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مجلة علمية فصلية مُحكمة متخصصة
بعلوم الرياضة تصدر عن
كلية التربية البدنية وعلوم الرياضة
جامعة بغداد

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

مجلة التربية الرياضية

مجلة علمية فصلية مُحكمة متخصصة بعلوم الرياضة تصدر عن
كلية التربية البدنية وعلوم الرياضة في جامعة بغداد

المجلد السابع والثلاثون
العدد الثالث
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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)

- 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) وعناوينهم (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 مواصـفاتها الفنية الدقيقة وعددها ومصـدرها 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.
- ✓ وصــف 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.

- ✓ تتضـمن مناقشـة النتائج تفسـير اتفاقها او عدمه مع المعلومة او المعرفة في الدراسـات المنشـورة 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 اضـــافة معلومات لم يتناولها البحث، وان يتم التعامل مع النتائج الموثقة في الدراســـة الحالية فقط.
- ✓ تجنب التعميم والتخمين للنتائج والتي لم تؤكدها الدراسة.
- ✓ تكتب المناقشـة بصـيغة المضـارع والماضـي، 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. فالاسـتنتاجات تشـير الى الخطوط العريضـة للدراسـات المسـتقبلية اسـتناداً على نتائج الدراسـة 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 الشـكر للشـركة، او المؤسـسـة 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 القســم يعد مكاناً لذكر اصــل 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) الإصـدار السـادس حصـراً وفق نظام (Microsoft Word 2010) صـعوداً 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 حصـــراً ضـــمن الملاحق، إذ تحتوي الملاحق على تفاصيل المنهاج التدريبي او البيانات او الجداول الكبيرة (الجداول المعيارية) أو ادوات 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 التكميلية.

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 – 3.17×2.54 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 بالصـيغة العربية حصـراً (0 1 2 3 4)، وعند اسـتعمال الاقواس لا يتم ترك مسـافة بين الاقواس مثل: (2540)، وعدم ترك مسـافة قبل علامات الترقيم مثل الفارزة، او النقطتين، او النقطة. مثال: التدريب الرياضـي، التعلم الحركي، علم النفس الرياضـي.
- ✓ لا يجوز اســـتعمـال برامج الترجمـة الفوريـة او مواقع الانترنـت للترجمـة للغـة الانكليزيـة مثـل (google translate) وغيرها.
- ✓ استعمال المصطلحات العلمية المعروفة والمتداولة، وعلى الباحثين المقدمين لبحثهم باللغة العربية ادراج المصطلحات العلمية باللغة الإنكليزية في متن البحث.
- ✓ الاســتشــهاد بالمصــادر يكون وفق أسـلوب (APA) الإصــدار الســادس حصــراً 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 الاسـتشـهادات بالمصـادر العلمية عن (25) مصـدر رصـين 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.

ثبت المحتويات

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The effect of rehabilitation exercises associated with local electrical stimulation according to the feeling of pain in the treatment of some cases of peripheral neuritis for women aged (50-55) years

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Abstract

The aim of the research was to develop rehabilitative exercises accompanied by electrical stimulation based on the perception of pain for women aged 50–55 years, and to identify the effect of these rehabilitative exercises accompanied by electrical stimulation—based on pain perception—on treating certain cases of peripheral neuropathy in women within the same age group. Accordingly, the researcher hypothesized that there would be statistically significant differences between the pre- and post-test results of the experimental group's electromyography (EMG) measurements, as well as statistically significant differences between the pre- and post-test results of pain level measurements using the Visual Analogue Scale (VAS) for the experimental group. The experimental research methodology was adopted using a one-group experimental design. The boundaries of the current research population were defined as women aged 50–55 years, with a total number of 9 patients who regularly attended the Al-Karkh Hospital / Physiotherapy Unit. All of them were deliberately selected using the comprehensive enumeration method, making up 100% of this population sample. The tests were determined, and rehabilitative exercises accompanied by electrical stimulation based on pain perception were designed. The experiment began with the pre-tests, followed by the implementation of these exercises. The duration of each rehabilitation session ranged from 28.5 to 32.36 minutes, with three sessions per week held on Sunday, Tuesday, and Thursday. Each session included four exercises and continued for eight consecutive weeks, resulting in 24 rehabilitation sessions. The experiment concluded with the post-tests. After processing the research results using the SPSS system, the conclusions and applications indicated that the rehabilitative exercises accompanied by electrical stimulation based on pain perception were suitable for women aged 50–55 years suffering from certain cases of peripheral neuropathy. These exercises had a positive effect on improving the EMG signals of the

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gastrocnemius muscles in both the right and left legs by increasing the peak level and reducing the spread area of the electrical signal. They also helped reduce pain levels as measured by the Visual Analogue Scale (VAS) in cases of peripheral neuropathy. It is essential to pay attention to the duration of the transitional rest period between electrical stimulation and the application of rehabilitative exercises based on pain perception when rehabilitating women aged 50–55 years with peripheral neuropathy. Furthermore, it is necessary to rely on the use of TENS (Transcutaneous Electrical Nerve Stimulation) current type when rehabilitating women in this age group to help reduce VAS-measured pain levels.

Keywords: Rehabilitative Exercises, Local Electrical Stimulation, Pain Perception, Peripheral Neuropathy.

Introduction:

Rehabilitation exercises are a means of stimulating the locomotor system and contribute to reducing the occurrence of exacerbations in various injury cases. In addition, these exercises play a role in supporting progress in functional efficiency to accelerate the recovery of motor, physical, and physiological capabilities, while taking into account the psychological factor following the injury. Integrating rehabilitation exercises with what technological means provides requires adherence to precautions, including the necessity of medical supervision when experimenting with technical rehabilitation protocols, and observing a scientific approach that is free of speculation or imposing personal experience. This is because this matter does not accept risking the condition of the injured person, especially neurological injuries, which are among the most difficult sports injuries due to the physiology of the nervous system and its anatomical composition, which requires familiarity with many of the sciences that assist in sports rehabilitation in physical education and sports science.

"Neurons are the foundation of the brain's working mechanism. They do not operate randomly, but rather as a network, organizing themselves into groups to specialize in processing different types of information, thus regulating the brain's working mechanism and making it more organized and precise) ".Alwan, 2012, p. 76)

“There are two types of nerve cells that emerge from the brain and spinal cord, either covered or not covered with melanin. The main part of the stem is surrounded by a membrane that reaches a thickness of (8 nanometers) in the melanin-covered cells. The melanin is outside the stem and separates from the cell membrane. The melanin membrane is segmented every (1-3) millimeters by nodes called (Renveir nodes), as shown in Figure (2-2) below) ”.Al-Ali and Hussein, 2016, p. 117)

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"The nervous system is the body's means of establishing a connection between the sense organs and the reception and response to events in the internal and external environment. It is the center of thinking, decision-making, initiation and control of actions. It performs its function of dominating and controlling all parts of the body and is responsible for any movement emanating from the body, starting from eye movement and ending with the large muscles. The nervous system also plays a major role in motor performance at all levels ".)Kamash, 2008, p. 210)

The general task of the nervous system is to stimulate the various vital organs in the body to continue to function, and in the case of continuous stimulation, the speed of the organism's motor activity increases. (Wadi and Al-Janabi, 2005, pp. 79-80)

"In the anatomical structure of the central nervous system (CNS), the spinal cord is located below a number of alpha and succinate nerves located here. Connected to this cord is the medial pons (Medulla Oblongata), then the pons and the midbrain, which together form the brainstem and cerebellum (Brain stem), which is important in the process of motor regulation during exercise, as it controls the place and position during movement in cooperation with the brainstem. The brain is divided into two hemispheres connected to each other by several nerve fibers. There is an area that connects the nerves of the cerebellum to the brain with the nerves of the spinal cord, in addition to the thalamus, which is responsible for sensation, and the hypothalamus, which controls involuntary signals ".)Al-Ali and Hussein, 2016, p. 128)

The researcher believes that women at the age or stage of menopause often suffer from some cases of neuropathy other than cases of peripheral neuropathy resulting from modern diseases, malnutrition or excessive obesity. These affect the fear of neuromuscular movement due to the pain that affects those extremities, and then their cumulative effect is in the weakness of muscle strength, which is one of the components of the motor system controlled by the voluntary peripheral nerves. Any weakness or pain in the contractile processes and neuromuscular coordination to produce movements will cause an exacerbation of muscle weakness resulting from nerve weakness and then confusion of movement, and entering a stage of potential more susceptible to the disease risks that the lack of movement at this age in particular for women.

"Peripheral neuropathy can thus be defined as a dysfunction affecting the nerves that originate from the brain and spinal cord, particularly those that connect to the extremities, such as the hands and feet. This type of inflammation causes a weakening or loss of normal nerve function, leading to pain, excessive sensitivity, and weakness in the affected person's extremities) ".Al-Shafi'i, 2024, p. 127)

"The causes of these peripheral nerve inflammations are multiple, including certain infections, injuries, specific diseases, or genetic diseases, etc., and the symptoms in those affected include numbness, tingling, and tingling in the hands and feet, or feeling as if they are wearing tight gloves or tight socks, thinning of the skin, low blood pressure, frequent dropping of objects from the hands when carrying them, excessive sweating, and digestive problems such as diarrhea or constipation, in addition to sexual dysfunction, especially in men. Specialist doctors have encountered problems in directing those affected to exercises that can be applied to reduce the symptoms of these inflammations and recover) ".Abdul Jawad, 2016, p. 11)

The researcher believes that women aged (50-55) years who are in a normal condition find it difficult to practice warm-up exercises and prepare the muscles for the contraction processes required by various exercises, especially for those who have not practiced physical activity regularly in the nature of their lives, so how about those who suffer from some cases of peripheral nerve inflammation, which calls for finding alternatives to strengthen the work of the muscles whose improvement in contraction processes is reflected in improving the action of nerve signals positively, and among these methods is the technique of local electrical stimulation.

"Electro Muscle Stimulation (EMS) technically means muscle contraction by delivering electrical waves to the muscle. These electrical waves are generated by a special electronic device and distributed through the ends of the electrodes to the surface of the skin directly above the muscles to be stimulated. In general, the electrodes are lined with an adhesive material so that they stick to the skin and facilitate the waves' transmission to the stimulated muscle. These waves resemble the potential action of waves coming from the central nervous system to stimulate the muscle to contract) ".Malatesta & Others, 2003, p: 574)

"The T.E.N.S. current for stimulation is low voltage and is delivered by electrodes placed over the skin at the ends of the muscle (its origin and its insertion). This combines two currents, one low and the other high frequency, to close the pain gate, while the first stimulates the pain-transmitting nerve fibers, which leads to the release of natural endorphins in the body) ".Jeffrey, 2009, pp. 136-137)

“The nerve cell is in a state of permanent electrochemical stability until it is stimulated by a message transmitted from a neighboring nerve cell. When the message arrives from one nerve cell to another, the receiving cell allows the entry of positive ions at a rate of about (100) million ions per second, which changes the charge of the receiving cell from the negative (normal) state to the positive state, forcing this cell to transmit the message through the axon towards the neighboring cell, so that this cell returns to the normal negative charge, awaiting another new message) ”.Al-Masha’la, 2010, p. 32) (Al-Atoum, 2010, p. 60)

"The electrical muscle stimulation current is pulses with a beginning and end determined by parameters represented by the gradation of its intensity, and the number of times is usually determined by the type and specifications of the device used, and it varies according to the medical, therapeutic, or sports use. In sports use, it is done through experimentation and adaptation, which is the method that the pulse takes from its beginning to its end. Its most common use is the gradation of intensity for each pulse, and the pulse undulation has several forms determined by the specifications of the stimulation device used) ".SALIBA &SALIBA, 2011, p: 20)

“The duration of electrical stimulation for one session should not be less than (10 minutes) at most) ”.Alawi and Abdel Fattah, 2000, p. 130)

Electrical stimulation is considered a type of isometric training, so this type of training should not be relied upon alone, but rather it should be combined with another type of training) ." .Al-Rabdi, 2004, p. 31)

Transcutaneous electrical stimulation (TENS) takes advantage of short duration, high repetition rate, low intensity galvanic pulses above the sensory nerve threshold and below the motor nerve threshold. It is believed that pain-induced fiber transmission is either peripherally inhibited or there is activation of central inhibitory fibers, similar to the original proposed gate control theory of pain relief from TENS) .".SALIBA & SALIBA, 2011, P: 20)

The researcher believes that when activating the integration processes between physical movements of rehabilitation exercises and electrical stimulation of muscles, it is necessary to adhere to the specifications of choosing the means and type of exercises that suit the specificity of some cases of peripheral nerve inflammation for women aged (50-55) years, and the effect of the direction of the resistance of this force on the working muscles that support the strengthening of neuromuscular control by strengthening the muscles targeted for rehabilitation to treat this common injury, and by virtue of the specificity of the burden that falls on the leg muscles, the need for balance tools and rubber ropes is considered a necessity to complete the therapeutic rehabilitation protocol as resistances that target the muscles to strengthen the nerves of this case.

“When preparing rehabilitation exercises, there are factors that must be taken into consideration in rehabilitation, which are the number of exercises used, the starting position from which each exercise begins, the performance rhythm of each exercise, the degrees of intensity with which each exercise is performed, the correct testing of rehabilitation exercises, the range of motion of the exercise, and the physiological endurance curve for rehabilitation exercises) ”.Jamal, 2005, p. 20)

"The intensity of muscle contraction depends on the intensity of the stimulus, as the muscle fibers that make up the muscle have different degrees of excitability. Some of them contract in response to a weak stimulus, which means that these fibers have high degrees of excitability, while other muscle fibers contract in response to a stimulus of greater intensity than the first, which means that these fibers have a relatively low degree of excitability compared to the first type) ".Jalal al-Din, 2007, p. 85)

As for“ the performance of static contractions, which are characterized by a relatively constant contraction state in which the amount of muscle tension is compatible with the

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degree of external resistance encountered by the muscle or group of muscles involved ”.)Sayed, 2019, p. 268)

Balance devices differ in their material or their effect on the body’s balance. They are of the following types: sponge devices, such as a thick, highly flexible mat that makes the individual feel the softness of its flat surface; rubber devices, which are in the form of models that players walk on; large Chinese rubber balls filled with air; and solid plastic and wooden devices that have a narrow base and a wide surface)) .".Frizzell & Dunn, 2015, P: 43

“Also, to maintain balance, the direction of the nerve impulses from the cerebral cortex is directed towards the muscles that increase the body’s control over stability in unnatural conditions of balance. In fact, muscle tension continues to contract in some muscles to maintain balance or maintain posture without us feeling it unless we focus on it or increase this tension according to what is required to ensure the feeling of balance”. Bronner & Other, 2013, P(365 :

After this digression to clarify this explanatory framework for the injury specificity and the independent variable in this research, the importance of this research is represented by the intended productivity to provide support to both doctors and therapists in the physical therapy department at Al-Karkh Hospital/Physiotherapy Department in order to help injured women who suffer from pain in cases of long standing to speed up recovery from this injury other than cases of peripheral impairment resulting from modern diseases, malnutrition or excessive obesity. The problem of the research lies in the fact that through the researcher’s reviews of the physical therapy department at Al-Karkh Hospital and her observation of the slow recovery processes from some cases of peripheral nerve inflammation for women aged (50-55) years, and the reliance on medical drugs with limited exercises, and the need for rehabilitation exercises that help those injured with these inflammations to overcome them, which prompted the lack of specialized rehabilitation exercises that meet or are consistent with the instructions of doctors who emphasize their regular application, the researcher directed to try to experiment with accompanying rehabilitation exercises For electrical stimulation, the research aims to prepare rehabilitation exercises accompanying electrical stimulation according to the feeling of pain. For women aged (50-55) years, and to identify the effect of rehabilitation exercises accompanied by electrical stimulation according to the feeling of pain in treating some cases of peripheral nerve inflammation for women aged (50-55) years, and the researcher assumes that there are statistically significant differences between the results of the electrical signal measurement tests (EMG) before and after the experimental research group, and there are statistically significant differences between the results of the pain measurement tests (V.A.S) before and after the experimental research group.

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Method and procedures:

The problem of the current research imposed the adoption of experimental research with a single experimental group design, considering that it is not possible to choose a control group as stated in this problem due to the lack of integration of physical therapy in the manner required by doctors. The boundaries of the current research community were women aged (50-55) years, totalling (9) infected women who visit Al-Karkh Hospital / Physical Therapy Department, who were diagnosed with some cases of peripheral nerve inflammation other than cases of peripheral neuropathy resulting from modern diseases, malnutrition or excessive obesity. After the researcher confirmed their laboratory analyses and clinical examinations of nerve mapping in this hospital that there were no injuries in the limbs or complications that do not allow the application of rehabilitation exercises, they were all chosen intentionally using the comprehensive enumeration method for the total research sample at a rate of (100%) of this community. Also, to maintain the internal integrity of the experimental design, their homogeneity was verified in the degrees of some extraneous variables, as shown in the results of Table:(1)

Table (1) shows the results of the homogeneity of the degrees of the patients in the research sample

Extraneous Variables	Unit of Measurement	N	Mean	Standard Deviation	Skewness
Injury Age	Day	9	10.11	0.782	-0.216
Chronological Age	Year	9	52.89	1.616	-0.687
Body Mass Index (BMI)	Kg/m^2	9	21.67	0.707	0.606

(BIM) = Body weight (mass in kg) / Body length squared in meters, Torsion coefficient between(1$\pm$)

The measuring tools for the recovery of some cases of peripheral nerve inflammation for women were determined based on consultation with neurologists, joints and fractures consultants at Al-Karkh Hospital / Department of Physiotherapy, which were represented by an (EMG) device with a (Bluetooth) transmitter using two sensors for each of the posterior gluteus muscle of the right and left leg. The results of the (EMG) signal are obtained and analyzed with the (Myo Research XP 1.06.67) program stored on a laptop computer. After synchronizing the movement of the injured person to test standing on tiptoes for (3) seconds with a (SONY) camera whose speed does not exceed (75 images per second), to take a reading of both the peak and area of the (EMG) signal for each of the two muscles, and it was represented by the pain level scale (V.A.S) graduated from (1-10) degrees to measure the degree of pain after standing according to the patient's ability to stand on the tips of the toes, as this

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measurement is done after (3) seconds of this type of Standing, i.e. one test was conducted, which is balance, to measure the degree of pain in the feet and the electrical signal of the posterior gluteal muscles of both the right and left legs of each injured person from the experimental group, as shown in Appendices (1) and.(2)

Basics of preparing rehabilitation exercises accompanied by electrical stimulation according to pain sensation and their applications:

R The goal of each exercise was determined to rehabilitate some cases of peripheral nerve inflammation in women aged (50-55) years, and to reduce the level of pain (V.A.S) in the posterior golf muscles of both the right and left legs, and to restore the ability to stand on the feet without this pain.

R The electrical stimulation device (Radium B333) was used, which contains an electrical transformer with switches that converts the direct electrical current into electrical vibrations that are transmitted to the posterior gluteus medius muscles of both the right and left legs by means of wire electrodes, the number of which varies from one device to another. The number of these channels or electrodes is (10) channels that help stimulate the muscles and nerves to prepare for the rehabilitation exercise in the treatment session. It contains several types of electrical waves, from which the (T.E.N.S) type was chosen for stimulation to suit some cases of peripheral nerve inflammation in women aged (50-55) years, gradually from (110) Hz to (180) Hz to stimulate the posterior gluteus medius muscles of both the right and left legs to strengthen their work and increase their synergy, taking into account the ability of women aged (50-55) years and their acceptance of this type of electrical stimulation by adopting the principle of gradual increase in the degree of electrical stimulation, as shown in Appendix.(3)

When electrically stimulating the hamstring muscles of both the right and left legs, care was taken to place the electrodes on both sides of each muscle.

Electrical stimulation of the posterior gluteus muscles of both the right and left legs was performed before rehabilitation with rehabilitation exercises targeting the rehabilitation of some cases of peripheral nerve inflammation in women aged (50-55) years.

The commitment to continuing comprehensive medical care and organizing periodic evaluations by the consultants and specialists responsible for them at Al-Karkh Hospital/Physiotherapy Department was taken into account.

The content of these rehabilitation exercises, tailored to suit each individual injured weightlifter, includes the following:

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Dynamic stability exercises.

Balance board exercises.

Resistance Bands exercises in degrees.(5 ,4 ,3 ,2 ,1)

The difficulty of the rehabilitation exercises was determined by calculating the maximum resistance received by all women suffering from pain in each rehabilitation exercise, by adopting the pain level scale (V.A.S) by gradually applying the rehabilitation exercises, as muscle strength gives an indication of a decrease in the degree of pain, as Figure (1) shows the percentages of these exercises in the total rehabilitation sessions applied to women aged (50-55) years:

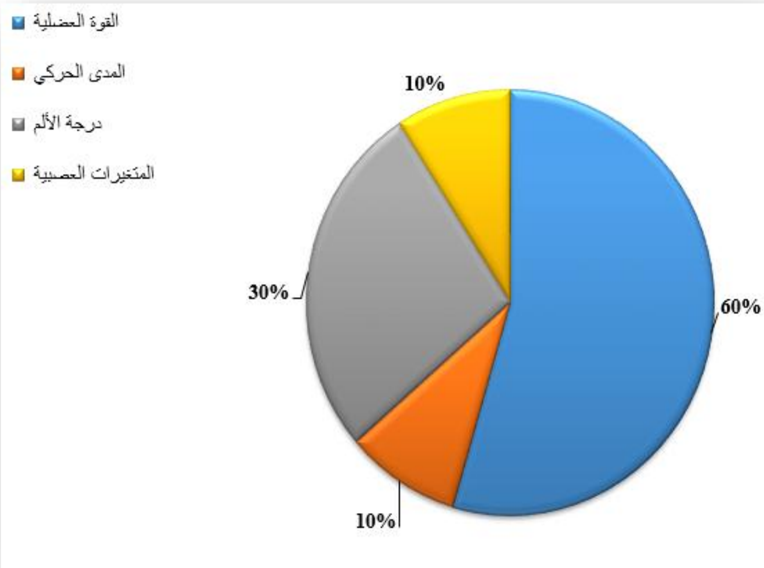

Figure (1) shows the distribution of percentages across the various rehabilitation exercises.

Muscle pain relief was considered by gradually increasing the (T.E.N.S) current for stimulation from (110) Hz to (180) Hz for a period of no less than (10) minutes in one session.

After completing the electrical muscle stimulation, the injured were given an appropriate rest period, after which rehabilitation exercises began.

