributes this result to the limited scope for measuring and evaluating the nature of work in recreational activities. The evaluation process for recreational activities has not received due attention from the boards of directors of sports clubs. Attention is concentrated on team sports activities such as football and volleyball, while such recreational programs and activities implemented for members are neglected. There is no committee to evaluate the performance of employees in recreational activities, nor are there specialized offices for measuring administrative performance. Furthermore there is no scheduled follow-up by management to ensure the efficient implementation of recreational activities no continuous communication between management and employees for ongoing performance evaluation, no established standars for measuring any shortcomings that may arise throughout the provision of recreational services to beneficiaries, and no authorization for changes in the administrative structure to guarantee performance evaluation. Finally, evaluation is not conducted by [unclear - possibly "by"]. professional in administrative performance evaluation are not depended upon, nor are the findings used to update programs and activities in subsequent years. Furthermore, the evaluation process fails to identify weaknesses in the implementation of recreational activities, and there is a lack of specialized seminars for performance evaluation and improvement of recreational services. Clear and well-defined standards for evaluating the performance of recreational services are also absent. This was highlighted in the study by Salaheldin & Abdelwahab (2010), which indicated several benefits of using the Six Sigma methodology, including control and design. Similarly the study by Aghili (2009) indicated that integrating the Six Sigma methodology using the Damic Cycle steps—identify, measure, analyze,

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recommend, and control—with the internal audit phases—planning, performance, analysis, recommendation and follow-up—is beneficial.

The answer to the sixth question, which states: What are the barriers to enhancing the quality of recreational services in accordance with the vision of the Arab Republic of Egypt 2030?

Table6. shows Score Relative Weight, and Chi-Square (χ^2) Value for the Sample's Responses to the Statements of the Sixth Dimension (Barriers to Improving the Quality of Recreational Services) (N = 488).

	Somewhat			**Somewhat**			**Somewhat**	**Somewhat**	**Somewhat**	**Somewhat**
		Somewhat		**Somewhat**		**Somewhat**				
		Somewhat	**Somewhat**	**Somewhat**	**Somewhat**	**Somewhat**	**Somewhat**			
.55	Lack of full conviction among the administration regarding the importance of recreational services.	**329**	**67.42**	**129**	**26.43**	**30**	**6.15**	**1275**	**%87.09**	**285.25**
.56	Inadequate managerial guidance for employees in implementing the philosophy of recreational service quality when initiating recreational activities.	**311**	**63.73**	**112**	**22.95**	**65**	**13.32**	**1222**	**%83.47**	**209.68**
.57	Insufficient periodic meetings to identify work-related problems and develop appropriate solutions.	**318**	**65.16**	**110**	**22.54**	**60**	**12.30**	**1234**	**%84.29**	**230.18**
.58	Failure to promote recreational activities and services through effective communication channels.	**321**	**65.78**	**118**	**24.18**	**49**	**10.04**	**1248**	**%85.25**	**245.81**
.59	Inadequate budget allocation for quality improvement and development initiatives.	**250**	**51.23**	**104**	**21.31**	**134**	**27.46**	**1092**	**%74.59**	**73.10**
.60	Failure to conduct continuous monitoring of financial expenditures and the quality of recreational services provided.	**319**	**65.37**	**126**	**25.82**	**43**	**8.81**	**1252**	**%85.52**	**246.55**
.61	Weak evaluation methods for assessing targeted outcomes to ensure the quality of recreational services.	**286**	**58.61**	**127**	**26.02**	**75**	**15.37**	**1187**	**%81.08**	**148.56**
.62	Failure of the administration to implement effective corrective actions to address deficiencies in employees' performance that affect the achievement of the required quality of recreational services.	**277**	**56.76**	**109**	**22.34**	**102**	**20.90**	**1151**	**%78.62**	**120.69**
.63	The information system does not include comprehensive data on inventories, equipment, and sports facilities, nor is such	**308**	**63.11**	**143**	**29.30**	**37**	**7.58**	**1247**	**%85.18**	**229.31**