The duration of the application of the rehabilitation exercises in each of the rehabilitation sessions ranged from (24.36) to (28.22) minutes, with (3) sessions applied in one week on

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the days (Sunday, Tuesday, Thursday) at a rate of (4) exercises in each session, which continued for (8) consecutive weeks, so that the total number of sessions reached (24) rehabilitation sessions, as shown in Appendix.(4)

The research experiment began by applying pre-tests on the infected women in the experimental research group, numbering (11) infected women. These tests were applied in Al-Karkh Hospital/Physiotherapy Department at ten o'clock in the morning on Wednesday, corresponding to the date.(2024/25/12)

Rehabilitation exercises accompanied by electrical stimulation were applied according to the feeling of pain on them during the period of their receiving physical therapy at Al-Karkh Hospital / Physical Therapy Department, extending from Sunday corresponding to the date (12/29/2024) until Thursday corresponding to the date.(2025/20/2)

After completing the rehabilitation exercises accompanied by electrical stimulation according to the feeling of pain, the post-tests were applied on Sunday, February 23, 2025..

After the completion of this experiment, the data were automatically processed using the SPSS system to extract the values of the percentage, arithmetic mean, standard deviation, skewness coefficient, and the t-test for correlated samples

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Results:

Table (2) shows the results of the pre- and post-tests for the experimental research group

Tests & Unit of Measurement			Measurement	Statistical Differences Processing for Comparison Between Pre- and Post-tests						Significance
				Mean	sd	Mean	sder	T	Sig	
Electrical Signal (EMG)	Right Calf Muscle	**Peak (μV)**	before	0.432	0.02	0.24	0.033	21.98	0.000	sig
			after	0.672	0.01					
		Area (μV·s)	before	0.253	0.02	0.077	0.027	8.663	0.000	sig
			after	0.33	0.00					
	Left Calf Muscle	**Peak (μV)**	before	0.413	0.01	0.115	0.015	23.55	0.000	sig
			after	0.528	0.00					
		Area (μV·s)	before	0.199	0.01	0.061	0.009	19.72	0.000	sig
			after	0.26	0.00					
Pain Degree (V.A.S) (Score)			before	8.222	0.44	6.778	0.667	30.5	0.000	دال
			after	1.444	0.52					

The differences are significant at a significance level of (0.05) and a degree of freedom of (8) when the degree of) Say (less than (0.05)

Discussion:

From reviewing the results of Table (2), it is clear that women aged (50-55) years who suffer from some cases of peripheral nerve inflammation have improved the post-test values of the five dependent variables compared to what these values were in the results of the pre-tests, which appeared clearly in the increase in the peak of the electrical signal (EMG) for the right and left golf muscles to give an indication of the efficiency of muscle contraction in the case of standing on the tips of the toes in the test measuring these electrical signals, in contrast to the increase in the area of spread of the electrical signal (EMG) in this test to give an indication of the lack of fatigue of these muscles targeted in this measurement. The results also showed a reduction in the level of pain severity (V.A.S) for cases of peripheral nerve inflammation by reducing their feeling of numbness, tingling and tingling in the hands and feet. The researcher attributes the emergence of these results to the rehabilitation exercises accompanying the electrical stimulation according to the feeling of pain, which the researcher was keen to apply this integration in the rehabilitation protocol in which the age and gender of the sample of women and the nature of their lives were taken into account, as

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they are not practicing sports activity in a way. Regularly, in addition to their constant feeling of pain in cases of prolonged standing, which helped the low-intensity electrical stimulation of the type (T.E.N.S) in preparing the muscles to perform exercises for a relatively short period of time, by adopting the principle of gradually increasing its hertz to suit the size of the muscle, the type of contractile work it performs, and the strength produced by this muscle, in addition to the good suitability of the time period for the continuation of this electrical stimulation, and the time period between receiving the stimulation and applying the rehabilitation exercises, which was also taken into account for the length of each rehabilitation exercise according to its difficulty according to the feeling of pain by adopting the pain level scale (V.A.S) in determining the difficulties of each rehabilitation exercise, and the repetitions appropriate for them without straining the muscles and in a logical manner. This helped the internal responses to accept these exercises to have a clear role in increasing the capabilities of each of the injured women and strengthening their muscles, which had a clear effect in reducing pressure on the neurons of the nerve cells and their branching dendrites by adopting the principle of relieving the burden on the system The motor system includes bones, muscles and nerves. Strengthening any part of it reduces the burden on the other part, depending on the physiology of the motor performance of the legs. This role in the systematic integration of stimulation and exercises in a single rehabilitation session, under the supervision of doctors according to sound standards, had a positive impact, leading to improved results of the dimensional values and progress in the recovery of the research sample of women in the experimental group.

“Sports rehabilitation is an organized, well-prepared and studied process carried out by specialists to work on raising the functional efficiency of the injured organ and trying to return it to the previous state it was in before the injury, and not allowing any deformities or disruption to its function) ”.Banwan, 2019, p. 51)

“Kinesiology is the basis of sports rehabilitation, which derives its effect from the scientific uses of various natural elements to treat injuries and manifestations of fatigue and exhaustion in many cases, without these natural methods having side effects as is the case with many unnatural chemical and radiological methods) ”.Bakri, 2020, p. 132)

"Transcutaneous electrical muscle stimulation (TENS) is a low-voltage device that delivers current through electrodes placed over the skin at both ends of the muscle (its origin and insertion). This combines two currents, one low and the other high-frequency, to close the pain gate, while the first stimulates the pain-transmitting nerve fibers, which leads to the release of natural endorphins in the body) ".Jeffrey, 2009, p. 137)

"The injured person must be trained to perform the exercises correctly and safely, and provided with the necessary support and assistance to improve results. This includes working to improve communication between the patient and the sports trainer or specialist physician, and providing continuous follow-up to assess the individual's progress and modify the program when necessary) ".Jacobs & Other, 2019, p: 245-255)

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"Messages are easily transmitted across neurons by neurotransmitters that permeate brain cells, and large changes in the concentration of these neurotransmitters in certain areas of the brain can alter our moods and affect our movement) ".Soussa, 2009, p. 11)

Likewise" ,repetition is the most important component of the rehabilitation exercise load in developing the nerves' function aimed at improving neuromuscular control to restore the body to its natural movements, especially in cases of weak neuromuscular control) ".Joan, 2023, p. 55)

Likewise“ ,the diversity of static and dynamic muscle contractions in strength training is of great importance, because overall strength lies in the ability to endure and control powerful movements in both directions of these two contractions) ”.Thomas & Newton, 2017, p: 154)

“One of the advantages of electrical stimulation is that it leads to the development of a strong stimulus for muscle growth, and it can be used to train specific muscle groups in isolation. Therefore, it can be used in rehabilitation processes after injuries, and it serves the same purpose as regular training, but in a short and abbreviated period. Its negative effects cancel out the role of nervous and coordination functions in training) ”.Al-Anbaki, 2010, p. 97)

"The more electrical stimulation applied to the muscle, the greater the force of contraction and the recruitment of the largest possible number of motor units, even if not all of them, because involuntary electrical stimulation of muscles differs from voluntary contraction in this respect, i.e. electrical stimulation to stimulate the muscle differs from voluntary contractions) ".Al-Bishtawi and Al-Khawaja, 2005, p. 330)

Conclusions and applications:

R Rehabilitation exercises accompanied by electrical stimulation according to the feeling of pain are suitable for sessions for women aged (50-55) years .Patients with some cases of peripheral neuropathy.

R Applying rehabilitation exercises accompanied by electrical stimulation according to the feeling of pain has a positive effect in improving both the EMG signals of the hamstring muscles of both the right and left legs by increasing the level of the peak and reducing the area of spread of this electrical signal, and reducing the level of pain intensity (V.A.S) in cases of peripheral nerve inflammation.

R It is necessary to pay attention to the transitional rest period between electrical stimulation and the application of rehabilitation exercises according to the feeling of pain when rehabilitating women aged (50-55) years .Patients with some cases of peripheral neuropathy.

R It is necessary to adopt the type of current (T.E.N.S) when rehabilitating women aged (50-55) years .Patients with some cases of peripheral neuropathy and pain relief (V.A.S).

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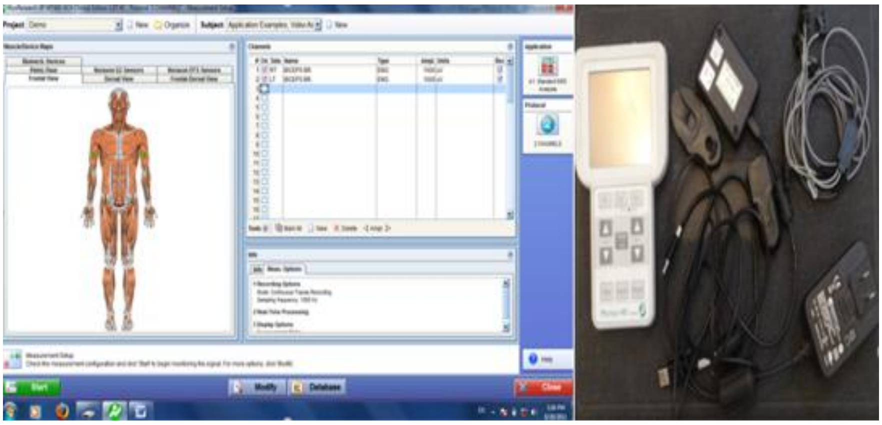
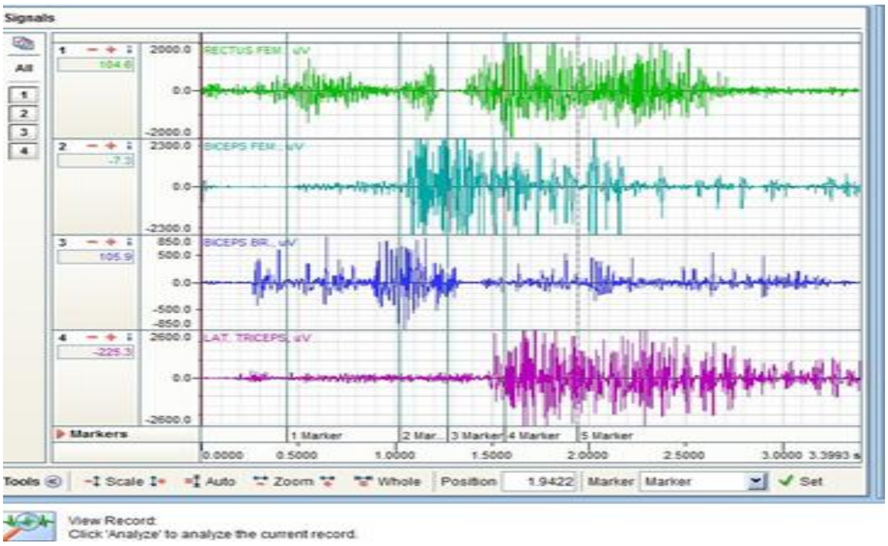
Appendices:

Appendix (1) shows the search tests for EMG images and the system window in the computer. The raw signal sent to the electromyography device)





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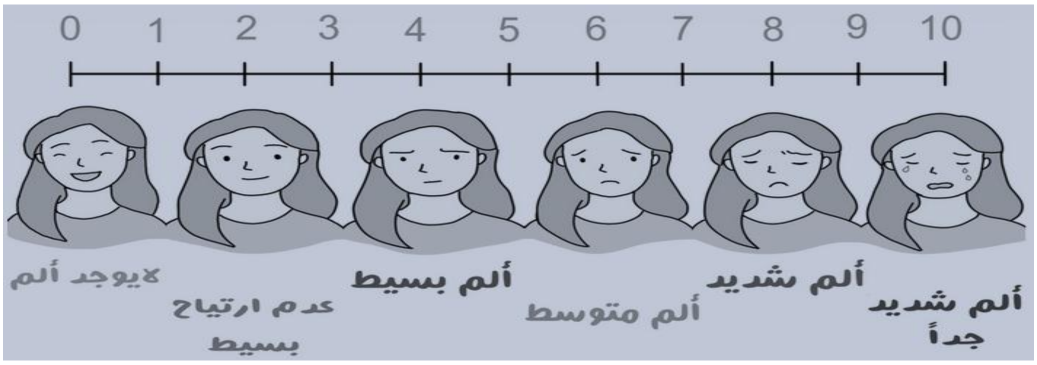
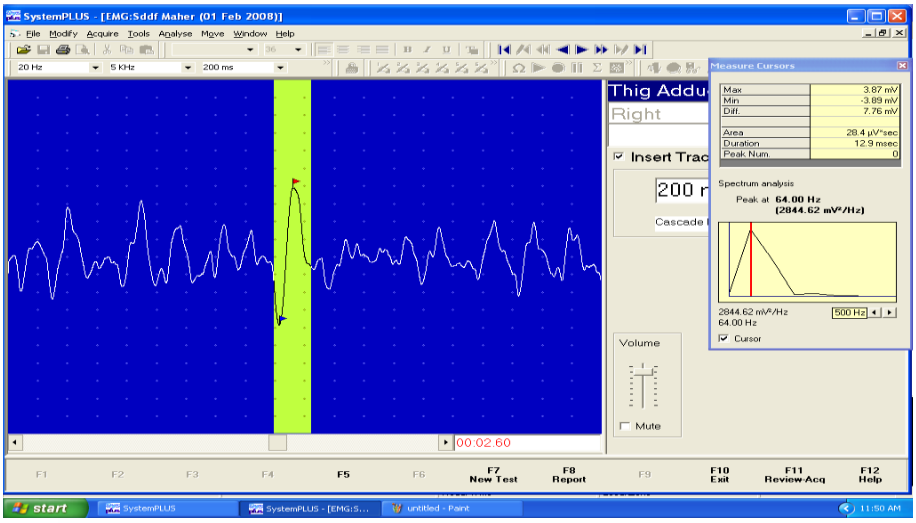


Appendix (2) shows the pain level measurement form:



Appendix (3) shows a picture of the electrical stimulation device (Rhidium B333).

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Appendix (4) illustrates a model of a rehabilitation session for applying rehabilitation exercises accompanied by electrical stimulation according to the sensation of pain.

Third rehabilitation week: Seventh session.

Objective of the rehabilitation exercises: To treat some cases of peripheral nerve inflammation in women aged (50-55) years.

First: Electrical stimulation session: for (10) minutes for each of the right and left gluteus muscles at a frequency of (110) Hz.

Second: Rest period between electrical stimulation and rehabilitation exercises: (5) minutes.

Third: Planning and content of the rehabilitation exercises:

Exercise N	Exercis Duratio	Repetitic	Rest Betwee Repetitions	Rest Betwe Exercises	Total Work Rest
1	2 sec	10	3 sec	120 sec	192 sec
2	3 sec	15	3 sec	120 sec	177 sec
3	3 sec	15	3 sec	120 sec	177 sec
4	2 sec	10	3 sec	120 sec	192 sec

(1) From the waist position, standing on a flexible mat, and alternate raising the legs and raising the leg backward, alternating between the legs for (2) seconds.

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(1) From a standing position, resting the foot on the toes and pressing on a solid ground, and raising the leg backwards, alternating between the two legs for (3) seconds, while leaning on a chair to relieve pressure on the leg muscles.

(3) From a standing position, supporting yourself with the sole of your foot and pressing on a low-height balance ball on a flexible mat using a base extension board, and raising your leg backwards, alternating between the two legs, for (3) seconds.

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Study of the Quality of Life of Foreign Students at DPU University: An Analysis According to Different Variables

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Abstract

The aim of this study is to investigate the quality of life of foreign students studying at the Faculty of Sport Sciences and international students studying at different faculties at DPU. In this context, "University Quality of Life Scale" was applied to determine the quality of life of students. The research data were obtained from a total of 272 students studying at the Faculty of Sports Sciences, Faculty of Business Administration,Faculty of Education and Faculty of Engineering. One-way ANOVA test was used for data analysis. The quality of life of the students,faculty, gender,educational status, place of residence,leisure time, time of arrival in Turkey and finally welfare level were analyzed . The quality of life of the student differed significantly according to the faculty,gender,education level,place of residence,and leisure time. It was observed that there was no significant difference in the variables of arrival in Turkey and welfare level.

Keywords: quality of life scale, foreign students, university students.

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Introduction

Nowadays, institutions and organizations are working to protect their assets. For this reason, it is necessary to monitor their quality on an ongoing and regular basis, especially in the field of educational services. For this reason, the teaching and teaching program is in line with the conditions of the times. Focus should be on activities that help students develop themselves socially. Focus should be on actions aimed at increasing learning using methods, tools and equipment that can be used in this sector. This is also balanced by changes in educational institutions such as Universities, basic scientific research, and community services. According to UNESCO (1998), the tasks of the new university are in parallel with changes in society. Take an active role in solving major global, regional and local problems such as poverty, hunger, ignorance, social exclusion and growing inequality at the international and national levels. Sustainable human development, universal respect for human rights, gender equality, and the application of the principles of justice and democracy in universities and society, in particular through the submission of alternative proposals and proposals; Developing intellectual and moral understanding and solidarity among nations and ethnic, religious, cultural and other groups through a peaceful and non-violent culture, preserving and supporting cultural diversity, and promoting intercultural understanding and compatibility. It also helps students understand the information, skills, attitudes, values, and abilities that will guide them to become responsible and determined citizens, help them change themselves and others, and improve the quality and effectiveness of the educational process in all its aspects. It aims to strengthen the linkages between different levels and forms of education in order to provide education for all and to raise the quality and effectiveness of the educational process in various aspects (Erdem, 2005).

Quality is an important concept in almost all fields throughout human history. Its importance is increasing day by day. Different concepts of quality have been developed in each sector and product. The Turkish Language Association (TDK) generally defines quality as "the measurable characteristic, quality, or feature that determines how something works and distinguishes it from others" (TDK Büyük Sözlük).

Abrams defined quality of life as the degree to which people are satisfied or dissatisfied with various aspects of their lives. Andrews (1974) pointed out that it is the individual's association with satisfaction and pleasure that represents the quality of life. (Akt. Farquhar, 1995).

The concept of well-being encompasses many variables. Well-being can be defined as how satisfied people are with their physical, psychological, and social functions and how uncomfortable they are with the presence or absence of characteristics related to these aspects of their lives. According to the World Health Organization, the concept of well-being is defined as a person's

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perception of one's place in life in relation to one's goals, expectations, standards, and interests within the culture and value systems in which they live. Well-being can also be described as a broad concept that is intricately influenced by an individual's physical health and condition Psychological, his beliefs, social relationships, and his relationship with the environment around him. (Wang ,2011, akt: Köksal, 2015).

Quality of life is the ability of an individual to achieve his desires, take advantage of opportunities to develop his personality, participate in various activities, possess sufficient resources in terms of quality, and believe that these resources are sufficient (Shin ve Johnson, 1978; akt. Farquhar, 1995) The good life of the individual is to meet one's needs effortlessly, control one's surroundings, make decisions freely, and find opportunities to develop oneself and live a meaningful life" (Gitmez, 1980; Cılga, 1994, As a multidimensional and wide-ranging concept, quality of life has become one of the important social indicators of individual and societal well-being. (Köksal, 2015

Universities play an important role in the quality of life. They will increase the educational and social programs offered to students. According to the quality of university life, the quality of life expresses the feeling of satisfaction that is experienced throughout the student life. The concept of quality of life is to have important opportunities for life, fulfill desires, and take advantage of opportunities for personal development, there are many studies that have been conducted with the aim of determining the quality of university life according to the area of interest. When studying these studies, it has been observed that there are studies aimed at faculty members and administrators, but the studies Aimed at students with limited numbers. The purpose of universities is to prepare students in the scientific and professional field, and for this purpose the answers to the following questions have been sought:

Is there a statistically significant relationship between the perceptions of foreign university students and the quality of university life based on some variables (gender, educational status, the college you study at, place of residence, how you spend your free time, when you came to Turkey, level of well-being)?

It has always been required for individuals to be satisfied with their financial lives and their current situation, to have their spiritual expectations adequately met, and to live their lives according to standards. The higher the level of well-being of individuals, the more productive they are. Negative behaviors in society will be high and they will be reversed. They are expected to decrease. For this reason, the concept of quality of life dates back to the 1970s. Since then, it has become an important topic of research.

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The goal was to make the school a place where students loved to go and come to willingly, and to improve their school life. The aim was to study the quality of life levels of foreign students studying at Dumlupinar University's Faculty of Mathematical Sciences and foreign students studying in different faculties, adapting to changes, and achieving the university's goal Represented by conducting high-level academic research. To achieve this goal, answers to the main problem and sub-problems were sought.

Do the quality-of-life levels of foreign students in universities differ according to the basic variables, and are the quality-of-life levels of students in universities considered a statistically significant indicator?

This study aims to determine the existence of a statistically significant relationship between some variables such as gender and age and the perceptions of university students about the quality of life at the university. It also aims to determine the existence of a statistically significant relationship between the variables that determine the quality of life levels of students and their satisfaction with the university. When studying studies related to this topic, it becomes clear that there are many studies in the field of quality of life. Research has been carried out in the field of quality of life in education, although not Much research has been done, but research is ongoing. However, there is research in the field of university quality of life. In this context, this study includes a few studies in Turkey. It will contribute to the quality of university life.

As a result of this study, the necessary data will be provided to university administrators and faculty members in order to create a higher quality university. Using this data and research recommendations, a higher quality learning and living environment can be obtained. Higher quality will lead to an increase in the number of students.

Methodology

In this section, the individuals involved in the research, data collection tools, data collection methods, and statistical methods used in data analysis are discussed.

Research Form

The overall objective of the research is to determine the quality of life of international students at Dumlupınar University. In this context, the quality of life of foreign students studying at Dumlobnar University has been assessed according to variables such as college, gender, educational status, place of residence, etc. Research is a survey model because it determines students' opinions on a topic according to different variables.

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Research Sample

272 foreign students studying at Dumlupinar University in the academic year 2021-2022 formed our working group. 57 students from the College of Mathematical Sciences, 76 students from the College of Business Administration, 76 students from the College of Engineering, and 63 students from the College of Education participated in our study.

Data Collection Tools

To collect data, the "University Quality of Life Scale" prepared by Hayriye ERİŞ was used. The University Quality of Life Scale is a five-point Likert scale. The scale consists of 35 items. The Cronbach Alpha internal consistency coefficient for the University Quality of Life Scale was 0.895, and the reliability of the retest was 0.886. Google Forms was used to reach students studying at different colleges. Written consent was obtained from the Department of Physical Education and Sport to apply the scale. Data collection took two weeks. A total of 275 students participated in the scale applied to determine the quality of life of university students. 3 were excluded. Students who participated in the study due to incompleteness of their answers.

Analysis

The data was analyzed using SPSS software. In this context, demographic variables were first grouped and frequency and percentage analysis was performed. Then it was examined whether the data followed a normal distribution, and the data were found to follow a normal distribution. The One-way ANOVA test was used to analyze the data that followed a normal distribution.

Results

In this section, the categories generated by students' answers and expressions have been shown.

Table 1: Analysis of all variables is presented

	F	Percentage
College		
College of Sport Sciences	57	21,0
Business College	76	27,9
College of Engineering	76	27,9
College of Education	63	23,2
Total	272	100,0

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Sex		
female	112	41,2
male	160	58,8
Total	272	100.0
Educational Status		
Preparatory	70	25,7
Bachelor	124	45,6
Master	50	18,4
Phd	28	10,3
Total	272	100.0
Where to stay		
Student Housing	39	14,3
Student Apartment	74	27,2
With the family	26	9,6
apartment	133	48,9
Total	272	100.0
How to spend your free time		
Exercise	94	34.6
Reading Books	53	19.5
Travel	45	16.5
Sitting with friends	58	21.3
Other	22	8.1
Total	272	100.0
When did you come to Turkey?		
0-2 Years	186	68,4
2-5 Years	68	25,0
More than 5 years	18	6,6
Total	272	100.0
Level of well-being		
Very bad	0	0,0
Bad	23	8,5
Normal	152	55,9
Good	91	33,5
Very good	6	2,2
Total	272	100.0

The research team includes 272 students studying at the faculties of Tigris University in the academic year 2022-2023. 112 students (41.2%) of the research team are female, and 160 students (58.8%) are male. 76 students (27.9%) are studying at the Faculty of Engineering, 76 students (27.9%) are studying at the College of Business Administration, 63 students (23.2%) are studying at the College of Education, and 57 (21.0%) are studying at the Faculty of Mathematical Sciences. 124 students (45.6%) of the study participants are undergraduate students, 70 students (25.7%) are preparatory students, and 50 Two students (18.4%) are master's students, and 28 students (10.3%) are doctoral students. When asked about the type of housing, 133 of them (48.9%) answered that they live in an apartment, 74 of them (27.2%) in an apartment, 39 of them (14.3%) in university housing, and 26 of them (9.6%) with their families. It was also found that 22 of them (8.1%) had a health problem. When asked how they spend their free time. 94 of them (34.6%) prefer to exercise, 58 (21.3%) prefer to spend time with friends, 53 (19.5%) prefer to read books, 45 (16.5%) prefer to travel, and 22 (8.1%) prefer to do other activity. When asked when they arrived in Turkey, 186 of them (68.4%) reported that they had been in Turkey for 0-2 years, 68 of them (25.0%) had been in Turkey for 2-5 years, and 18 of them (6.6%) had been in Turkey for more than 5 years. When asked about their level of well-being, 23 students (8.5%) reported that their level of well-being was poor, 152 students (55.9%) reported that their level of well-being was normal, 91 students (33.5%) reported that their level of well-being was good, 6 students (2.2%) reported that their level of well-being was very good, and no student reported that their level of well-being was very poor.

Table 2: The Relationship between the College Variable and Quality of Life

	Mean	N	S.D.	F	Sig.
College of SportSciences				16.208	.000
BusinessCollege	87.6316	57	10.47213		
College of Engineering	90.5132	76	14.05560		
Collegeof Education	98.7237	76	17.23763		
Total	83.1905	63	10.01750		

As shown in Table 2, there is a statistical difference when comparing the quality of life between students attending different colleges [F (3, 268) = 16.208, p = 0.00]. The quality of life of students of the College of Engineering (X = 98.72) is higher than that of the College of Business

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Administration (X = 90.51), the students of the College of Mathematical Sciences (X = 87.63), and finally the students of the College of Education (X = 83.19).

Table 3: Relationship between sex and quality of life

	Mean	N	S.D.	F	Sig.
male					
female	92.0000	160	15.50897	4.060	.045
Total	88.3750	112	13.19645		

As shown in Table 3, the quality of life of students by sex. When comparing, there is a statistical difference [F (1,270) = 4.060, p = 0.045], as the quality of life of male students (X = 88.3750) is higher than that of female students (X = 92.0000).

Table 4: Relationship between educational status and quality of life

	Mean	N	S.D.	F	Sig.
preparatory					
Bachelor	94.9643	70	15.94547	9.455	.000
Master	93.9677	124	16.21047		
Doctor	89.3000	50	13.51228		
Total	83.4571	28	8.26497		

As shown in Table 4, there is a statistical difference when comparing students' quality of life with their educational status [F(3,268) = 9.455, p = 0.000]. The quality of life of ready students (X = 94.9643) is higher than that of undergraduate students (X = 93.9677), master's students (X = 89.3000) and finally doctoral students (X = 89.3000).

Table 5: The relationship between accommodation and quality of life

	Mean	N	S.D.	F	Sig.
Student Housing					
Student apartment	83.0769	39	10.22737	10.702	.000
Family Accommodation	88.1081	74	10.18939		
apartment	84.8462	26	11.89182		
Total	95.1278	133	16.76460		

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As shown in Table 5, there is a statistical difference in students' quality of life when compared to where they live [F(3,268) = 10.702, p = 0.000]. The quality of life of students living in an apartment (X = 95.1278) is higher than students living in a detached apartment (X = 93.9677), students living with their families (X = 84.8462), and finally students living in student housing (X = 83.0769).

Table 6: The relationship between how you spend leisure time and quality of life

	Mean	N	S.D.	F	Sig.
Exercise					
Reading Books	91.2766	94	13.70770	2.705	.031
Wandering	87.5660	53	13.19602		
Sitting with friends	87.3556	45	16.03994		
Other	95.1207	58	16.41787		
Total	88.5909	22	11.85090		

As shown in Table 6, there is a statistical difference when comparing students' quality of life with how they spend their leisure time [F(4,267) = 2.705, p = 0.031]. The quality of life of students who spend their free time sitting with their friends (X = 95.1207) is higher than students who spend their free time exercising (X = 91.2766), students who prefer to read books (X = 87.5660), and finally students who spend their free time walking (X = 87.3556).

Table 7: The Relationship between Time to Arrive in Turkey and Quality of Life

	Mean	N	S.D.	F	Sig.
0-2 Years					
Years2-5	91.2634	186	15.04266	2.218	.111
More than 5 years	87.5000	68	13.10064		
Total	94.0556	18	15.58835		

As shown in Table 7, there is a statistical difference in the quality of life of students when compared to the period when they arrived in Turkey [F(2, 269) = 2.218, p = 0.111]. The quality of life of students who have spent more than 5 years (X = 94.0556) is higher than students who have spent 0-2 years (X = 91.2634) and finally students who have spent 2-5 years (X = 87.5000).

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Table 8: Relationship between Well-Being and Quality of Life

	Mean	N	S.D.	F	Sig.
bad					
Normal	86.1304	23	9.46911	2.293	.078
Good	90.5263	152	12.83721		
Very good	92.3077	91	18.21824		
Total	79.5000	6	7.06399		

As shown in Table 8, there is a statistical difference when comparing students' quality of life to their level of well-being [$F(3, 268) = 2.293$, $p = 0.078$]. For students with a good level of well-being, the quality of life ($X = 92.3077$) is higher than for students with a normal level of well-being ($X = 90.5263$), students with a bad level of well-being ($X = 86.1304$), and finally students with a very good level of well-being ($X = 79.5000$) respectively.

Discussion

In this section, the results of a study on the quality of life of foreign students enrolled in the Faculty of Sport Sciences at Tigris University and foreign students enrolled in other colleges were discussed.

When examining the averages related to the quality of life by colleges, it is clear that students in the College of Engineering and the School of Business have higher averages. A significant difference has been observed among students from higher colleges. In other studies conducted in this area, similar results have been found in terms of relationships with faculty. Sirgy, Grzeskowiak, and Rahtz (2007) conducted a college-based study, focusing on the close relationship between a student's perception of quality of university life.

A statistically significant difference was found between the levels of university quality of life of male students by gender. Based on this result, it can be said that they find it more positive. The results of this study differ from those found by Doganay and Sari (2006) in their study to determine the quality of university life of students of Gükurova University, as they found no statistically significant difference between the sexes. Salıcı (2010) conductedA study on physical education and sports students at Düzci University concluded that there was no statistically significant difference between the sexes. The reason for the significant gender difference in this study may be the difference in the profiles of students at the university. Low (2000) and Ren (2009) found that the level of satisfaction of female students with their university life differed significantly from the level of student satisfaction. In another study (Hayri et al., 2017), no

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statistically significant difference was found between the level of satisfaction of male and female students and their quality of life.

The presence of statistically significant differences in the preparatory stage was determined based on the educational status of the students and their quality of life. This is due to the fact that these students did not start studying at university. This is different from the study conducted by Hayriye (2017) which showed that there was no statistically significant difference between quality of life and educational status.

It is about the satisfaction of international students with life and their change of residence. There were statistically significant differences. It was found that students living in a home were more satisfied. This is also important. These results are also consistent with the study of Akyol, 1993 akt. Vara ,1999 akt. Geçen, 2008) (Myers, 1995)The students' satisfaction with life in the housing and shelter questionnaire was assessed for students living in homes. Students living in student dorms were more satisfied with life. Similar results were reached for students living in dorms. The effect of the living environment on life satisfaction: This result has been recorded in other studies (Fouberg ve Tepper, 1997; In addition, both outcomes are consistent with expectations, and support each other in terms of factors that affect students' quality of life.

When comparing students' life satisfaction scores with how they spent their free time, a statistically significant difference was found in their life satisfaction scores based on how they spent their free time. This difference was largely in favor of exercising and then sitting with friends. Exercise helps people relax physically and mentally. Due to its effect on reducing stress, exercise is believed to affect their life satisfaction. This finding is consistent with the study of Ergin et al. (2011) which indicated that life satisfaction levels in sports practitioners are higher than non-practitioners. The result of the study (Yavuz, 2019) supports the result of the current study, as there is a statistically significant difference between life satisfaction levels and exercise.

When studying the averages related to quality of life according to the length of stay in Turkey, it was observed that there was no statistically significant difference between the quality of life and the length of stay in Turkey. This means that life satisfaction and quality of life are not affected by the length of stay. A study conducted by Firat (2019) indicated that the satisfaction of foreign students did not increase over time. Firat's study showed results similar to ours.

It was found that there was no statistically significant difference between quality of life and level of well-being. The majority of students rate their level of well-being as normal and good. In a study conducted by Demirel and Harmandar (2009) to identify factors that may be a barrier to university students' participation in recreational activities, they found that 56.6% of university students participating in the study have a normal level of well-being, while 30.6% of them have a

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good level of well-being (Demirel and Harmandar, 2009; Özşaker (2012) also found in his study that the level of well-being of young people is 54% of the normal level of well-being and 26.8% of the level of good well-being (Özşaker, 2012; 128). The results of the studies conducted are consistent with the results of our study.

As a result, the quality of life at the university has been found to vary according to the faculties, gender, educational status, place of residence, and how to spend leisure time, and there are no statistically significant differences depending on the presence of a disease, the time of arrival in Turkey, or the level of well-being. It is important to conduct studies in this direction in order to improve the quality of life of foreign university students.

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The Effect of a Training Program Based on Artificial Intelligence Techniques According to Physical Fitness Level Using Motion Sensors (Accelerometer & Gyroscope) on Developing Explosive Power and Passing and Shooting Skills Among Young Basketball Players

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Abstract

Basketball training no longer relies solely on coaches' personal experience or traditional on-field repetition. Instead, it has undergone a qualitative shift thanks to the integration of artificial intelligence (AI) technologies, which have become effective tools in analyzing performance and guiding training with precision and objectivity. In light of rapid technological advancements, it is now possible to obtain accurate motion data that surpasses human observational capabilities, enabling the design of individualized training programs tailored to each player's needs. The research problem stems from field observations indicating a decline in the performance level of several young basketball players during matches in the Iraqi league. This decline is attributed to difficulties in maintaining a high level of physical and technical performance throughout the game, especially during extended periods of play or under conditions that require sustained high effort. This leads to a drop in passing accuracy and weaker performance in one-on-one situations.In response to these challenges, the researcher designed an innovative training program based on AI technologies, utilizing performance sensors (Accelerometer & Gyroscope) to assess and analyze each player's physical level and adapt training accordingly.The study adopted an experimental methodology using two groups: an experimental group that underwent the AI-based training program, and a control group that trained using traditional methods. The program lasted six weeks, with two training sessions per week. The results clearly demonstrated the superiority of the experimental group in developing speed endurance, as well as improving performance in essential basketball skills such as passing and shooting. These findings highlight the

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effectiveness of integrating artificial intelligence and motion analysis in enhancing the athletic performance of young basketball players

Keywords: Artificial Intelligence Techniques, Motion Sensors, Accelerometer, Gyroscope, Physical Fitness Level.

Introduction

Basketball is a team sport that requires a high level of physical fitness and precise technical skills, with explosive power, passing, and shooting skills playing a crucial role in a player's on-court performance. Sports training no longer relies solely on coaches' experience and intuition, as it once did. It has become more precise and effective thanks to technological advances and artificial intelligence applications. In the modern digital age, it has become possible to analyze athletic performance with an unprecedented level of accuracy, surpassing traditional assessment capabilities. This has opened up broad horizons for designing training programs aimed at developing each player's individual physical and skill capabilities. Recent years have witnessed a remarkable development in the use of artificial intelligence technologies in sports. In light of rapid technological development, it has become imperative to integrate artificial intelligence technologies into training programs with the aim of improving athletic performance based on players' physical level and enhancing training efficiency through accurate assessment and real-time feedback.Recent studies have indicated that artificial intelligence is capable of analyzing athletic performance with high accuracy, which enhances the efficiency of individual and group training (D, K, M & ,J, 2021, pp. 1152-1170.(Especially in team sports like basketball, physical fitness plays a crucial role in enhancing performance, as it directly impacts players' ability to execute basic skills. Explosive power, passing, and shooting skills are among the key pillars that determine a player's effectiveness on the court. It has become possible to employ smart sensors to accurately analyze motor and physical performance levels, provide real-time data that helps draw a comprehensive picture of the player's needs, and design training modules based on that data. The use of motor performance sensors is Smart bands have become effective and affordable tools for measuring and analyzing physical performance, especially in team sports such as basketball. They are one of the most prominent applications of artificial intelligence in sports, providing accurate data on a player's physical and motor condition, allowing coaches to design individualized training programs based on each player's strengths and weaknesses. These technologies also contribute to the development of specific physical abilities, such as explosive power, which is the foundation for quick and sudden movements such as jumping, lunging, and cutting. Explosive power plays a pivotal role in basketball, particularly in quick movements such as jumping for a shot or rebound, and sprinting towards the ball, in addition to enhancing basic technical skills, most notably passing and shooting. Given this importance, this study sheds light on the impact of an AI-based training program

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adapted to the physical level of female players, using performance sensors as an accurate analysis tool, to develop explosive power and improve passing and shooting skills. This approach comes within the framework of the effort to enhance training efficiency and achieve the highest possible returns from training modules, thus contributing to improving the team's overall performance and supporting their path to achieving higher levels of professionalism.

Study problem

Many young female basketball players struggle to maintain a high level of physical and technical performance during a game, especially during long periods of play or in conditions that require high and sustained effort. Explosive power is one of the most important physical requirements affecting the quality of skill performance, particularly in executing accurate passes and effective shooting. However, a decline in this ability leads to decreased passing efficiency, slower responses, and poor performance during one-on-one confrontations. Field observations indicate that relying on traditional training programs that follow a uniform pattern that does not take into account individual differences among players may be insufficient to develop these crucial abilities to the desired extent. This calls for innovative training methods that take into account each player's individual level. With advances in artificial intelligence and sensor technology, modern technological solutions have emerged that enable the accurate analysis of motor and physical performance through sensors such as the accelerometer and gyroscope integrated into smart fitness bands. These devices provide real-time, objective data that can be used to design individual training programs powered by artificial intelligence, aimed at developing explosive power and improving basic skills such as passing and shooting. From this perspective, the problem of the current study arises in the following question:

How effective is an AI-based training program, based on physical fitness analysis using motion sensors (accelerometer & gyroscope), in developing explosive power, passing and shooting skills in young female basketball players?

Research objectives

1-Identifying artificial intelligence techniques according to physical level using the motion sensor (Accelerometer & Gyroscope) and in developing explosive power, passing and shooting skills among young female basketball players.

2-To identify the effect of a training program enhanced with artificial intelligence techniques according to the physical level using the motion sensor (Accelerometer & Gyroscope) in developing explosive power and passing and shooting skills among young female basketball players.

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Research hypotheses

1-There are statistically significant differences between the pre- and post-tests of the research sample in developing explosive power, passing and shooting skills among the research sample.

2-There are statistically significant differences between the experimental and control groups in developing explosive power and passing and shooting skills among young female basketball players .In favor of one of the two groups

Research areas

Human field: (14) players from the young women of the Sulaymaniyah Sports Club

Time frame: from 10/11/2024 to 12/4/2025.

Spatial area: Sulaymaniyah.

Research methodology and field procedures.

Research methodology

Given the experimental nature of the research problem, the researcher saw that the experimental approach is the most appropriate for addressing this problem, as it provides the possibility of controlling the basic variables affecting the phenomenon being studied. It is “an attempt to control all the basic factors affecting the dependent variable or variables in the experiment, except for one factor that the researcher controls and measures its effect on the dependent variable or variables) ”Abdul Hamid and Kazim, 2001, p. 105.(

Research community and sample

The research sample consisted of (14) players from the Sulaymaniyah Sports Club, who regularly play basketball within the youth category at the Sulaymaniyah Club, and they were chosen in a deliberate random manner. It is worth noting that (randomness in choosing the sample does not mean spontaneity or improvisation, but rather requires accuracy and care in applying the selection methodology) to ensure appropriate and objective representation of the members of the original community) .Alam, 2010, p. 19(They were divided into two groups, experimental and control, as they represent the research community faithfully.

Methods of collecting information, devices and tools

Information collection methods

1-Technical observation and experimentation.

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2-Personal interviews.

3-Tests and Measurements

Tools and equipment

measuring tape, whistle, indicators, Basketball number (6), stopwatch, target zone.

Measurement and testing

1- Explosive strength test Vertical jump test (Sargent) Alawi and Radwan, 1994 .

Purpose of the test: To measure the explosive strength of the leg muscles.

Performance Description: The tester stands after immersing his fingers in a special substance (calbork) next to the scoreboard (or a fixed measuring tape). The tester raises his special arm completely to its extension to place a mark for fingers on the board without raising the heels and not raising the shoulder level of the special arm above the shoulder level of the other arm. After that, the arm is lowered, the arms swing together forward and backward with the knees half bent and extended to jump vertically to the maximum possible height and place a new mark with the special arm and along its extension. The distance between the two marks is a result of the strength of the jumping muscles in the vertical direction.

Registration- :Measured in centimeters, the tester is given three attempts and the best one is recorded.

2- Basketball passing test in different situations (Nelson & & Johnson, 1999, p. 143)

Tools: A ball, a wall, and 5 circles drawn on the wall. Each circle is approximately 50 cm in diameter. They are numbered sequentially.(5-1)

Marking Distribution: Markers are placed at various heights, ranging from 1.2 meters to 2 meters above the ground. The purpose of this distribution is to simulate passing the ball in various situations that require varying accuracy and passing power.

Description: The player stands 4.5 meters from the wall and passes the ball directly towards the marks drawn on the wall (in the shape of a target). The player then receives the ball and passes it back.

Score: The number of successful passes is calculated in a specified period of time (e.g., 30 seconds).

3-Peaceful scoring test (Hammoudat and Jassim, 2005, p. 234)

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Purpose of the test: To measure the accuracy of ladder scoring.

Equipment needed: basketball court, basketball goal, whistle to start.

Number of attempts: Each player is given (10) attempts.

Points calculation: The player is awarded one point for each successful scoring event, where the highest points a player can collect are (10) points.

4-Scoring test by jumping from under the basket (Jawad, 2004, p. 180)

Purpose of the test: To measure accuracy in scoring from under the basket.

Equipment needed: basketballs, basketball goal, stopwatch.

Number of attempts: Each player is given two attempts.

Calculating points: One point is calculated for each ball that enters the basket. The total points obtained by the player in each attempt are calculated. Points are calculated for the player for the best attempt within (30) seconds.

Field research procedures

Pre-tests

The researcher conducted pre-tests for the research sample of female basketball players from the Sulaymaniyah Sports Club .On Sunday, November 10, 2024, the physical and skill capabilities measurement tests were conducted on the Sulaymaniyah Club field, at 3:30 PM. These tests aimed to collect primary data related to the study variables. In order to verify the homogeneity and equivalence of the sample members in these variables, ensuring that all participants start from a similar level when implementing the training program, the researcher calculated the statistical value (T) to verify the absence of statistically significant differences between the sample members in the pre-measurement stage

Sample homogeneity

Table 1. show Sample homogeneity

variable	Unit of measurement	The middle	The mediator	deviation	skewness
explosive power	right	34.50	34.5	1.160	0.517
Handling	number	15.571	16	1.01	0.544

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Peaceful scoring	a point	6.928	7	0.615	0.024
scoring from below basket	a point	9.072	9	0.616	0.025

Mutualism between two groups

Table 2. It shows the equivalence between the two research groups, the experimental and the control.

variable	control group		experimental group		value (t)	Error level
	Mean	SD	Mean	SD		
explosive power	34.85	1.345	34.142	0.899	1.168	0.266
Handling	15.142	0.899	16.00	1.00	1.686	0.118
Peaceful scoring	7.00	0.577	6.857	0.690	0.420	0.682
scoring from under the basket	9.142	0.690	9.00	0.577	0.422	0.679

*Moral at error level (0.05)≥with a degree of freedom of.(12)

Main experiment

An AI-enhanced training program has been developed to develop explosive power, passing and shooting skills in young female basketball players .Using ChatGPT technology, the program's goal is to use artificial intelligence technologies to analyze the physical and skill capabilities of young female players, then customize individual training sessions tailored to each player's needs based on accurate data. Data is collected using advanced performance sensors and motion tracking devices (accelerometer & gyroscope), then processed by artificial intelligence technologies to provide personalized training recommendations.

Application period: The training program begins on Wednesday, November 13, 2024, and continues until Wednesday, January 8, 2025.

Artificial intelligence is used to design innovative training strategies aimed at preparing female athletes to compete.

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Players are classified into three levels (high, medium and weak) using the motion sensor.

The program extends over 8 weeks.

The program includes two training units per week, on Sundays and Wednesdays.

Focus on developing explosive power: The program includes targeted exercises to improve explosive power, which is the basic physical ability in basketball that greatly affects skill performance.

Improving basic skills: Specific exercises include improving ball control, passing, dribbling, and shooting skills. Each drill is designed to reflect the players' physical and technical abilities.