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	information updated on a regular basis.									
.64	Lack of dedicated databases for participants in various recreational activities.	277	56.76	109	22.34	102	20.90	1151	%78.62	120.69
								12059	%82.37	

The crucial chi-square value at a importnace level of 0.05 is 5.99. Table (6) shows that the percentage of the research sample's opinions on the statements of the fifth axis (barriers to developing the quality of recreational services) ranged between 74.59% and 87.09%, while the percentage for the axis as a whole reached 82.37%. There are statistically significant differences between the research sample's opinions on all statements indicating agreement. The researcher dimensions this result to the existence of many obstacles to developing the quality of recreational services, the most important of which are: the absence of complete conviction on the part of management regarding the importance of recreational services; the inadequacy of management's direction to employees in applying the philosophy of recreational service quality when commencing activities; the infrequency of holding periodic meetings to identify problems facing the work and develop appropriate solutions; the lack of publicizing activities and services through effective communication channels; the low budget allocation for spending on improvement and development processes; the lack of continuous monitoring of financial expenditure items and the quality of services provided; the weakness of evaluation methods for the targeted results to ensure the achievement of recreational service quality; and the failure to take The administration has implemented corrective and effective procedures to address shortcomings in employee performance that affect the achievement of the required service quality. These shortcomings include the lack of comprehensive and up-to-date information systems for warehouses, equipment and playgrounds, as well as the absence of databases for participants in various recreational activities. This was highlighted in a study by Ezz El-Din Mahmoud (2014), which indicated insufficient attention to customer care from both management and staff, a lack of interest in measuring customer feedback on services provided and a failure to identify customer needs and desires in Palestinian government hospitals

Conclusions

1. The Six Sigma methodology plays a important role in improving the quality of recreational services if suitable implemented in accordance with Egypt's Vision 2030.
1. 2.conducting Six Sigma in sports clubs offering recreational services requires the presence of individuals with specialized skills whose roles and skill levels are clearly defined.
2. The diagnostic aspects of support and commitment enable to improve the quality of recreational services, as outlined in Egypt's Vision 2030 have not yet been achieved.
3. The availability and examination of management information systems are insufficient as a means to enhance recreational services in line with Egypt's Vision 2030.
4. It is essential to provide statistical software and the latest versions of Six Sigma programs and to facilitate training on their use.
5. 6.Six Sigma processes significantly influnce the achievement of competitive advantage. 7. The Six Sigma system helps in setting performance standards and measuring the actual performance of sports institutions providing recreational services thereby enabling corrective actions and improvements to enhance their efficiency.
6. 8. The Six Sigma methodology can be applied to improve quality in sports clubs providing recreational services if the necessary requirements for success are met.
7. 9. Implementing Six Sigma contributes to developing the stnding of sports clubs providing recreational services compared to other institutions.
8. 10.There are many obstacles that hinder the improvement of the quality of recreational services in accordance with the Arab Republic of Egypt's Vision 2030.

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Recommendations

1. In light of the research findings, the researcher recommends the following:
2. 1.Offering statistical software and the latest versions of Six Sigma programs and facilitating training on their use.
3. 2.Improviment the information and communication infrastructure to provide wider access to internet services in countries that are sports tourism destinations or countries targeted by tourism marketing.
4. 3.Establishing a clear and specific strategy to accomplish distinguished service delivery in sports clubs, based on the Six Sigma methodology.
5. 4.Conducting training courses for office staff to refine their skills and talents for implementing and improving service quality.
6. 5.Establishing a Service Quality Management Unit in the Minya sports clubs and adopting the Six Sigma requirements.
7. 6.Carrying out corrective and effective measures by management to address shortcomings in employee performance that affect the achievement of the required service quality.
8. 7.Conducting continuous monitoring of financial expenditures and the quality of services offere

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