Gradual adaptation: The program features a gradual adjustment mechanism based on the improvement of each player's physical abilities, ensuring maximum benefit from the exercises.

Exercises are included that rely on periods of intense effort followed by controlled rest periods based on data generated by the physical response.

Players' stress is analyzed and training loads are carefully adjusted to reduce the possibility of injury.

The system uses artificial intelligence to analyze performance and provide weekly updates on the training program based on progress.

The training load is distributed according to the players ’levels using an artificial intelligence program.

Total number of training units: 16 training units over the course of the program.

The control group trains according to the trainer's curriculum.

Post-tests

The researcher conducted the post-tests on the players on Sunday, January 12, 2025. She conducted the tests for explosive power and the skills of passing and shooting at the Sulaymaniyah Sports Club stadium at (thirty past three). The researcher conducted the post-tests with the same procedures as the pre-tests on the team’s players:

Statistical methods

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The data were processed to achieve the research objectives and hypotheses using statistical methods. The researcher used the SPSS statistical package and the following statistical laws:

1-Arithmetic mean.

2-The mediator.

3-Standard deviation.

4-Coefficient of skewness.

5-T-test for unrelated samples

6-T-test for correlated samples

Result

Table 3. Shows the arithmetic mean and value t calculated in the pre- and post-tests of the control group

Test name	Pre-test		Post-test		Mean Deference	T value	P-value
	Mean	SD	Mean	SD			
explosive power	34.85	1.345	40.0	1.00	5.142	8.18	0.000
Handling	15.142	0.899	16.857	0.690	1.714	9.292	0.017
Peaceful scoring	7.00	0.577	7.857	0.377	0.857	6.00	0.001
scoring from below basket	9.142	0.690	10.143	0.899	1.00	4.583	0.004

*Significant at 6 degrees of freedom and significance level(0.05) ≥

Table 4. Shows the arithmetic mean and value) t (calculated in the pre- and post-tests of the control group

Test name	Pre-test		Post-test		Mean Deference	T value	P-value
	Mean	SD	Mean	SD			
explosive power	34.142	0.899	42.571	0.975	8.428	14.75	0.000

Handling	16.00	1.00	18.0	0.577	2.00	9.165	0.000
Peaceful scoring	6.857	0.690	8.851	0.899	2.00	6.481	0.001
scoring from below basket	9.00	0.577	11.571	0.786	2.571	8.647	0.000

*Significant at 6 degrees of freedom and significance level(0.05) ≥

Table 5. Shows the differences between the experimental and control research groups.

variable	control group		experimental group		T value	P-value
	Mean	SD	Mean	SD		
explosive power	40.0	1.00	42.571	0.975	4.869	0.000
Handling	16.857	0.690	18.0	0.577	3.361	0.006
Peaceful scoring	7.857	0.377	8.851	0.899	2.711	0.019
scoring from under the basket	10.143	0.899	11.571	0.786	3.168	0.008

*Moral at error level (0.05)≥with a degree of freedom of.(12)

Discussing

The results of the study showed that there were statistically significant differences between the experimental group and the control group in all studied physical and skill variables (explosive power, passing, layup, and under-the-basket scoring), in favor of the experimental group, as the experimental group showed a clear improvement in all studied variables compared to the control group. This improvement is attributed to the integration of modern technologies and advanced training methods, which indicates the effectiveness of the training program based on artificial intelligence techniques and the use of motion sensors. Explosive power: The players of the experimental group achieved a significant improvement in explosive power (42.571) compared to the control group (40.0), with a (t) value of (4.869) and a significant significance at the (0.000) level. This improvement is attributed to the precise ability of the motion sensors to provide immediate and accurate feedback on motor performance, and the precision of the training program in designing an individual training load appropriate for each player, based on the data provided by the performance sensors. This allows the training to be adapted to each player's physical condition, thus improving its ability to maintain explosive power, which helps players and coaches modify exercises and improve the quality of movements during training. This is consistent with (Chollet, 2017) (that artificial intelligence techniques contribute to designing individual training units based on the physical level of each player, which increases the efficiency of physical development) (Chollet, 2017, p. 154) and this was reinforced by (Baca et al., 2020) by saying (that the use of modern techniques in training programs is an important factor in achieving excellence) (Baca, Dabnichki, Heller & ,Kornfeind, 2020, p. 89). As for the skill of handling (passing), the results showed that the experimental group recorded a higher average (18.0) compared to (16.857) for the control group, and the value (t) (3.361) was significant (0.006). This indicates that the use of artificial intelligence with motion tracking devices helped improve motor precision and neuromuscular coordination during handling skills. Feedback plays a key role in correcting motor errors as they occur, as feedback is important in accelerating the learning process, as stated by Nizar Al-Talib and Kamel Al-Wais" :A person who knows their progress and success will progress faster than someone who trains without this knowledge ".(Al-Talib and Al-Wais, 2002, p. 124) In ladder scoring, the experimental group scored an average of 8.851, compared to 7.857 for the control group, with a t-value of 2.711 at a significance level of 0.019. This confirms that training using motion sensors contributed to improving balance, motor timing, and spatial awareness during ladder scoring. Zhang et al., 2021, also confirms this. (Artificial intelligence techniques are capable of analyzing fine motor patterns during jumping and shooting, which supports the development of skill performance) (Zhang & all, 2021). The results of scoring from under the basket showed that the experimental group outperformed the control group with an average of (11.571) compared to (10.143), and the (t) value reached (3.168) at a significance of (0.008), indicating that the program helped players improve movement timing, shooting angle, and appropriate force to reach the goal. Here, (Pueo et al., 2017) shows that motion sensors can record acceleration and rotation and identify fine motor errors around the basket (Pueo & al., 2017, pp. 218-227). These results indicate that the use of artificial intelligence with motion sensors is not limited to just collecting data, but rather contributes to improving the quality of performance through "reinforced learning and precise individual training that suits each player's physical and skill characteristics. The continuous interaction between the players and the system is also important ".Smart is a psychological stimulant that increases concentration.

Conclusions and recommendations

Conclusions

1-The adoption of artificial intelligence techniques in sports training works to develop the explosive power of young female basketball players.

2-The adoption of artificial intelligence techniques in sports training works to develop the handling skills of young female basketball players.

3-The adoption of artificial intelligence techniques in sports training works to develop the skill of peaceful shooting among young female basketball players.

4-The adoption of artificial intelligence techniques in sports training works to improve the jump shooting skill of young female basketball players.

5-These results underscore the importance of integrating AI technologies into sports training, as sensors provided accurate analysis that helped improve physical and skill performance.

Recommendations

1- Promoting the use of smart sensing technologies to accurately analyze motor and skill performance, contributing to the development of detailed databases that help coaches design targeted and effective training programs tailored to each player's needs.

2-Leveraging artificial intelligence technologies within training modules to dynamically adjust training loads and provide training plans that address individual differences, thus maximizing performance efficiency and improving individual training outcomes.

3-Encourage future comparative research comparing the effectiveness of AI-enhanced training with traditional training methods, to measure the impact of technology on developing the physical and skill performance of young female basketball players.

4-Developing smart training platforms and applications based on artificial intelligence that provide immediate feedback and real-time performance analysis, enhancing self-learning among female athletes and supporting continuous and accurate skill improvement.

Appendix

Sample training program exercises designed using artificial intelligence techniques

Proposed training unit to develop explosive power, passing and shooting skills

Training unit duration: 60 minutes   Number of units per week: 2 units

Objective: To develop explosive power and basic skills (passing - shooting)

1-Warm-up (10 minutes) – for all levels

General Exercises (3 minutes): Light jogging + arm rotation + trunk rotation

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Dynamic warm-up (5 minutes): Foot speed drills, lateral jumps

Sensor-guided exercises (2 minutes): Small acceleration movements with motion analysis to condition the target muscles.

2- Main exercise: Developing explosive power (20 minutes)

Exercise: Repeated vertical jumps with rubber resistance

Level	Intensity (resistance/speed)	repetition	Rest between rounds
High	High	10 × 4	30seconds
average	Medium	10 × 5	40seconds
weak	low	10 × 6	40seconds

- Monitored via sensors, and direct feedback provided.

3- Skill Exercise 1: Fast, Accurate Passing (15 minutes)

Exercise: Passing from the movement within the squares

Level	Intensity (resistance/speed)	repetition	distance between colleagues	Rest between rounds
High	High	12 × 2	5meters	30seconds
average	Medium	12 × 3	4meters	40seconds
weak	low	12 × 4	3meters	40seconds

- Reaction time, number of accurate passes, and pass force are calculated via sensors.

4- Skills Exercise 2: Shooting under pressure (10 minutes)

Exercise: Shooting from the move after dribbling

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Level	Intensity (resistance/speed)	repetition	Pressure type	Rest between rounds
High	High	6attempts x 2 rounds	mobile defender	30seconds
average	Medium	5attempts x 2 rounds	Fixed defender	40seconds
weak	low	4attempts x 2 rounds	No defender	40seconds

5- Cool down (5 minutes)

Stretching, stretching, and deep breathing exercises

Review quick performance data via the sensor's smart app.

Technical notes

AI can be used at the end of the module to provide individual player reports and analytical reports to the coach.

Workouts change weekly as the player progresses based on data analysis.

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Pulmonary Function Differences between Trained Padel Players and Physically Inactive Young Adults in Saudi Arabia: A Cross-Sectional Study

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Abstract

This study aimed to assess and compare pulmonary function parameters between trained padel players and physically inactive young adult males in Saudi Arabia. Forty-eight participants (23 padel players, 25 untrained controls), aged 20.8 ± 1.67 years, underwent spirometry testing using the MIR New Spirolab device following international standards and scholarly exercise physiology frameworks and guidelines. The assessments included static lung volumes, dynamic capacities, and maximal ventilatory performance. The trained padel players demonstrated significantly higher values in inspiratory reserve volume, expiratory reserve volume, inspiratory capacity, vital capacity, forced expiratory volume in one second, peak expiratory flow, and maximal voluntary ventilation compared to the control group ($p < 0.001$). The study revealed no differences between the groups regarding tidal volume measurements and forced expiratory volume to forced vital capacity ratios. The study results show that regular padel training leads to better pulmonary function, which suggests the sport can enhance respiratory fitness in active people.

Keywords*:* pulmonary adaptation, respiratory volume, intermittent sport, spirometry testing, exercise physiology.

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Introduction

Padel is a contemporary racket sport that unites elements of tennis and squash. It is a doubles sport played on a confined court. The game was developed in Mexico in the late 1960s, but has seen its popularity grow worldwide and experienced rapid expansion in recent decades, mainly in Europe and the Middle East. Padel has become increasingly popular in Saudi Arabia under the framework of Vision 2030, which promotes community sports and well-being. The sport fits into the category of intermittent high-intensity physical activity because it demands quick movements and sustained bursts of acceleration and deceleration, thus it engages both the aerobic and anaerobic energy systems (Escudero-Tena et al., 2024).

Participation in sustained high-intensity or endurance-based sports leads to cardiopulmonary system adaptations that improve athletes' respiratory efficiency and ventilatory performance. The adaptations caused by endurance training resulted in enhanced chest wall flexibility and strengthened respiratory muscles, together with better alveolar ventilation (Hackett, 2020; McArdle, Katch, & Katch, 2015; Vainshelboim, 2016). The respiratory system adapts to increased vital capacity alongside inspiratory reserve volume and expiratory reserve volume while improving dynamic airflow parameters, such as forced vital capacity, forced expiratory volume in one second, and peak expiratory flow (Razzaq et al., 2016; Shadmehri et al., 2021). Previous research has demonstrated that trained athletes, especially those who participate in endurance and intermittent sports, show better pulmonary function test results than people who do not exercise (Marangoz et al., 2016). A study by Yasul et al. (2022) revealed that male sport climbers demonstrated larger inspiratory reserve volume and maximal voluntary ventilation than untrained controls, because climbing activities require frequent ventilatory efforts. Similarly, Ahsan and Ali (2023) found that athletes who played randomly intermittent dynamic sports like futsal had significantly higher physiological measures, including peak inspiratory and expiratory flows, and forced vital capacity, compared to athletes in other sports, indicating that sport-specific ventilatory demands may drive respiratory adaptations. Exercise physiology research supports these findings by showing that training improves pulmonary diffusion capacity while reducing ventilatory effort at submaximal exercise levels (McArdle et al., 2015).

Research on the pulmonary profiles of padel athletes remains extremely rare, despite the extensive knowledge available about athletic respiratory profiles. Currently, literature lacks any study that evaluates both static and dynamic pulmonary function tests of trained padel players compared to inactive individuals. This lack of understanding about the topic requires an investigation to study padel's effects on respiratory health and capacity specifically among youth and recreational athletes.

The present study assessed different pulmonary function indicators between Saudi Arabian padel players who trained regularly and people who stayed physically inactive. The study results enhance our understanding of sports-related respiratory adjustments while serving to develop initiatives for using padel to boost respiratory wellness. The results of this study will have a substantial effect on the development of padel; thus, it is a crucial piece of research.

Methods

Study Design and Participants

This study used a cross-sectional approach to evaluate how trained padel players compare to inactive individuals in terms of pulmonary function. The padel group consisted of people who practice padel at private clubs (at least three times per week) and perform both aerobic and anaerobic exercises that are typical of padel match play. The study included 48 male participants between the ages of 18 and 26, divided into two groups: 23 trained padel players recruited from private clubs in the Western Region of Saudi Arabia, and 25 physically inactive individuals recruited from Umm Al-Qura University, in Makkah. The data collection was conducted at the Exercise Physiology Laboratory in the Department of Sport Sciences, College of Education, at Umm Al-Qura University, between January and March 2025 and took place across nine data-collection sessions.

The trained group consisted of padel players who met four conditions for participation: they had to have been training and competing in padel for at least three years, with an average of 12 training and competitive hours per week; be nonsmokers; have no respiratory or cardiovascular diseases; and have no active respiratory tract infections. The physically inactive participants (untrained controls) underwent the same screening process to rule out smoking, medical conditions, and recent illnesses, and to confirm that they were not connected with any particular sport and did not engage in a regular exercise program. The study received ethical approval from the institution, and all participants received information about the research goals and methods before testing and signed a written consent form.

Anthropometric Assessments

The first data-collection visit included measurements of participants’ height in centimeters and weight in kilograms. The digital physician scale (Model: MDW-250L, Adam Equipment, United Kingdom) used in this study followed the International Society for the Advancement of Kinanthropometry (ISAK) protocols for measurements (Esparza-Ros et al., 2019). The calculation of body mass index (BMI) requires weight in kilograms, divided by height in meters squared (kg/m^2).

Pulmonary Function Testing

The MIR New Spirolab device (Medical International Research, Italy), a portable turbine-based spirometer for clinical and research purposes, was used to administer pulmonary function tests. This device meets the technical standards of the American

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Thoracic Society (ATS) and European Respiratory Society (ERS) for accuracy and reproducibility (Exarchos et al., 2020; Miller et al., 2005). The tests were conducted according to ATS/ERS guidelines in controlled settings where room temperatures stayed at 22 °C and relative humidity was maintained between 30% and 60%.

The participants completed the spirometry tests while seated, using a disposable mouthpiece and a nasal clip to stop nasal air leakage. They received instructions for maximal respiratory efforts followed by at least three test repetitions. The analysis selected the most reproducible test result, which satisfied the <5% variability margin criterion.

The measured variables led to functional classification-based groupings for reporting purposes according to international standards and scholarly exercise physiology frameworks (McArdle, Katch & Katch, 2015). The nine pulmonary variables were organized as follows:

1. Static Lung Volumes (Volume Parameters): These represent air volumes associated with normal and maximal respiratory movements:

- Tidal Volume (VT): The amount of air that moves in or out of the lungs with each respiratory cycle. Unit: Liters (L)
- Inspiratory Reserve Volume (IRV): The maximum volume of air that can be inhaled after the end of a normal inspiration. Unit: Liters (L)
- Expiratory Reserve Volume (ERV): The volume of gas that can be maximally exhaled from the end-expiratory lung volume during tidal breathing. Unit: Liters (L)
- Inspiratory Capacity (IC): Maximal volume that can be inspired after a normal expiration (VT + IRV). Unit: Liters (L)
- Vital Capacity (VC): Total air exhaled after a maximal inspiration. Unit: Liters (L) (Ponce et al., 2023)

2. Forced Expiratory Parameters (Dynamic Lung Function): These parameters assess the speed of airflow and the degree of airway resistance during maximal forced breathing maneuvers:

- Forced Expiratory Volume in 1 Second (FEV_1): The volume of air forcibly exhaled during the first second of a maximal expiration following full inspiration (reflects the degree of airway obstruction). Unit: Liters (L)
- FEV_1/FVC Ratio (%): The proportion (%) of the total forced vital capacity (FVC) that is exhaled in the first second (used to differentiate between obstructive and restrictive lung diseases). Unit: Percentage (%)

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- Peak Expiratory Flow (PEF): The highest flow rate achieved during a forced expiration starting from full lung inflation (reflects large airway function and effort-dependent).

3. Maximal Ventilatory Capacity: This parameter combines the power of the respiratory muscles with the ventilatory system's ability to sustain effort.

- Maximal Voluntary Ventilation (MVV): The greatest amount of air that can be breathed in and out during one minute through forceful and deep breathing. The test measures air volume for 12 seconds before calculating the one-minute value. The test evaluates total ventilatory capacity, while airway resistance, lung compliance, and neuromuscular effort affect the results. Unit: Liters per minute (L/min)

Statistical Analysis

Statistical analyses were performed using SPSS Version 24.0 (IBM Corp., Armonk, NY, USA) and MedCalc Statistical Software Version 12.218 (MedCalc Software Ltd., Ostend, Belgium). The data distribution was evaluated using multiple approaches, including the Kolmogorov–Smirnov test, visual inspections of histograms and Q–Q plots, and statistical evaluations of skewness and kurtosis.

Variables that were normally distributed were expressed as mean ± standard deviation (SD). Independent samples *t*-tests were applied to assess between-group differences. The threshold of statistical significance was set at $p < 0.05$. Effect sizes were calculated using Cohen's *d* and interpreted as small (0.2), moderate (0.5), or large (0.8), in accordance with Cohen's (1988) guidelines.

A post-hoc power analysis was conducted using G*Power 3.1 (*t*-tests: difference between two independent means, two-tailed), assuming a large effect size (Cohen's $d = 0.80$). Based on the final sample of 23 trained padel players and 25 untrained controls, the analysis yielded an achieved power of 0.81 ($1–\beta = 0.805$) at an alpha level of $\alpha = 0.05$, confirming sufficient sensitivity to detect significant differences in pulmonary function measures between groups.

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Results

The research participants' demographic information appears in Table 1. As previously noted, the study involved 48 male participants, 23 trained padel players and 25 physically inactive controls. Participants ranged in age from 18 to 26 years; the average age of the entire study population was 20.8 ± 1.67 years. Participants had an average height of 172.2 ± 2.51 cm, and their mean body weight was 74.0 ± 4.26 kg. The mean BMI across all participants was 24.9 ± 1.48 kg/m².

The groups showed no significant statistical differences in age (p = 0.462), height (p = 0.180), weight (p = 0.610), or BMI (p = 0.843), which confirmed their demographic similarity at the beginning of the study.

Table 1 Participants' Demographic Characteristics (N = 48)

Variables	Overall (N = 48)	Trained padel players (N = 23)	Untrained controls (N = 25)	*t*	*p*-value
Age (years)	20.8 ± 1.67	21.0 ± 1.95	20.6 ± 1.38	0.731	0.462
Height (cm)	172.2 ± 2.51	172.7 ± 3.03	171.7 ± 1.85	1.335	0.180
Weight (kg)	74.0 ± 4.26	74.3 ± 5.20	73.6 ± 3.73	0.507	0.610
BMI ($kg \cdot m^{-2}$)	24.9 ± 1.48	24.9 ± 1.62	25.0 ± 1.38	0.843	0.843

Figure 1 illustrates the differences in VT values between the trained padel players and the untrained controls. Independent samples t-tests were conducted to determine whether there were significant differences in VT testing between the groups. The results showed no significant differences in VT; $t(45.88) = 0.67$; $p = 0.506$, two-tailed; $d = 0.10$; or 95% CI [-0.099, 0.186].

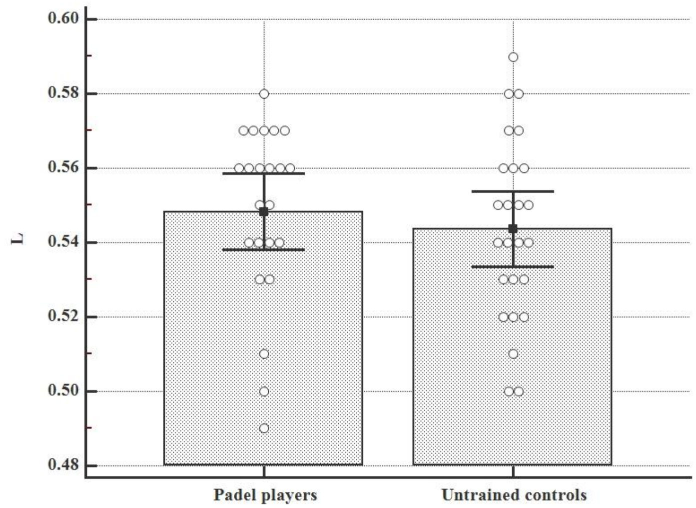

Figure 1. Comparison of tidal volume (VT) between trained padel players and untrained controls.

In contrast to the above, as Figure 2 shows, a significant difference was observed in IRV values between the trained padel players (2.276 ± 0.243 liters) and the untrained controls (1.768 ± 0.242 liters): $t(45.67) = 7.26$; $p < 0.001$, two-tailed; $d = 2.14$; 95% CI [0.367, 0.648].

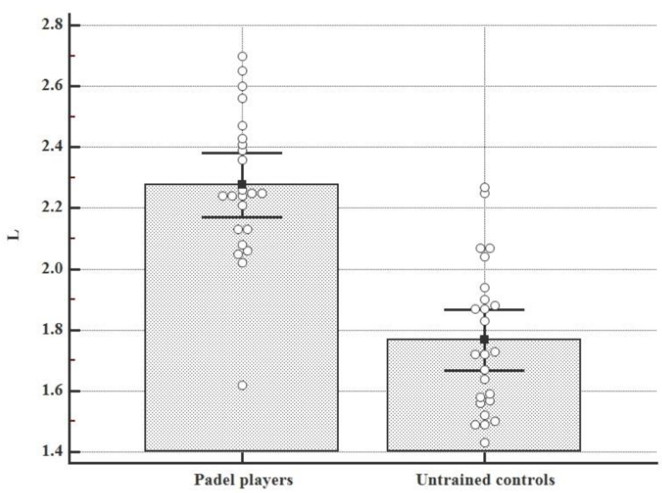

Figure 2. Comparison of reserve volume (IRV) between trained padel players and untrained controls.

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Regarding ERV, as shown in Figure 3, trained padel players (1.770 ± 0.152 liters) displayed significantly higher values than untrained controls (1.222 ± 0.173 liters): $t(45.89) = 11.63$, $p < 0.001$ (two-tailed); $d = 3.42$; 95% CI [0.452, 0.641].

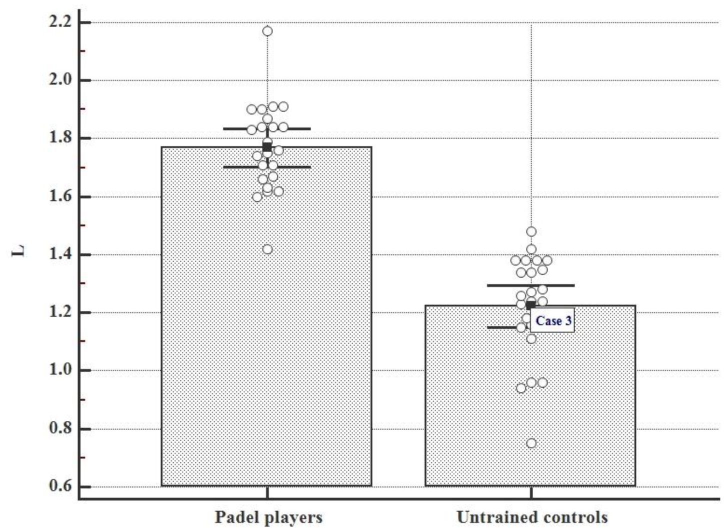

Figure 3. Comparison of expiratory reserve volume (ERV) between trained padel players and untrained controls.

As shown in Figure 4, trained padel players (3.978 ± 0.478 liters) had significantly higher IC values than their untrained counterparts (3.473 ± 0.496 liters): $t(45.01) = 3.59$; $p < 0.001$, two-tailed; $d = 1.06$; 95% CI [0.222, 0.788].

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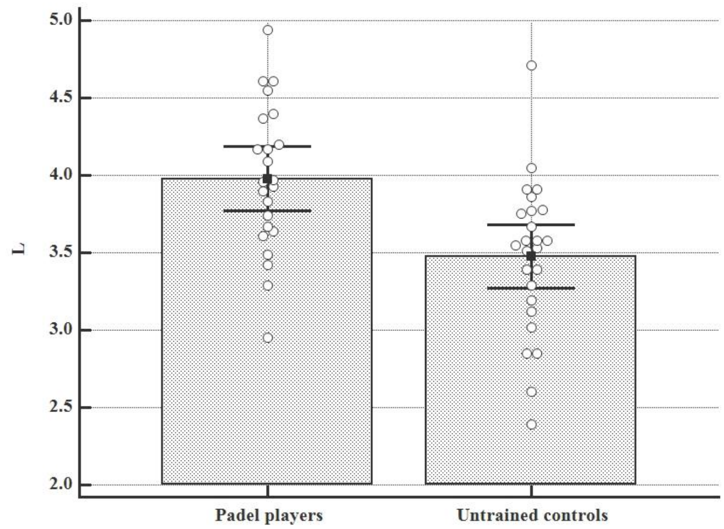

Figure 4. Comparison of inspiratory capacity (IC) between trained padel players and untrained controls.

Figure 5 presents the comparison of VC values between the trained padel players (6.527 ± 0.462 liters) and untrained controls (5.441 ± 0.585 liters). VC values were significantly higher in the trained group: $t(44.99) = 5.38$; $p < 0.001$, two-tailed; $d = 2.09$; 95% CI [0.511, 1.122].

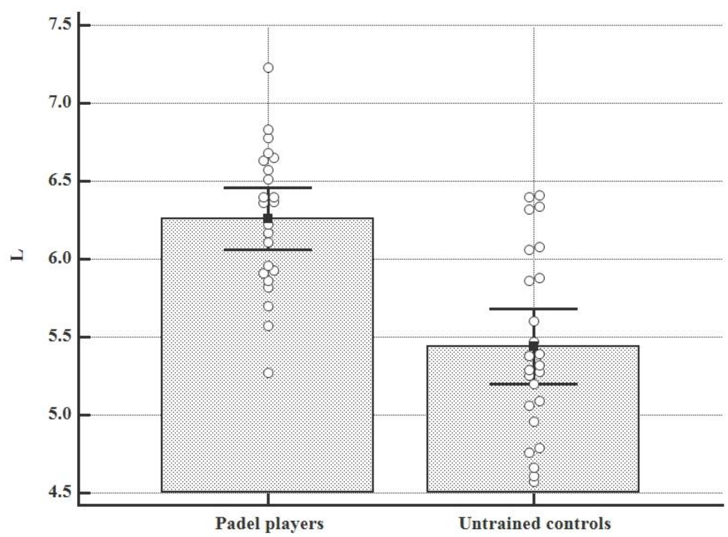

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Figure 5. Comparison of vital capacity (VC) between trained padel players and untrained controls.

Figure 6 shows that trained padel players (4.502 ± 0.189 liters) had significantly higher FEV1 values than untrained controls (4.225 ± 0.260 liters): $t(43.79) = 4.23$; $p < 0.001$, two-tailed; $d = 1.24$; 95% CI [0.145, 0.408].

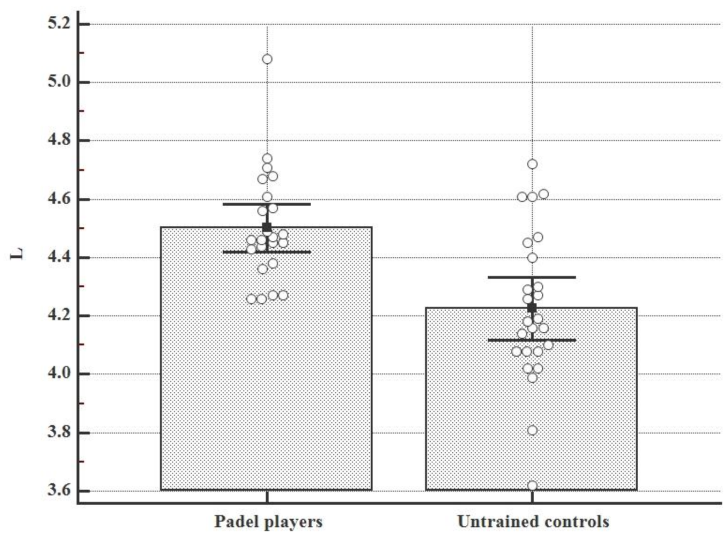

Figure 6. Comparison of forced expiratory volume in 1 second (FEV1) between trained padel players and untrained controls.

Figure 7 illustrates the differences in $FEV_1/FVC\%$ values between trained padel players (81.480 ± 1.645%) and untrained controls (80.548 ± 2.828%). The results showed no significant difference: $t(39.12) = 1.40$; $p = 0.175$, two-tailed; $d = 0.41$; 95% CI [-0.406, 2.270].

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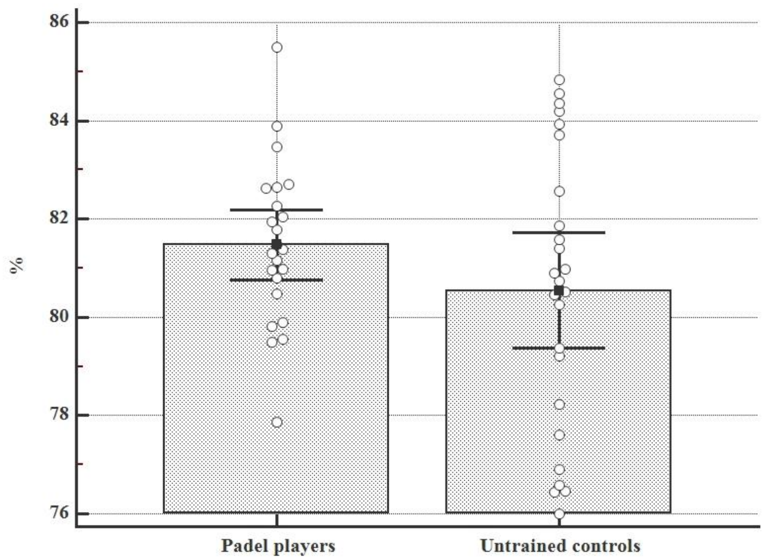

Figure 7. Comparison of total forced vital capacity (FEV_1/FVC%) between trained padel players and untrained controls.

Regarding PEF, as Figure 8 shows, trained padel players (6.144 ± 0.221 L/sec) displayed significantly higher values than untrained controls (5.733 ± 0.296 L/sec): $t(44.21) = 5.46$; $p < 0.001$ (two-tailed); $d = 1.60$; 95% CI [0.259, 0.563].

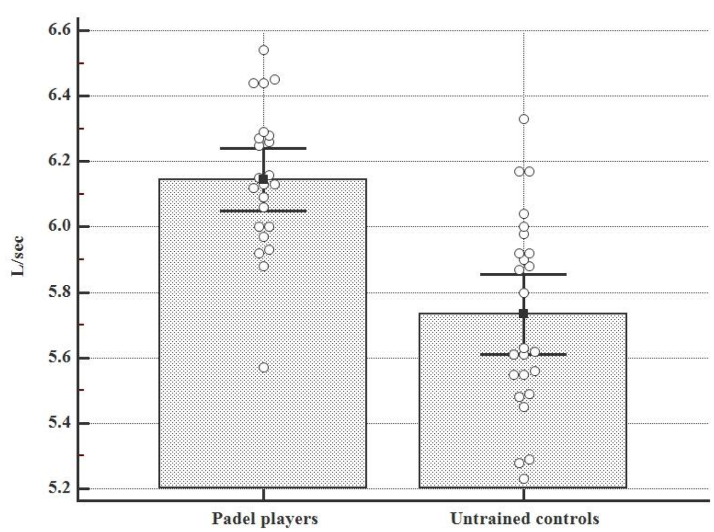

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Figure 8. Comparison of peak expiratory flow (PEF) between trained padel players and untrained controls.

As shown in Figure 9, trained padel players (122.284 ± 4.298 L/min) had significantly higher MVV values than their untrained counterparts (106.678 ± 7.802 L/min): $t(37.94) = 8.67$; $p <$ 0.001, two-tailed; $d = 2.50$; 95% CI [11.962, 19.249].

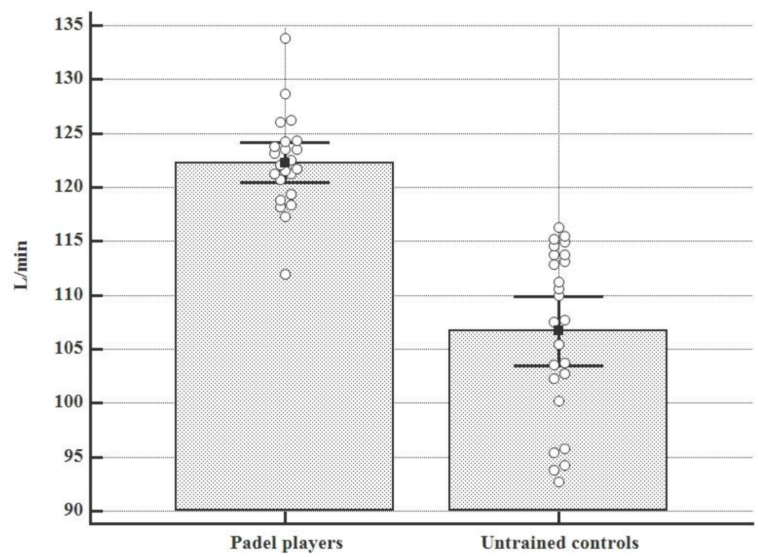

Figure 9. Comparison of maximal voluntary ventilation (MVV) between trained padel players and untrained controls.

Discussion

The research findings demonstrated that trained padel players achieved better pulmonary function results than inactive controls. The measured variables, ERV, IRV, VC, and MVV, showed large effect sizes, with d values of 3.42, 2.14, 2.09, and 2.50, respectively, which indicated significant physiological changes. Previous studies established that intermittent high-intensity efforts similar to padel match play led to better ventilatory efficiency and stronger respiratory muscles (Marangoz et al., 2016).

The trained players showed improved values in MVV, PEF, and FEV_1, compared to the inactive controls, but VT and the FEV_1/FVC ratio remained the same between the groups. The respiratory adaptations in this study were observed in dynamic ventilation parameters, rather

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than resting capacity, which is supported by the lack of significant group differences in VT and the FEV_1/FVC ratio. Soccer athletes participating in longer-duration high-intensity training demonstrated similar patterns of elevated FVC, FEV_1, and PEF values (Minaeifar, Rasekh, & Karirmi, 2020; Razzaq, Al-Madfai, & Saeed, 2016). A study by Ahsan and Ali (2023) supports this by showing that athletes who play randomly intermittent dynamic sports, such as soccer and rugby, have higher PEF and FVC values compared to athletes in other similar sports (e.g., volleyball and futsal), which demonstrates the respiratory benefits of sport-specific training.

In trained padel players, the VC and IC values increased because of the combined effects of increased alveolar recruitment and better thoracic compliance, which improved expiratory muscle function from the repeated maximal inspiratory and expiratory efforts in padel match play. Bouldering athletes have shown similar sport-specific improvements in lung volumes, according to Yasul, Öner, and Akçınar (2022), because their respiratory demands are both intensive and intermittent. The physiological changes observed match previous research findings, which demonstrate that forced breathing cycles enhance alveolar elasticity and stabilize intrapulmonary pressure dynamics (Delgado & Bajaj, 2021; Lofrese et al., 2021).

The combination of padel's intermittent high-intensity efforts, frequent directional changes, and repeated muscle activations leads to significant cardiorespiratory adaptations in trained players. Padel athletes develop better ventilatory capacity than inactive individuals because of the sport-specific neuromuscular and respiratory conditioning. Previous research demonstrated that playing padel regularly improves oxygen transport while boosting VO_2max and enhancing pulmonary ventilation efficiency, particularly during prolonged rallies and high-intensity phases (Martín-Miguel et al., 2025; Müller & Del Vecchio, 2018).

These physiological benefits match the sports characteristics described in Martín-Miguel et al.'s (2025) work because of the intermittent multidirectional movements and the hybrid aerobic-anaerobic characteristics of padel. Aerobic capacity remains a crucial performance factor in padel, but the observed high MVV values indicate a well-developed ventilatory reserve, which can delay fatigue in prolonged matches or rallies (Müller & Del Vecchio, 2018). The present study's findings enrich the scarce research on pulmonary adaptations in racket sports by demonstrating that padel provides an effective method for enhancing respiratory performance in young adults.

Limitations and Directions for Future Study

This research focused on healthy young adult males, using spirometric measures as its only assessment tool. The parameters used in this study offer essential information about pulmonary function, but they do not show changes in respiratory muscle strength or gas exchange efficiency. Future research should include female participants, as well as participants from different age groups and training backgrounds. Research designs that follow participants over time are also required, to determine how respiratory improvements change with training volume and intensity and whether they persist in the long term.

Conclusions

The research demonstrates that padel training enhances dynamic pulmonary function parameters in healthy young adult males. The research indicates that sport-specific respiratory requirements lead to quantifiable improvements in ventilation. Future research should aim to determine if similar adaptations occur in different populations and over extended training periods while using more extensive assessment tools to measure respiratory muscle strength and gas exchange efficiency changes.

Acknowledgments

The author thanks all participants who participated in this research by dedicating their time to it.

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Impact of ACTN3 Gene Polymorphism (R577X) on Physical Performance in Wrestlers of 74 kg Weight

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Abstract

The purpose of this study was to examine the relationship between the ACTN3 R577X polymorphism and muscle strength, vertical jump, and 30Â m sprint performance in wrestlers. RR were better performers in each of the assessed items compared with RX and XX athletes. The findings were consistent with the hypothesis of ACTN3 dominance in strength, power, and sprint performance, at least for power-oriented athletes. For all participants, there was a positive relationship between both indices of muscle strength and vertical jump height and negative relationships between these indices and sprint time, suggesting that greater muscle strength was related to improved sprint performance. These results emphasize the genetic component in sports performance and the possibility of using genetic information for talent identification and support optimization. The authors note that future research should investigate the interaction between ACTN3 and other genetic factors associated with athletic ability, as well as ethical concerns regarding the use of genetic information in sports. Overall, this investigation adds to the understanding of how genetics may contribute to athletic performance and better training for power sports.

Keywords: ACTN3, R577X polymorphism, athletic performance, strength, sprinting.

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Introduction

Genetic determinants significantly impact sports performance, especially in power and explosive sports, such as wrestling. Among all the genes studied, the ACTN3 gene has been identified as one of the most relevant, considering its involvement in muscle fiber composition and Fast-Twitch muscle, particularly, which is relevant for strength and speed (North et al., 1999). The ACTN3 gene, whose protein product is α-actinin-3 is necessary for fast-twitch muscle fiber function and presence of this protein has been reported to be related to superior performance in power sports (Berman & North, 2010; Coelho et al., 2016) .

The ACTN3 R577X polymorphism is the major variant of this gene, and R is the allele which expresses the functional α-actinin-3, while X is the variant which results in the expression of the nonfunctional protein. Thus, RR or RX genotypes may be more beneficial to explosive activities such as sprinting, jumping, and powerlifting as they carry functional α -actinin-3, while the XX genotype might benefit endurance as it lacks this protein (Eynon et al., 2014; Papadimitriou et al., 2018).

Previous research has revealed a strong correlation between the RR genotype and performance at an elite level in anaerobic-related sports. For example, Heffernan et al. (2016) also observed relevant findings in soccer players were (2016) whom reported that rugby players carriers of the RR genotype had higher strength and power levels (Coelho et al., 2016). Furthermore, (Koku et al., 2019) also found that the RR genotype was associated with higher performance in explosives strength tests in athletes. By contrast, those with the XX genotype have been faster in endurance activities suggesting again for sex specific differences of the gene in different sport talents (Heffernan et al., 2016; Massidda et al., 2019).

Of the polymorphisms in ACTN3 gene, its association with the performance of the endurance events is well-documented, but to those of combat disciplines as wrestling, which require aspects of speed, strength and overall anaerobic endurance, less is known relatively (Berman & North, 2010; Bıçakçı et al., 2024). Since wrestling is a sport, in which, high levels of power and strength in short periods are needed, it is essential to keep in mind the genetic appendices of performance. According (Mantovani et al., 2021), power athletes tend to have better performance because they carry the RR genotype and have increased explosiveness strength, which is very important to the wrestler.

Although only limited data are available for ACTN3 on wrestling, findings from other sports such as football, rugby and rowing are useful. For instance, (McAuley et al., 2021) performed a meta-analysis that reported significant links between the ACTN3 and footballer status. Similarly, (Massidda et al., 2019; Papadimitriou et al., 2018) reported that the RR genotype was

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significantly associated with power performance and supported the association between the genetic variant and performance in power sports as a maximally effort task.

The aim of this investigation was to evaluate the association between the ACTN3 R577X polymorphism and physical performance trait values of wrestlers belonging to the 74 kg category in the 30-meter sprint, leg strength, and vertical jump tests. Through investigation of these genetic factors, the research seeks to advance the knowledge regarding genetic determinants of combat sports performance, which may ultimately have implications on talent identification and training in wrestling.

Materials and Methods

Study Design

In this study, we applied a case-control design to investigate the association of the ACTN3 R577X polymorphism with physical performance in wrestlers. Materials and methods The investigation took place under standardized conditions using genetic profiling and physical performance testing with a group of male wrestlers, 74 kg weight class category. The study protocol was approved by the ethical review committee of the hospital, and a signed informed consent was obtained from all patients.

Participants

Participants were n = 10 wrestlers from Al-Kadhimiyah Wrestling Club in Baghdad, Iraq. All participants were male wrestlers aged between 18-30 and had at least 3 years competition experience. All subjects were assigned to the same 74 kg weight category to maintain uniformity. The participation criteria were for participants to be healthy, active athletes with any prior medical history of genetic disease (e. g., fragile X syndrome) or major injuries in the last six months. Exclusion criteria comprised subjects receiving medications or supplements that may influence muscle performance or metabolism.

Tools/Reagents

The following tools and reagents were used in the study:

Genetic Analysis: A commercial ACTN3 R577X genetic test kit (Genetic Health Labs, New York, USA) was used for genotyping the ACTN3 R577X polymorphism. This test is based on PCR (Polymerase Chain Reaction) amplification and restriction fragment length polymorphism (RFLP) analysis.

Physical Performance Testing

Leg Strength: A calibrated Leg Press Machine (Technogym, Italy) was used to assess leg strength, with participants performing a one-repetition maximum (1RM) test.

Vertical Jump Test: The Just Jump System (Club-Vita, USA) was used to measure vertical jump height, a standard test for evaluating explosive leg power.

30-Meter Sprint Test: The Digi Timing System (Brower Timing Systems, Utah, USA) was used to measure sprint times over 30 meters.

Blood Sampling

Blood samples were collected from all participants before the physical testing, using sterile techniques. Approximately 5 mL of blood was drawn from the antecubital vein of each participant. The samples were transferred to EDTA tubes for DNA extraction and genetic analysis. Blood collection was performed by a certified medical technician under sterile conditions, and all samples were stored at -20°C until the analysis was completed.

Training Protocol

The training program of this study was developed to fit the unique characteristics of the physical requirements of wrestling (improvement of strength, power, speed and anaerobic endurance). The protocol was divided into three main training modalities: strength and power, speed and agility, and endurance training. Every part was designed meticulously to make athlete Outstanding while keeping them safe and reduce the risk of injury. The training regimen ran for 8 weeks with clear progression guidelines to maintain ongoing development of the athletes' performance.

Strength Training

Wrestlers need strength training because it improves muscular endurance, allows to perform with greater force and increases the general control during a match. The strength component focused on compound lifts for large muscle groups to improve functional strength specific to wrestling. The strength workouts were performed on three a week (eg, Monday, Wednesday, and Friday). The training was periodized and allowed for incremental increases with no risk of overtraining.

Session Structure Warm-up The session started with a 10–15-minute warm-up that consisted of dynamic stretching (e.g., leg swings, arm circles) and foam rolling of large muscle groups. The primary lifts were based on compound exercises such as barbell squats (three to four sets of 6–8 repetitions at 85% 1RM), deadlifts (three to four sets of 6–8 repetitions at 80% 1RM), bench press (three to four sets of 6–8 repetitions at 80% 1RM), and overhead press (three sets of 8 repetitions). Accessory lifts were also incorporated to target muscles used in wrestling: pull-ups (3 sets of 8-10 reps), Romanian dead lifts (3 sets of 8-10 reps), and lunges (3 sets of 12 reps per leg). All the sessions ended with static stretching to help maintain and even improve flexibility and to decrease the muscle stiffness that occurs after exercising.

The intensity of the exercises was progressively increased throughout the study. Once participants could perform the prescribed repetitions with proper form, the load was increased by 2.5-5% to ensure continuous strength development. In week 4, a reload week was incorporated to allow for recovery and to prevent overtraining.

Speed and Agility Training

Speed and agility are fundamental qualities for wrestlers, as they are crucial during dynamic movements such as takedowns, escapes, and transitions. The speed and agility component of the training protocol was structured to improve quickness, reaction time, and explosive power. Sessions were scheduled twice a week (e.g., Tuesday and Thursday), and were focused on high-intensity interval training (HIIT), sprints, and agility drills.

The session structure began with 10 minutes of dynamic warm-ups, including drills like high knees, butt kicks, and lateral shuffles, followed by mobility exercises to enhance joint flexibility and range of motion. The main training included six to eight sets of 30-meter sprints at maximum effort, with a 90-second rest period between each sprint to promote recovery and maintain high intensity. Shuttle runs (five sets of 20 meters) focused on rapid changes in direction to mimic the movements involved in wrestling, while lateral agility drills (four sets of 10-15 repetitions using cones or markers) practiced side-to-side movement. Plyometric exercises included box jumps (three sets of 8 repetitions), broad jumps (three sets of 10 repetitions), and med ball slams (three sets of 10 repetitions). Each session concluded with static stretching, focusing on the hip flexors, quads, hamstrings, and calves, holding each stretch for 20-30 seconds to improve flexibility and reduce muscle tension.

Over the course of the training period, the distance for sprints was gradually increased by 5 meters in weeks 4 and 6. Similarly, plyometric exercises, such as box jumps, were made more challenging by progressively increasing the box height or adding external resistance (e.g., weighted vests).

Endurance Training

Conditioning is essential in wrestling because it gives competitors the ability to sustain a high level of performance in the match. The endurance training program was designed to increase muscular anaerobic capacity, lactate threshold, and general muscular endurance. The energy needs of a wrestling match were replicated using High Intensity Interval Training (HIIT). Sessions were held on average two times per week (e.g., one on Monday and another on Thursday), with a combination of sprints, circuit training, and endurance intervals.

The session format started with 10 minutes of light jogging and dynamic stretching, to warm up lower body muscles before high-intensity exercises. The primary training consisted of 4-minutes of high-intensity (80-90% of maximum heart rate) effort alternated by 2-minutes of active recovery (easy jogging walking). This was performed 5-6 times to replicate the anaerobic nature of wrestling. The Tabata Protocol involved 20 seconds of work, followed by 10 seconds of rest, for 8 rounds. Exercises included sprints, kettlebell swings, and jump rope, designed to improve cardiovascular and muscular endurance. Circuit training combined endurance and strength exercises performed in quick succession with minimal rest, such as push-ups, burpees, mountain climbers, and jump squats. Three circuits were completed with 10-15 repetitions for each exercise. The session ended with light jogging and static stretching, focusing on major muscle groups like the hamstrings, quads, and calves to improve flexibility and aid in muscle recovery.

The HIIT intervals were progressively intensified by increasing the duration of the work phase by 30 seconds every two weeks, while the rest period was gradually reduced by 10 seconds. By week 4, resistance was introduced to certain exercises, such as using a weighted vest for sprints and adding external weights for bodyweight exercises, to further enhance endurance.

Data Collection

Physical performance data was collected on three separate days, spaced one week apart, to ensure reliability and reduce the impact of fatigue:

Day 1: Genetic testing and blood sampling were conducted. Participants were also given a familiarization session with the testing equipment.

Day 2: Leg strength (1RM) and vertical jump tests were administered.

Day 3: 30-meter sprint times were recorded.

Performance tests were conducted in the morning hours to control for diurnal variations in physical performance. All tests were supervised by a certified strength and conditioning coach to ensure proper technique and minimize injury risk.

Statistical Analyze

Data were analyzed using SPSS version 25 (IBM). Descriptive statistics (mean ± standard deviation) were calculated for all variables. One-way Analysis of Variance (ANOVA) was used to compare the differences in performance measures (leg strength, vertical jump, sprint time) between different ACTN3 genotypes (RR, RX, XX). A Tukey post-hoc test was applied when significant differences were found. The level of significance was set at $p < 0.05$. Correlations between genetic variations and performance metrics were assessed using the Pearson correlation coefficient.

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Results

Table 1. Descriptive Statistics Coefficients for Performance Measures across ACTN3 Genotypes (RR, RX, XX)

Genotype	Measure	Mean	Standard Deviation	Skewness
RR	Leg Strength (kg)	215	7.91	0.15
	Vertical Jump Height (cm)	55	2.29	0.25
	30m Sprint Time (s)	4.1	0.13	0.12
RX	Leg Strength (kg)	204	8.07	0.18
	Vertical Jump Height (cm)	52	2.01	-0.08
	30m Sprint Time (s)	4.3	0.15	0.10
XX	Leg Strength (kg)	180	7.91	0.30
	Vertical Jump Height (cm)	46	1.58	0.52
	30m Sprint Time (s)	4.8	0.18	-0.25

Table 2. ANOVA Results for Performance Measures Across ACTN3 Genotypes (RR, RX, XX)

Measure	RR Mean	RX Mean	XX Mean	F-statistic	p-value
Leg Strength (kg)	215	204	180	6.58	< 0.05
Vertical Jump Height (cm)	55	52	46	4.56	< 0.05
30m Sprint Time (s)	4.1	4.3	4.8	5.12	< 0.05

Table 3. Tukey Post-Hoc Test for Performance Measures Across ACTN3 Genotypes (RR, RX, XX)

Comparison	Mean Difference	Standard Error	p-value
RR vs RX (Leg Strength)	11.00	2.56	0.02
RR vs XX (Leg Strength)	35.00	2.56	0.001
RX vs XX (Leg Strength)	24.00	2.56	0.01
RR vs RX (Vertical Jump)	3.00	1.25	0.04
RR vs XX (Vertical Jump)	9.00	1.25	0.002
RX vs XX (Vertical Jump)	6.00	1.25	0.01
RR vs RX (Sprint Time)	-0.20	0.14	0.13
RR vs XX (Sprint Time)	-0.70	0.14	0.001
RX vs XX (Sprint Time)	-0.50	0.14	0.01

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Table 4. Pearson Correlation for Performance Measures Across ACTN3 Genotypes

Measure 1	Measure 2	Pearson Correlation Coefficient	p-value
Leg Strength	**Vertical Jump Height**	0.85	0.004
Leg Strength	**30m Sprint Time**	-0.45	0.04
Vertical Jump Height	**30m Sprint Time**	-0.60	0.01

Discussion

The findings of the present investigation add strong evidence in favor of the importance of the ACTN3 R577X polymorphism in determining elite strength and power phenotypes. More specifically, the results evidence that participants with the RR genotype achieved a better score for leg strength, vertical jump and 30 m TA, relative to those with the RX and XX genotypes. These findings are consistent with the notion that the ACTN3 R577X polymorphism makes a substantial contribution to several aspects of performance in sport, including power- and sprint-related traits.

For the leg strength of the dominant leg and GELE, a notably higher performance was found in the RR genotype vs both the RX and XX genotypes. This result is in line with the literature, where the RR genotype has been found to be linked to a greater amount of fast-twitch muscle fibers (fibers that are necessary for quick, forceful contractions demanded in explosive movements, like jumping or sprinting) (North et al., 1999; Papadimitriou et al., 2016). The significant relationship between leg dynamic strength and vertical jump in the present study reinforces the notion that leg strength remains a potential predictor of performance during explosive movements. This is consistent with (Jacob et al., 2018; Papadimitriou et al., 2016) who also observed high relationships among lower limb strength and vertical jumping outcomes in professional; athletes.

Although this study supports previous findings, it provides an additional aspect by focusing A C T 3N3 R577X polymorphism in wrestling athletes in a certain weight category (74 kg) (Qi et al., 2024). This way we have a more detailed knowledge on how a genetic polymorphism may impact performance in a given sport. Additionally, a limitation of the study is the reliance on a limited sample size involving 10 wrestlers per genotype group, which can limit the wider applicability of the findings with larger and more representative sample populations being required for more generalizable results. However, the coherence of results obtained by different tests–leg strength, vertical jump height, and sprint—indicates a significant genetic instructiveness in athletic events, especially in power- and speed-type sports (Etz & Arroyo, 2015).

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For the association between leg strength and sprint time, the result that stronger athletes run faster times is consistent with previous work conducted by (Del Coso et al., 2022; Papadimitriou et al., 2018). The negative correlation found between leg strength and sprint time in the present study emphasizes the importance on the ability to produce force rapidly in improving sprint acceleration. Furthermore, the inverse correlation found between the height of peak vertical jump and 40-yd sprint time highlights the association of explosiveness with both tasks. These results are in accordance with the observations of (Ahmetov & Fedotovskaya, 2015; Chen et al., 2023; Melián Ortiz et al., 2021) found strong relationships between athletes' results in explosive power tests and their results in various athletics tests.

Interestingly, one new feature of the current study is the genetic information in performance traits of elite wrestlers, which has been relatively neglected in genetic studies previously. This supports the importance to individualize training due to employment of genetic testing in order to understand to which kind of sports an athlete is genetically predisposed. Genetic factors such as the ACTN3 polymorphism, have previously been demonstrated to have an impact on the performance of strength-power sports (Yang et al., 2003). This indicates the need of being genetic data part of the athlete evaluation in order to adjust the training to the specific genetic predisposition of individual athletes. Additionally, (Ma et al., 2013) who further reinforce the concept of genetic testing to establish individualized sports training protocols for athletes, depending on their genetic predisposition. The argument put forward in the introduction of this current investigation— that the ACTN3 R577X polymorphism is associated with varying performance in athletes—was supported by evidence of significant genotype-related differences in performance. Subjects with RR genotype performed better with respect to all the analyzed variables compared to the RX and XX athletes, proving the hypothesis.

Yet while the data is consistent with the hypothesis, it implies that more work is necessary to discern the nuanced nature of how genetic factors may be modulated through training and environment to determine optimal competitive sports performance. The limitations of this study, and the fact that the sample was small and limited to a single sport and weight class suggest the need to replicate this study with larger, more diverse populations. Also, ACTN3 is also 1 of the multiple genes associated with athletic status so, further future investigations ought to consider examining the possible interactions between ACTN3 and other genotype variables like ACE I/D polymorphisms in order to obtain a more complete picture of genetic factors regarding athletic status.

In summary, this investigation extends the great importance of the ACTN3 R577X polymorphism to strength, explosive power and speed performance. The evidence supporting the greater expression of the RR genotype in power- and sprint-orientated sports is reinforced, and serves to emphasize the role of genetic endowment in the strength/power domain of sport. The

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study does encourage future, more extensive and diverse research in this area to determine the full extent of the effect of genetic factors in different sports and athlete populations.

Conclusions

The present report highlights a major role in those parameters of the ACTN3 R577X polymorphism. Performance measures of leg strength, vertical jump height and 30-m sprint time are increased in athletes possessing the RR genotype compared with either RX or XX genotypes, implying that ACTN3 is involved significantly in power and sprint performance. These results emphasize the role of genetic factors in athletic ability, particularly in sports requiring rapid force production and explosive power.

The research's implication on how genetic variations can affect performance in individual sports including wrestling, could lead to new avenues of personalized training and talent identification. If genetic testing were to be part of how athletes are chosen, sportspeople may be able to pin better identify those athletes who are genetically predisposed to succeed in power sports. Moreover, training plans adjusted to the individual genotype could optimize training results and athletic performance.

Future studies should explore the interplay between the one of genetic factors such as ACTN3 with other performance-related genes. Generalization of the present study to other sports and larger and more heterogeneous group of athletes might give a better insight in the genetic makes of athletic performance. "This study may show that genetic analysis has an important role in developing the science of sport," he said. "It is useful for precise and effective modulation of athlete development and athletic performance.

Recommendations

This study demonstrates that there is a potential role for genetic testing for sports pre and of post selection of track and field athletes in power-based events. By selecting for favorable ACTN3 R577X polymorphism profiles, sporting organizations can refine their selection procedures, being able to concentrate on athletes that have the expected genetic background for strength and sprinting.

Furthermore, individualized prescribed exercise based on genetic profiling may also improve training efficacy. Athletes with the RR genotype might be adapted ER and skill dependent training programs, whereas those with the XX or RX genotype might follow strength and explosion vet power-oriented training programs for improvements in their performance.

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Further studies are warranted to investigate interaction between the ACTN3 gene and other potential genetic markers for athletic performance, such as ACE I/D polymorphism and myostatin. More extensive research in other sports and with different athlete populations is also advocated, so that more general findings can be established.

In addition, the knowledge of athletes and coaches on genetic players can contribute to plans of training more specific, and could also improve sports performance. Last but not least, ethical standards for genetic testing in sports need to be generated guaranteeing privacy, autonomy and fair play of the genetic information.

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The effect of special exercises for some biomechanical variables of the rotation phase of 100 m freestyle for the swimmers of the national team (16-18 years old)

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Abstract

The aim of the research through study, analysis and clarifying the differences for the swimmers that the freestyle swimming style is preferred by most of the swimmers of the Iraqi national team, as the need for research and investigation has increased to solve the issues related to spinning performance and identify the values of some biomechanical variables of the spinning phase, swimming for 100 m freestyle swimming and the research issue lies due to the difficulty of directing swimmers during spinning performance in the water and the difficulty of communication between the coach and swimmers to give them accurate instructions during their spinning performance. The experimental method adopted the experimental design (pre-test, post-test for one group) to suit the nature of the research problem and the number of (6) swimmers representing 100% of the original population, which are the players of the Iraqi national team (16-18 years) and the experiment was conducted on the experimental group for (8) consecutive weeks at (3) times a week and after the completion of the application, the data were collected and the SPSS system processed the results to be the conclusions It is necessary to explain the importance of the biomechanical variables as indicated simply and to increase the culture and awareness of swimmers through the mediation

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and how the use of angles, distances, and appropriate force affects the economy of effort to create a developed sports generation to raise the level of sports for the better.

Keywords: Exercises, kinetic variables, rotational phase, freestyle, 100-meter freestyle.

Introduction

Freestyle swimming is the basis of the four swims, as this type is favored by all swimmers because of the speed and fun, which depends heavily on the motor performance of all parts of the body with high-level compatibility, Olympic swimming is one of the important sports in the schedule of Olympic sports, which includes several swimming styles (butterfly, back, breaststroke, freestyle), because freestyle (Salman, 2015) has a great importance in the schedule of international competitions, as it is unique in its many races compared to the rest of the methods that range from (50 m to 1500 m) due to the ease of performance in it (Salman, 2015) It is unique in its many races compared to the rest of the methods that range from (50 m to 1500 m) due to the ease of performance in it, as for the (100 m) freestyle event, the rotation stage is one of the most important stages in this event, Changing the momentum before and after the turn with a minimum value is necessary to sustain the momentum of the race speed on the approach and after the push to gain an advantage and outperform the other swimmers. Pushing the wall should be strong at the same time by moving the legs together to help increase the pushing force, which is affected by the change in momentum, the pushing force should be implemented horizontally and not upwards, and the biomechanical variables are factors that influence motor performance directly, as we can determine through technical and biomechanical analysis and biomechanical analysis can identify the strengths and weaknesses of swimmers and then provide sufficient information for the coach to have a base full of accurate information to work to enhance the strengths, work to develop them and avoid weaknesses and then develop the digital achievement of the swimmers (Abdulkarim, Majeed, and Hadi, 2024). The performance of movement between body parts needs compatibility to determine the movement of the body according to certain trajectories of body parts, certain angles of body joints, and specific times as well as several other variables (Amer et al., 2024).

Materials and Methods

The researchers used the experimental method in the experimental design method (pre-test, post-test for one group) The selection of the research sample comes within the basic and important points in the research procedures adopted by the researchers to reach results with high credibility, so the researchers deliberately selected a random sample consisting of (6) swimmers representing (100%) of the population of origin, which are the players of the Iraqi national team (16-18 years old) in the event of The importance of the study lies in the

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importance of the mechanical positions that the swimmer must take in the rotation and after the 100 m, which gains the body the highest linear momentum and the least possible decrease, These mechanical positions during the rotation prepare the swimmer for the appropriate motor field. Studies and analyses indicate that the freestyle style is the preferred style for the majority of swimmers on the Iraqi national team After clarifying the differences between different swimming styles (Hussain et al., 2022), the need for research and investigation has increased to solve issues related to the rotation phase as indicated (Hamid, Al-Shamaa, and Haider, 2024) Identify the values of some biomechanical variables of the rotation phase, swimming for 100 m swimming and the study hypothesizes: There are statistically significant differences in some biomechanical variables affecting the rotation phase in the (100 m) freestyle swimming between the pre-test and post-test as the experiment lasted from 24/2/2024 to 14/4/2024 with (24) training units of (3) training units per week in the Olympic People's Pool and after the completion of the experiment and the application of post-tests, the researchers verified the results using the statistical package system (spss).

Biomechanical variables of the rotational phase in swimming

1. **Angular velocity:** It is the rate of angular travel of an object over a specified time, (Omar, Hussein Mardan; Rahman, Iyad Abdul, 2011, p. 34).

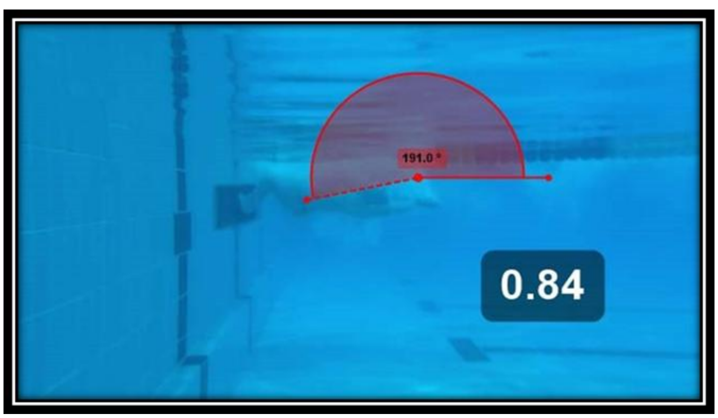

Figure (1): shows the angular velocity

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2. **Knee angle:** It is measured at the moment of maximum flexion, which is the angle between the thigh and the leg and is measured from the side towards the flexion. (Najah and Thamer, 2015, p. 85).

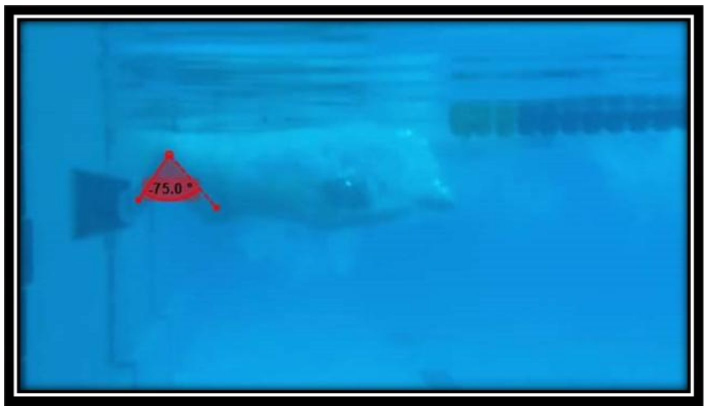

Figure (2): shows the Knee angle

3. **Directional angle:** It is the angle between the horizontal line and the line passing through the center of gravity of the object at the moment of thrust (the moment of last contact with the wall) during rotation.

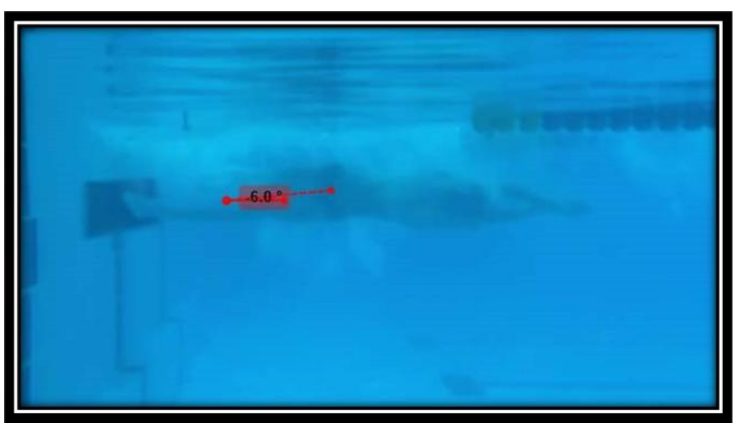

Figure (3): shows the Directional angle.

4. **Flow velocity:** the distance between the last touch of the wall, over time.

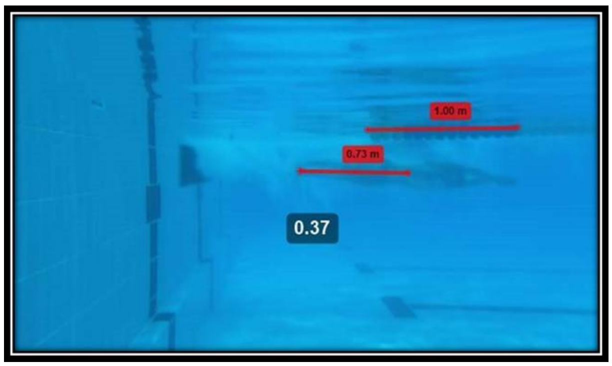

Figure (4): shows the flow velocity.

The two researchers adopted the technical performance test of the rotation skill in freestyle swimming, as the performance of the rotation phase of swimming was filmed and the performance was analyzed by the (Kinovea) program for movement analysis, using a single camera at a speed (120 p/s) placed at a distance of (1.50 m) underwater and a distance of (11.5 m). from the swimmer, the pre-test was conducted for the sample and according to the movement analysis to extract the biomechanical variables of the rotation phase of the swimmers and present them to the coach to correct the movement in the rotation phase for each swimmer according to what he needs to develop the performance after the group finished the training units in which the movement was corrected, the swimmer is filmed and the performance is analyzed again to complete the post-test in conditions similar to the conditions of the pre-test. The analysis of rotational performance was performed using rapid video filming of the national team swimmers (16-18 years old) and variables were extracted for the rotational phase.

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Results

Table (1): Shows the mean (μ), standard deviation (σ), and differences of the mean (μ.Difference) and standard deviation (σ.Difference) of the pre and post-test of the biomechanical variables of the Rotational phase in (100m freestyle) swimming

Biomechanical variables	Unit	Pre-test		Post-test		μ.Difference	σ.Difference	T	Sig Value
		μ	+σ	μ	+σ				
Angular velocity (C.O.M)	d/s	226.13	12.90	240.008	14.121	-13.878	2.956	-11.491	0.000
Knee angle	d	74.666	1.632	78.888	2.366	-3.333	0.816	-10.000	0.000
Directional angle	d	86.000	1.4142	92.500	1.378	-6.500	2.167	-7.344	0.001
Flow velocity	m/s	1.640	0.231	1.901	0.201	-0.261	0.098	-6.482	0.001

Discussion

We notice from the above table that there are statistically significant differences and therefore we notice from the analysis has significantly affected the results of the swimmers and therefore the process is reversed whenever the training is done correctly on the rotation We notice from table (1) the values of the differences for the arithmetic means of the biomechanical variables of the rotational phases of the 100 m freestyle swimming, where it was found that the differences between the arithmetic means of the variables under study for

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the pre and post-tests were significant in favor of the post-test, and the reason for the significance of the differences between the arithmetic means of the variable of angular speed between the pre and post-tests in favor of the post-test. The significance of the differences between the arithmetic means of the angular velocity variable between the pre-test and post-test in favor of the post-test as a result of increasing the speed in the direction of the horizontal vehicle during swimming before performing the rotational movement, which helped the swimmer to transfer the kinetic energy from the horizontal vehicle to the vertical vehicle more quickly, which increased the value of the angular velocity of the rotation of the body's center of gravity, which led to a reduction in the time required to perform this phase (Tarsh, Kazim, and Kazim, 2018) (Abdulkareem et al., 2017)

The decrease in the value of the time variable resulted from the motor adaptation of the swimmers, as we find that the differences also appeared significant for the knee angle variable at maximum flexion, as we find that the value of the angle increased for most of the swimmers, which reduced the time required to extend the legs during the performance of the push (Hammood et al., 2024).

We also find a change in the value of the direction angle variable after pushing, as significant differences appeared between the pre and post-tests as a result of using the proposed device as an aid to correct the motor path taken by the swimmer after performing the rotation, as we find that the angle measurement was above the horizontal line passing the center of gravity of the swimmer at the last touch with the wall, while it was modified to be below the horizontal line passing the center of gravity of the body at the last touch, which helps in increasing the flow distance (Najah and Thamer, 2015).

We notice from table (1) that the flow velocity that we appeared with significant differences between the values of the arithmetic mean of the pre and post-tests, which reflected positively in increasing the value of the flow velocity variable, as it is known that the water resistance is less due to the value of surface resistance, as the value of the resistance imposed on the swimmer's body is reduced due to the lack of load currents imposed on the swimmer, which is large when swimming on the water surface due to the turbulent movement of the liquid due to the movements performed by the swimmer, which moves the water (Alwan and Fadhli, 2012, page 130), increasing its effect on the swimmer's body (Alwan and Fadhli, 2012, p. 130).

Conclusions

1. Changes in the biomechanical variables associated with the rotational phase of the swimmer have led to the development of a significant increase in rotational speed.

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2. Differences between swimmers in the use of biomechanical variables related to the rotational performance of swimming according to the individual differences between the sample members.

Recommendations

1. Explain the importance of biomechanical variables in a simple way and increase the education and awareness of swimmers on how the use of proper angles, distances, and force can affect the economy of effort to create an advanced athletic generation for the betterment of the sport.

2. Increase the emphasis on the rotational phase of swimming during training, and include it in the training units due to its effective role in improving the level of achievement.

Appendix

Sample training units during the week and days to add special exercises for the rotation phase of training
Special preparation period and competitions
Volume: 20-25 km
Number of modules: 3 per week

	SATERD AY	SUND AY	MONDA Y	TUESDA Y	WEDNESDAY	THURSDA Y	**FRIDAY**
MORNING	**En3 +sp2 Start + turn 3 Km**	**Rest**	**Rest**	**Sp3 + En2 4 Km**	**Rest**	**Sp3 + start 3 Km**	**Rest**
AFTERNOON	**Rest**	**Sp3 + En1 Pull + Fins 4 Km**	**En1 + Sp3 Turn+start 4 Km**	**En3 +sp1 3 Km**	**Sp2 + En2 Start + turn 5 Km**	**Test 8×25m (5s)**	**Rest**
Out Water	**Lastic + run + Barbell**	**Rest**	**fitness**	**Rest**	**Lastic + run + Barbell**	**Rest**	**Rest**
KM / DAY	**3**	**4**	**4**	**7**	**5**	**3**	

Note: Special exercises have been inserted into the training modules marked in green

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The Effect of Corrective Exercises on Some Biomechanical Variables and the Performance of the Hand Jump Skill in the Junior Category

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Abstract

The study aimed to highlight the importance of corrective exercises and to address the development and status of athletic activities. It also emphasized the significant role of human movement in the successful execution of various sports performances. Furthermore, the study explored the field of biomechanics and its relationship to optimal performance through motion analysis. The significance of this research lies in designing corrective exercises for a selected sample group with the intention of improving their performance, overcoming technical faults, and achieving better athletic results. The front handspring skill on the floor exercise mat is considered one of the most difficult techniques for athletes, due to its requirements for technical precision and motor coordination. During a particular phase of the skill, the body reaches a handstand position, necessitating accurate synchronization between the force exerted by the hands against the ground and the moment the body's center of gravity passes through the imaginary vertical axis.

Keywords: Artistic Gymnastics, Motion Analysis, Floor Exercises, Skill Performance, Biokinematic Variables.

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Introduction

The development in gymnastics and the achievement of creative and innovative performance, particularly on the floor exercise apparatus—which is one of the six primary apparatuses in artistic gymnastics—has not occurred randomly but through the application of the most advanced scientific methods. Movements performed on the floor serve as the foundation for all other apparatuses and are a central focus of sports events worldwide, aimed at achieving the highest levels of performance and attaining outstanding accomplishments. Technological advancements in mechanical analysis, in general, and in artistic gymnastics, in particular, play a critical role in enhancing the quality of skill performance, both in competitions and educational processes. Artistic gymnastics is characterized by the diversity of its performance, encompassing multiple apparatuses, including the floor exercise, which involves skills such as the front handspring. Achieving advanced skill performance in sports is an essential objective in the educational process, and researchers in this field continually seek innovative methods and tools to enhance performance. Sports apparatuses contribute significantly to improving technical execution and physical abilities, in accordance with the specific requirements of each sport. Since gymnastics performance is evaluated based on technical execution, the International Gymnastics Federation prescribes the proper form for skill execution, and any deviations result in deductions from the performance score.

This study aimed to diagnose errors in performing the front handspring for youth aged 8–13, identify the most significant biomechanical variables affecting its learning, and propose corrective exercises to optimize these variables.

Several researchers have addressed related topics. For instance, Rasha (2014) examined the effect of specialized physical exercises on selected biomechanical variables of the “Gazelle Jump” in rhythmic gymnastics, showing significant post-test improvements in speed and takeoff angle. Zina (2008) analyzed the relationship between biomechanical and physical-motor abilities in performing the back aerial somersault from a stationary position, finding significant correlations that affected performance. Abi Ramz (2005) investigated the effect of corrective exercises on kinematic variables of the spindle movement on the vault apparatus for youth, reporting meaningful improvements post-intervention. Ali (2002) studied the effect of educational exercises on the biomechanical variables of the front handspring, showing positive impacts for the experimental group. Mustafa (2019) examined the effect of specialized exercises using an innovative rotating support device on selected kinematic variables of the front handspring, demonstrating improvements for the experimental group. Sarmad (2021) explored the effect of a multi-stage innovative device on biomechanical variables in learning the Tkatchif skill on the

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horizontal bar, indicating positive effects on performance. Ibtehal (2021) assessed corrective exercises based on a model for handstand and cartwheel skills on the floor, reporting significant improvements in biomechanical indicators and skill performance.

Collectively, these studies emphasize the importance of designing corrective and specialized exercises according to mechanical principles, highlighting the positive role of progressive and sequenced application—covering preparatory, main, and final phases—in developing and enhancing gymnastic skills.

Methodology

The researcher employed the experimental method using the two equivalent groups design (control and experimental) with pre- and post-tests, as it was suitable for the research requirements. The research population was determined from artistic gymnastics players at the Specialized School for the academic year 2024–2025. The researcher used the purposive sampling method to select the sample, which initially consisted of 12 players. Out of them, 10 players were chosen, representing 83.33% of the original sample. These players were divided into two groups—control and experimental—comprising 5 players in each group. The reason for excluding the two players was due to injury**.**

Data Collection Tools

- Floor exercise mat.
- Foam mats.
- Measuring tape (6 meters).
- Ruler (1 meter).
- Video camera (1 unit), Sony, with a range of 30–1000 frames per second.
- Computer, HP.
- Laser discs (2 units), Prince brand.
- Tripod for the camera.
- Motion analysis software (Kinovea, version 0.8.27).
- Electronic scale.

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Table 1: Description of the Research Sample (Control and Experimental Groups)

Variable	Mean (M)	(SD)	Skewness
Age (years)	10.63	0.937	0.047
Training age (years)	3.25	1.23	-0.168
Weight (kg)	30.75	4.79	0.899
Height (cm)	140.38	7.18	-1.67
Arm length (cm)	25.25	1.96	-0.952
Forearm length (cm)	24.25	2.53	0.123
Trunk length (cm)	43.38	0.827	0.483
Thigh length (cm)	37.88	3.64	0.468
Leg length (cm)	34.25	2.49	-0.305

Table 2: Equivalence of Control and Experimental Groups

Variables / Equivalence	Groups	Mean	SD	Levene's Test	F	Sig	df	t	Sig
Performance (s)	Control	2.88	0.545	0.062	0.810	0.250	0.306	0.816	0.438
	Experimental	3.13	0.415						
Vertical Inclination Angle (°)	Control	16.25	3.96	2.80	0.133	1.00	1.84	0.544	0.601
	Experimental	15.25	1.09						
Trunk Angle First Contact (°)	Control	55.00	3.24	0.105	0.754	2.75	2.22	1.24	0.251
	Experimental	52.25	3.77						
Thigh Angle First Contact (°)	Control	77.25	2.28	0.118	0.740	-1.25	1.30	0.962	0.364
	Experimental	78.50	1.80						
Hip Angle First Contact (°)	Control	132.25	2.28	1.62	0.238	1.50	2.38	0.630	0.546
	Experimental	130.75	4.82						
Linear Displacement of Hip (m)	Control	1.19	0.076	1.80	0.217	0.028	0.040	0.686	0.512
	Experimental	1.16	0.048						
Linear Hip Velocity (m/s)	Control	3.90	0.511	1.95	0.200	0.046	0.245	0.188	0.856
	Experimental	3.94	0.198						
Hip Angle First Contact for Arms (°)	Control	68.50	4.56	0.664	0.439	1.50	2.62	0.573	0.582
	Experimental	67.00	3.67						
Arm Contact Time (s)	Control	0.290	0.037	0.109	0.750	0.017	0.024	0.713	0.496
	Experimental	0.307	0.040						
Flight Time (s)	Control	0.160	0.022	0.079	0.786	0.015	0.015	1.04	0.328
	Experimental	0.175	0.025						
Body Tilt Angle (°)	Control	39.25	4.02	0.072	0.796	0.500	2.48	0.201	0.846
	Experimental	38.75	3.83						
Covered Angle (°)	Control	146.50	3.91	2.48	0.154	2.25	4.97	0.453	0.663
	Experimental	144.25	10.40						
Trunk Angular Velocity (°/s)	Control	297.23	55.22	1.74	0.223	-2.26	26.63	0.085	0.934
	Experimental	299.50	22.28						
Total Performance Time (s)	Control	0.776	0.074	1.57	0.245	0.002	0.036	0.056	0.957
	Experimental	0.774	0.032						

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Corrective Educational Units

After conducting personal interviews with a group of experts and specialists in teaching methods and based on their opinions and recommendations, the researcher prepared the corrective educational units and finalized them while considering the following:

- The total number of corrective educational units was eight (8), with one unit implemented per week.
- The total number of corrective exercises used to address the errors identified during the pre-tests for the research sample was thirty-two (32) exercises.
- The number of errors corrected in each corrective unit ranged from 1–2 errors, depending on the difficulty of the error.
- The number of corrective exercises per unit was five (5) exercises, depending on the type of error.
- The corrective exercises were implemented according to the sequence of the skill's sections (preparatory, main, and final).
- Corrective exercises were executed during the first half of the main section for 30 minutes out of the total 60 minutes allocated to the main section.
- The duration of each corrective unit was 30 minutes, including 10 minutes for explaining the errors and demonstrating the corrective exercises, and 20 minutes for applying the corrective exercises.
- The third corrective educational unit for the handstand skill was repeated due to the presence of some errors that were not adequately corrected.

Post-Test

The post-test was conducted on Saturday, 1/2/2025, starting at 3:30 PM and ending at 4:15 PM. Camera settings, dimensions, and speed, as well as the tasks of the assisting team, recording of attempts, the order of players, and performance evaluation, were all organized according to the same procedures and conditions used in the pre-test.

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Statistical Analysis

The Statistical Package for the Social Sciences (**SPSS**) program was used to extract:

- Mean (M).
- Standard deviation (SD).
- Skewness coefficient.
- Independent samples T-test.
- Levene's Test.
- Paired samples T-test.

Results

Table 3: Pre- and Post-Test Differences in Performance Angles of the Handstand Skill for the Control Group

Variable / Control	Test	Mean (M)	SD	F-S	A-F	H-A	t	Sig
Vertical Inclination Angle (°)	Pre-test	16.20	3.96	4.40	2.97	1.33	3.32	.029
	Post-test	11.80	2.28					
Trunk Angle – First Motion (°)	Pre-test	55.00	3.24	2.20	10.06	4.50	.489	.650
	Post-test	52.80	7.63					
Thigh Angle – First Motion (°)	Pre-test	77.20	2.28	.400	4.04	1.81	.222	.836
	Post-test	76.80	2.59					
Hip Angle – First Motion (°)	Pre-test	132.20	2.28	2.60	7.67	3.43	.758	.491
	Post-test	129.60	7.09					
Hip Angle – First Motion for Arms (°)	Pre-test	68.60	4.56	-.600	4.77	2.14	.281	.793
	Post-test	69.20	8.26					
Body Tilt Angle Based On (°)	Pre-test	39.20	4.02	6.60	9.10	4.07	1.62	.180
	Post-test	32.60	6.07					
Angle Covered (°)	Pre-test	146.60	3.91	10.00	9.41	4.21	2.38	.076
	Post-test	136.60	7.23					

Table 4: Pre- and Post-Test Differences in Performance Angles of the Handstand Skill for the Experimental Group

Variables	Test	Mean	SD	Skewness	Kurtosis	Std. Error	t	Sig
Vertical Tilt Angle (°)	Pre	15.20	1.10	-0.400	5.22	2.34	0.171	0.872
	Post	15.60	5.03					
Trunk Angle, First Phase (°)	Pre	52.20	3.77	6.40	6.73	3.01	2.13	0.101
	Post	45.80	7.33					
Thigh Angle, First Phase (°)	Pre	78.60	1.82	4.60	2.70	1.21	3.81	0.019
	Post	74.00	3.54					
Hip Angle, First Phase (°)	Pre	130.80	4.82	11.00	6.00	2.68	4.10	0.015

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	Post	119.80	9.07					
Arm-Hip First Contact Angle (°)	Pre	67.00	3.67	-15.00	4.90	2.19	6.85	0.002
	Post	82.00	7.18					
Body Tilt Angle Based on Support (°)	Pre	38.80	3.83	14.60	5.13	2.29	6.37	0.003
	Post	24.20	1.48					

Table 5: Post-Test Differences in Study Variables for the Handstand Skill Angles

Variables / Post-Test	Groups	Mean	SD	F – S	H – M	t	Sig.
Vertical Inclination Angle (°)	Experimental	15.60	5.03	3.80	2.47	1.539	.162
	Control	11.80	2.28				
Trunk Angle – First Contact (°)	Experimental	45.80	7.33	-7.00	4.73	1.480	.177
	Control	52.80	7.63				
Thigh Angle – First Contact (°)	Experimental	74.00	3.54	-2.80	1.96	1.429	.191
	Control	76.80	2.59				
Hip Angle – First Contact (°)	Experimental	119.80	9.07	-9.80	5.15	1.904	.093
	Control	129.60	7.09				
Arm–Hip Angle – First Contact (°)	Experimental	82.00	7.18	12.80	4.89	2.616	.031
	Control	69.20	8.26				
Body Inclination Angle (°)	Experimental	24.20	1.48	-8.40	2.79	3.008	.017
	Control	32.60	6.07				
Total Inclination Angle (°)	Experimental	163.60	6.39	27.00	4.32	6.257	.000
	Control	136.60	7.23				

Discussion

The results of the statistical analysis reflect the presence of statistically significant differences in the post-test between the experimental group and the control group for the flight time variable, in favor of the experimental group in performing the handstand skill. No significant differences, however, were observed in the variables of hand contact time and total performance time. Flight time is directly associated with the push-off force exerted by the hands, which represents the decisive factor in providing the body with sufficient propulsion to execute the aerial somersault and achieve adequate height during the aerial phase. The greater this force, the longer the flight time, allowing the athlete additional time to optimize landing timing, reduce injury risk, and ensure smooth transitions between performance phases. It also provides the body with adequate time to prepare for the subsequent phase of the skill.

The researcher attributes this improvement to the fact that flight time is closely linked to the resultant speed generated during the push-off, particularly the vertical component of the push. A skilled athlete is able to convert a larger proportion of horizontal speed into vertical speed, which increases height and consequently flight time—the period the body remains airborne from leaving the ground until landing. This duration is influenced by several factors, including jump height (related to muscular strength) and coordination level during the aerial phase. From this perspective, the corrective exercises based on motion analysis played a significant role in adjusting performance angles and enhancing the ability to convert horizontal velocity into vertical velocity. This resulted in higher vertical speed at the expense of horizontal speed, achieved through precise motion analysis, identification of movement errors, and scientific correction aimed at increasing vertical velocity.

This outcome aligns with what Samir Mosallat (2000) indicated: analyzing motion through recording and quantitatively identifying influential variables—such as launch speed, height, and angle—is the most effective method to address variables that coaches or athletes seek to improve in performance (Mosallat, 2000, p. 233). Moreover, identifying movement errors helped athletes use their muscles correctly to increase elevation and control during flight, which was clearly reflected in the post-test results, showing a positive effect on flight time. Wajih Mahjoub (2001) also confirms that motion analysis "is used to solve problems related to learning and training, by diagnosing movements, balancing their components, timing, and force, and differentiating between correct and incorrect movements. This supports skill development and technical understanding, providing coaches with a model of ideal movement to guide appropriate training methods to learners and avoid movement errors" (Mahjoub, 2001, p. 15). Applying advanced motion analysis programs enabled precise identification and scientific correction of movement errors, which the results clearly demonstrated.

Regarding hand contact time, the researcher notes that it is a critical factor in improving the handstand skill, as it reflects the effectiveness of the push force generated upon hand-ground contact. The shorter this time while maintaining sufficient force, the better the technical performance and movement efficiency. However, the results showed no statistically significant differences between the groups, indicating that the corrective exercises were not sufficiently targeted to improve this variable, or that other factors such as individual technique or muscular balance influenced it. This is consistent with Loui Ganmal Al-Samid'i (2007), who stated that "the mechanical effect of force on the body over a short time equals the product of the force and the specific time instant, demonstrating that the relationship between push and contact time is closely linked to the performance angles adopted during the push-off and flight phases. Specifically, the transition from running to hand-ground contact requires greater force in a shorter time to maintain momentum without losing speed" (Al-Samid'i, 2007, p. 93). Despite numerical differences favoring the experimental group, these differences did not reach statistical significance, likely because the push variable is influenced by both force and time, which were relatively similar across groups. Both coach and researcher worked on developing physical components and skill abilities to achieve optimal performance.

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This aligns with Adel Abdel Basir (1999), who noted that "the type of sport aiming for elite performance determines the nature of physical and skill components, and there is a close relationship between the development of physical components and skill abilities" (Basir, 1999, p. 91), which is reflected in the nature of the exercises used in this study.

Regarding total performance time, results also indicated no statistically significant differences, despite temporal differences favoring the experimental group. This reflects that contact time plays a central role in determining overall performance quality and movement success, which is affected by factors such as muscular strength, motor balance, and coordination between performance phases. Haider Nawar (2012) emphasized that "movement time is influenced by how force is applied; periods in which force is not applied according to goal requirements lead to discontinuous and non-fluid performance, especially between the preparatory and main skill phases" (Al-Amiri & Haider Nawar, 2012, p. 39). The researcher notes that total performance time is influenced by body inclination, push force, and launch angle, and that the corrective exercises did not specifically target this variable but rather focused on improving motor control and muscular coordination. Improvements in this variable may also relate to general adaptation from training or differences in individual commitment within groups. This is supported by Talha Hossam Eldin (2003), who indicated that "the amount of push force generated during takeoff depends on muscular strength, joint extension speed, and coordination, with the vertical component of push achieved through sudden and simultaneous extension of working joints" (Hossam Eldin, 2003, p. 136). From this standpoint, improving total performance time requires continuous training incorporating advanced techniques to control timing during flight and landing, allowing athletes better opportunities to adjust launch angles and flight time, thereby enhancing overall skill performance.

Overall, the results are logical and reflect the effect of corrective exercises and motion analysis on developing technical and motor performance for this complex skill.

Conclusions

1. The adoption of corrective exercises based on motion analysis has a positive effect on the hip angle at the moment of initial hand contact in the handstand skill, indicating an improvement in arm positioning at the beginning of the movement, which positively reflects on overall body balance during performance.
2. Corrective exercises informed by motion analysis have a positive impact on the body tilt angle during the support phase of the handstand skill, suggesting an improved ability to maintain balance and distribute body mass properly during skill execution.

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3. Corrective exercises guided by motion analysis show a positive effect on the final vertical tilt angle in the handstand skill, reflecting an improvement in the final body posture—a key indicator for evaluating technical performance quality.
4. Corrective exercises based on motion analysis positively influence flight time in the handstand skill, reflecting development in explosive strength and neuromuscular coordination.
5. Corrective exercises derived from motion analysis positively affect the overall performance score of the handstand skill.

Recommendations

1. The researcher recommends the use of biomechanical analysis as a permanent diagnostic tool for evaluating athletes' technical performance, due to the precise data it provides, which contributes to scientifically guided training.
2. It is recommended to involve gymnastics coaches in development courses focused on quantitative analysis using video and mechanical analysis software.
3. Emphasis should be placed on developing body and hip tilt angles during technical training, as these angles have a direct effect on stability, balance, and fluidity during flight and support phases.
4. Researchers and coaches should consider relevant body measurements (e.g., height, trunk length, leg length, arm length) when designing corrective exercises, as these measurements are critical for correcting movement trajectories in many sports skills.

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Functional strength training and its impact on some of the skill abilities of soccer players

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Abstract

The researcher touched on the importance and place of the game of football among sports, as functional strength exercises were prepared and their impact on some skill abilities in football. The research community included the teams of government institutions in Diyala Governorate, and the research sample was chosen intentionally, which was represented by the Diyala youth and adult football teams. There are 9 indoor players This research is one of the scientific attempts to raise the skill level of the teams of government institutions in the governorate through the use of functional strength training. The results showed that there is a clear development among the research sample in the post-test as a result of the use of these training.

Keywords Functional strength training, football skills.

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Introduction

Football has gained widespread popularity across various countries, becoming a universal language because it provides enjoyment both through watching and playing. It is considered one of the challenging team sports, requiring its players to possess skill, intensity in performance, and quick attentiveness. Therefore, it demands new methods and approaches to develop its training aspects. The success of any football process depends on comprehensive preparation, aiming to enable players to master the skills that accelerate the path to victory.

Several factors influence the players' execution of different game plans during a match, including their skill level, physical fitness, and proficiency in fundamental techniques. Players are required to perform high levels of running throughout a match, which may last 90 minutes, and to overcome various resistances. These include managing body weight against gravity, continuous rotations, sudden stops, physical challenges, maintaining balance, and engaging in physical contact with opponents, the ball, and the playing field. All of these demands necessitate advanced skill and physical preparation, enabling players to execute game strategies efficiently and effectively without a decline in performance during the match.

Martin Bidzinski notes the importance of integrating football skills with physical fitness components, as both must be developed simultaneously. Over time, the application of a structured training program enhances the effectiveness of passing, receiving, and running with and without the ball. Moreover, the quality of a football player's performance can only be accurately assessed under pressure—whether physical, psychological, or competitive—as this reflects their true abilities. Training under such conditions significantly improves overall performance (Bidzinski, 1996).

According to Issam Abdel-Khalek (2000), the ability to perform a skill is closely related to specific physical motor abilities. Mastery of a skill depends on the development of these abilities, such as muscular strength, coordination, flexibility, agility, and balance. The level of skill performance is often determined by the extent to which an individual has acquired these specific physical and motor characteristics (Abdel-Khalek, 2000).

The researcher observes that neglecting strength training during the preparation period of football players results in a lack of the muscular strength required to perform fundamental skills efficiently. This deficiency is clearly reflected in the performance of players at that stage, which emphasizes the need to address this phase and to explore the most suitable training methods for them, as they represent the future of football teams. Strength training for youth is considered one of the important training methods for enhancing their technical level. Such training works by indirectly affecting the muscles, transferring the strength gained from a specific movement to the entire neuromuscular system.

Therefore, the researcher aims to use strength training to develop muscular strength in young football players and to investigate its effect on the improvement of skill performance levels (currently under investigation).

Functional strength training is considered one of the modern approaches in sports training. It is characterized by integrated movements that engage multiple muscle groups simultaneously. The advancement of various football skills and the ability of certain players to change the course of a match through their individual capabilities have prompted the researcher to explore functional strength training for football players.

Regarding the influencing factors, there may be challenges in identifying the variables that affect the effectiveness of this type of training. Factors that should be considered include age, physical fitness, nutrition, prior training experience, and previous injuries. Therefore, when studying functional strength training, it is necessary to investigate its effectiveness and determine its impact on specific skill abilities in football players. Functional strength training is recognized as an important training method for enhancing technical and physical performance because it indirectly affects the muscles, transferring the strength gained from a particular movement to the entire neuromuscular system.

Consequently, researchers aim to utilize functional strength training to improve performance, helping football players understand its effect on the levels of skill performance under investigation.

Research Objective: The study aimed to investigate the effect of functional strength training on certain skill abilities of the Diyala Youth and Sports Football Team.

Research Hypothesis: There are statistically significant differences between the pre-test and post-test measurements in the technical performance level of the experimental group, in favor of the post-test measurements.

Research Scope: **Human Scope,** Diyala Youth and Sports Football Team. **Temporal Scope,** From February 10, 2023, to June 10, 2024. **Spatial Scope,** The study was conducted at the late Ali Salam Indoor Hall and the Sports and Scout Activity Hall of Diyala College of Education.

Methodology

The researcher employed the experimental method using a single-group experimental design with pre-test and post-test measurements, as it suits the nature of the study.

Research Population and Sample

The research population includes the teams of government institutions in Diyala Governorate. The research sample was selected intentionally, consisting of the Diyala Youth and Sports Football Team, totaling nine (9) futsal players.

Homogeneity of the Research Sample

The research sample was homogeneous in terms of the variables: age, height, weight, and training experience. Table (1) illustrates this.

Table (1): Homogeneity of the Research Sample in the Studied Variables

No.	Variables	Mean	Standard Deviation	Skewness Coefficient
1	Age	28.41	1.18	1.04
2	Height (cm)	175.6	3.16	0.56
3	Weight (kg)	68.8	2.43	2.22
4	Training Experience (years)	3.4	1.21	0.99

Data Collection Methods

The researcher relied on scientific references, previous studies, and international electronic sources to determine the necessary tools, measures, and tests for collecting the research data.

Observation

The researcher observed that previous studies focused on either the physical, skill, or tactical aspects of players, but they did not address the integration of these aspects with functional strength training. This gap highlighted the need for the present study.

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Questionnaire

The questionnaire was used to determine the following:

1. The most important skill tests applied to the Diyala Youth and Sports Football Team players (as shown in Appendix 1).
2. The most suitable functional strength training exercises for the Diyala Youth and Sports Football Team players (as shown in Appendix 2).

First: The researcher designed a set of 24 specific functional strength tests for the players. These tests were developed to align with the functional strength requirements of the Diyala Youth and Sports Football Team.

Second: The most suitable functional strength training exercises for the players were identified, including:

- Running with the ball for 10 minutes.
- Performing the throw-in skill 10 times.
- Rotating around the ball and shooting.
- Running with the ball and receiving from above.
- Running with the ball and receiving from below.
- Short passing exercises with the maximum number of repetitions.

Additionally, the researcher prepared a survey form for a panel of nine (9) experts holding academic degrees in Physical Education and Sports Sciences to evaluate the appropriateness of these functional strength exercises for the Diyala Youth and Sports Football Team players.

Equipment and Tools Used in the Study

- Rastameter
- Medical scale
- Measuring tape
- Stopwatch
- Footballs
- Cones
- Standard football field
- Whistle

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Scientific Validity and Reliability

Discriminant Validity

The discriminant validity of the skill tests in their initial form was calculated by computing the mean differences between a distinguished group of players (9 players from the same research population but outside the research sample) and a non-distinguished group (9 players from the Diyala Youth and Sports Football Team). This procedure was conducted on Monday, February 20, 2024. Table (2) illustrates the results.

Table (2): Significance of Differences Between the Distinguished and Non-Distinguished Groups for Skill Tests (n1 – n2 = 18)

No.	Variables	Distinguished Group (Mean ± SD)	Non-Distinguished Group (Mean ± SD)	Difference Between Means	t-value
1	20-meter Ball Running Test (Transition Speed)	5.17 ± 0.98	6.23 ± 1.02	1.06	2.30
2	Three Rotations Around the Ball Then Shooting (Motor Balance)	1.30 ± 0.65	1.97 ± 0.58	0.67	3.72
3	Shooting at Cones in Goal Posts (Spatial Accuracy)	2.11 ± 0.99	3.06 ± 0.78	0.95	3.65

Reliability Coefficients

The researcher retested the method on Sunday, March 3, 2024, using a sample of nine players familiar with the tests, considering a two-week interval between the two applications. Pearson's correlation coefficient was used to determine the relationship between the two applications, as shown in Table (3).

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Table (3): Correlation Between the First and Second Applications of the Skill Tests (n = 9)

No.	Variables	First Application (Mean ± SD)	Second Application (Mean ± SD)	Difference Between Means	r-value
1	20-meter Ball Running Test (Transition Speed)	4.65 ± 1.02	3.91 ± 0.98	0.74	0.71
2	Three Rotations Around the Ball Then Shooting (Motor Balance)	1.18 ± 0.72	1.41 ± 0.63	0.23	0.74
3	Shooting at Cones in Goal Posts (Spatial Accuracy)	1.09 ± 0.95	1.89 ± 0.82	0.80	0.81

Procedures

Pre-Tests for the Research Sample

The pre-tests for the research sample were conducted on Wednesday and Thursday, March 10–11, 2024. The researcher informed the participants of their results to help them improve their performance.

Table (4): Physical Fitness Components and Applied Tests in the Study

No.	Component	Test Description	Unit of Measurement
1	Transition Speed	20-meter Ball Running Test	Seconds (least time)
2	Motor Balance	Three Rotations Around the Ball Then Shooting	Maximum number of repetitions
3	Spatial Accuracy	Shooting at Cones in Goal Posts	Maximum number of repetitions

Main Experimental Tests for the Research Sample

The main experiment for the study sample was conducted from Thursday, March 14, 2024, to Thursday, May 16, 2024, over a period of eight (8) weeks, with three training sessions per week. Each session lasted 90 minutes and included a variety of skill exercises based on the objectives of the training unit.

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After designing the exercises, they were presented to a group of experts in sports training and football to provide their opinions and feedback regarding the suitability of the exercises for the research sample, which consisted of the Diyala Youth and Sports Football Team. The exercises were then adjusted according to the experts' recommendations before being implemented in the training units.

Post-Tests

The post-tests for the research sample were conducted under the same conditions as the pre-tests on Sunday and Monday, May 19–20, 2024. The aim of the post-tests was to determine the level achieved by the players and to assess their improvement after practicing the applied skills.

Statistical Analysis

The researcher employed appropriate statistical methods, including:

- Mean (Arithmetic Average)
- Median
- Standard Deviation
- Skewness Coefficient
- Significance of Differences Between Means (t-test)
- Pearson's Simple Correlation Coefficient
- Percentage of Improvement (%)

Results

Table (5): Differences Between Pre-Test and Post-Test Measurements for Skill Tests in the Experimental Group

No.	Variables	Pre-Test (Mean ± SD)	Post-Test (Mean ± SD)	Mean Difference ($\bar{X}f$)	SD Difference (Sf)	Calculated t-value
1	20-meter Ball Running Test	4.65 ± 1.02	6.17 ± 1.12	1.52	1.18	4.47
2	Three Rotations Around the Ball Then Shooting (Motor Balance)	1.18 ± 0.72	2.62 ± 0.84	1.44	0.87	5.76

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3	Shooting at Cones in Goal Posts (Spatial Accuracy)	1.09 ± 0.95	2.57 ± 0.79	1.48	0.93	5.69

Discussion

Based on the data presented in Table (5), a clear distinction can be observed between the mean values of the pre-test and post-test measurements. This indicates the presence of statistically significant differences in favor of the post-test. These results provide further evidence of the positive impact of the exercises implemented during the training sessions, which aligns with the assertions made by Fabio Comana. Functional strength exercises include a set of integrated, multi-level movements that involve various aspects of motion, including acceleration, stability, and deceleration (command, 2004).

The effectiveness of functional strength training lies in its ability to engage multiple muscle fibers simultaneously. The observed improvements can be attributed to the careful planning of the functional exercise program, the appropriate selection of training loads based on the participants' age and training stage, and the implementation of modern training methods during the main training sessions.

In this regard, Dave Schmitz (2003) emphasizes that one of the most important features of functional strength training is the focus on the core, as strong core muscles connect the lower limbs with the upper limbs. Furthermore, functional strength training incorporates multi-directional movements, which are performed by concentrating on one limb at a time. This makes it one of the most effective training methods for enhancing core (mid-body) muscle strength and overall balance (Schmitz, 2003).

The researcher believes that functional training, which is often confused with sport-specific training, is the preferred training approach for most athletes. Although functional training may share certain similarities with sport-specific training, it is important to recognize the distinctions between the two. The primary difference lies in the fact that functional training focuses on strengthening the core muscles, while acknowledging the pivotal role of the spine in facilitating movement.

Conclusions

There are statistically significant differences between the mean scores of the pre-test and post-test measurements for the research sample in terms of skill performance, in favor of the post-test. This study represents a scientific effort to enhance the skill performance of football players through functional strength training. Moreover, it may draw the attention of football coaches and practitioners to the importance of developing psychological capacities through functional strength exercises, which could, in turn, positively impact the skill performance levels of football players.

Recommendations

The use of specialized skill tests within functional strength training provides an effective means of assessing the performance level of football players. The proposed program implements functional strength exercises with consistent intensity, repetitions, and rest intervals across different age groups, given their role in enhancing muscular strength and the effectiveness of skill performance. Additionally, applying functional strength training studies can contribute to improving the overall performance levels of football players. The program also presents a scientific approach to using these exercises, which may help address deficiencies and weaknesses in the players' performance.

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The Effect of Problem-Based Learning Instructional Units on Acquiring the Kip-Up Skill on the Horizontal Bar

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Abstract

The research problem emerged from the researcher's observation that many students encounter difficulties in learning certain curricular skills in gymnastics, particularly the kip-up skill on the horizontal bar, which is considered challenging due to the lack of understanding of the correct technique and the inability to visualize the appropriate movement pathway for performing the skill. This prompted the researcher to investigate the problem and attempt to provide a solution. The importance of the study lies in designing instructional units based on the problem-based learning approach and examining their effect on acquiring the kip-up skill on the horizontal bar, with the aim of assisting students in mastering this skill through a modern instructional strategy. The researcher employed the experimental method with two groups, experimental and control, as it was suitable for the nature and objectives of the study. The research population consisted of 247 third-year students in the College of Physical Education and Sports Sciences at the University of Diyala during the academic year 2023–2024, from which a sample of 16 students was selected for the experimental group and 16 for the control group. Pre-tests were conducted prior to the intervention. The results indicated that instructional units designed according to the problem-based learning approach are effective in teaching the kip-up skill on the horizontal bar to students at this level, and the researcher recommended adopting such instructional units due to their positive impact on skill acquisition.

Keywords: Instructional units, Problem-based learning, Kip-up on the horizontal bar.

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Introduction

The concept of the instructional unit is regarded as one of the educational terms that emerged in response to the development of the teaching–learning process, aiming to achieve modern curricula that meet the demands and challenges of the contemporary era. Scholars and experts have long debated the definition of this term until it became established as a curricular framework or organizational method. This aligns with Al-Saeed and Gaballah (2014), who defined instructional units as “a part of the curriculum, a specific organization of the subject matter, and a teaching method that places students in learning situations which, as a whole, form an integrated unit with clear objectives that can be achieved through these situations.” Similarly, Fawzi (2014, p.40) stated that “an instructional unit is a set of classroom procedures adopted by the teacher to implement a given subject matter characterized by integration, coherence, and objectivity, placing students in comprehensive learning situations that stimulate their interest and require them to perform diverse activities that allow them to gain specific experiences and achieve predetermined educational objectives.” Among the modern teaching strategies is problem-based learning, which, according to Al-Balushi (2009, p.263), “was formally introduced into the field of education and teaching by Barrows, who applied it as a novel and alternative method in training medical students at McMaster University in Canada in the 1950s, by presenting real and authentic problems for students to investigate and generate solutions for.” This type of learning encourages students to construct meaning, develop conceptual understanding, and build confidence in their ability to confront new problems in the future and generate scientific and practical solutions independently, rather than relying on ready-made answers. As Zeitoun (1992, p.53) emphasized, this approach makes learning meaningful, purposeful, and far from rote memorization, thereby enhancing students’ ability to succeed and experience satisfaction in their learning. In the context of gymnastics, which is considered a demanding and precise sport that often requires instructional support to simplify skill acquisition, educators have sought to provide diverse and accessible learning conditions to accelerate the learning process. As Bormann (1987, p.269) highlighted, “kip movements are among the most important linking movements; despite variations in the starting style and grip, the performance technique remains consistent, as the swing energy is transferred to the trunk upon deceleration, and by using the reaction of support, the body can rise to a higher position on the apparatus.” The primary aim of the kip movement, according to Liersch and colleagues (1978, p.70), “is to move the body from a lower level to a higher one by flexing and extending at the hip joint.”

After observation and review, the researcher found that most students encounter difficulties in learning certain curricular skills in gymnastics, particularly the kip-up skill on the horizontal bar. This skill is considered challenging for students due to their lack of understanding of the correct technique and their inability to visualize the appropriate movement pathway required to perform the skill.

Research Objective: To identify the effect of using instructional units based on the problem-based learning approach on acquiring the kip-up skill on the horizontal bar.

Research Hypothesis :There are statistically significant differences between the experimental and control groups in favor of the experimental group.

Scope of the Study

Human Scope: Third-year students at the College of Physical Education, University of Diyala.

Spatial Scope: The gymnastics hall at the college.

Temporal Scope: From December 17, 2023, to March 26, 2024.

Methodology

The researcher employed the experimental method using a pre-test and post-test design for both the experimental and control groups, as it was suitable for the nature and problem of the study.

Research Sample

The research population consisted of third-year students at the College of Physical Education and Sports Sciences, University of Diyala, for the academic year 2023–2024. The study sample included 32 students selected randomly. The experimental group consisted of 16 students chosen by random draw, and the control group also included 16 students selected in the same manner. Additionally, a pilot sample of 5 students from the third-year cohort, who were not part of the main study sample, was used for preliminary testing.

Data Collection Tools

Sources and References, Arabic and foreign sources, and a results recording form. The equipment used in this study included an HP computer and one Sony video camera, which were employed to record and analyze students' performance during the learning and assessment of the kip-up skill on the horizontal bar.

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Procedures

The study employed several procedures to conduct the research. First, three evaluators were assigned to assess the performance of the kip-up skill on the horizontal bar for all participants in the study sample, using a 10-point scale. A pilot experiment was conducted on December 17, 2023, Sunday, at 8:30 a.m. in the gymnastics hall with five students from the third-year cohort who were not part of the main study sample. The pre-tests for the research sample were administered on Wednesday, December 20, 2023, at 10:30 a.m. in the gymnastics hall. During these tests, the researcher ensured the standardization of all testing conditions, including time, location, equipment, and implementation procedures, to maintain consistency and control across pre- and post-tests. The main experiment was conducted from December 24, 2023, to February 11, 2024, during which the instructional units based on the problem-based learning approach were applied. Each instructional unit lasted 45 minutes, with one unit delivered per week over eight weeks. The subject teacher provided explanations and demonstrations of the skill according to the curriculum for both the experimental and control groups. The control group received traditional instruction, while the experimental group was taught using the problem-based learning approach. The researcher's role was limited to preparing the instructional units, monitoring the progress of the experiment, controlling time and repetition, and supervising the implementation of all instructional units. Post-tests were conducted on Wednesday, February 14, 2024, at 10:30 a.m. in the gymnastics hall under the same conditions as the pre-tests to ensure high reliability of the results.

Results

Table 1: Shows the means and standard deviations for the pre-test and post-test for the experimental and control groups

group	Test	N	Mean	Standard Deviation	Standard Error
Experimental Group	Pre-test	16	2.389	0.054	0.013
	Post-test		5.556	0.029	0.007
Control Group	Pre-test	16	2.432	0.068	0.017
	Post-test		3.902	0.054	0.014

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Table 2: Shows the differences in means, standard deviations, standard errors, t-values, and significance levels for the experimental and control groups.

Variables	Mean Difference	Standard Deviation Difference	Standard Error	t-value	Sig.
Experimental Group	-0.167	0.062	0.015	10.796	0.000
Control Group	-2.500	0.966	0.242	10.351	0.000

Discussion

It can be observed from Table 1 that there are significant differences between the pre-test and post-test in the kip-up skill test in favor of the post-test, indicating an improvement in the performance level of the study sample as a result of the instructional units based on the problem-based learning approach. The researcher attributes this improvement to the fact that students, when exposed to any new learning experience, acquire additional knowledge and skills, as reflected in the performance scores of each individual. This improvement in skill execution aligns with the observations of many experts in the field; Talha et al. (2006) noted that when beginners learn a new sports skill, there are varying performance levels during the initial days of learning, with some learners taking longer and others mastering the skill more quickly, while some fall in between these two extremes. The results clearly demonstrate the effectiveness of the instructional units based on problem-based learning, as they contributed to the development of students' performance at varying rates. Mohamed Odeh Al-Rimawi (1994) emphasized that educational strategies should foster the growth of each learner's problem-solving abilities, encourage self-assessment, and enhance motivation for learning.

Regarding the control group, Table 1 also shows significant differences between the pre-test and post-test in favor of the post-test. The researcher attributes this improvement to the instructional methods employed by the teacher, which contributed to some progress in the control group, although less pronounced than in the experimental group.

Comparing the experimental and control groups in the post-test reveals the superiority of the experimental group's results, which can be attributed to the effectiveness of the instructional units designed according to the problem-based learning approach. The researcher notes that the experimental group outperformed the control group because this approach enhanced specific aspects of learning, including active student engagement and participation in tasks, which contributed to improved performance. In contrast, the control group relied on traditional

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instruction, which primarily involved rote transmission of information and limited application, resulting in lower performance levels and reduced ability to correct mistakes during skill execution. The positive outcomes observed in the experimental group are therefore attributed to the impact of the instructional units and the problem-based learning strategy, which significantly facilitated better skill acquisition in the kip-up test. Farida Ibrahim also emphasized that the most effective learning model involves visual observation, and that learning can be accelerated and enhanced when information is presented and processed through multiple senses.

Conclusions

The problem-based learning approach plays a significant role in promoting the development and acquisition of the kip-up skill. A clear improvement in performing the kip-up skill was observed when applying this approach and organizing the instructional units accordingly, which contributed to this progress. The integration of the problem-based learning strategy had a substantial and effective impact on the learning process, facilitating skill acquisition and enhancing overall student performance.

Recommendations

Emphasis should be placed on using the problem-based learning approach in acquiring the kip-up skill. It is important to employ a variety of modern learning tools in all their forms, as they stimulate interest and increase students' motivation toward the learning process. Furthermore, the use of the problem-based learning strategy is recommended for teaching other sports skills and activities to enhance learning outcomes and engagement.

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Contribute to the pivotal thinking skills in performing the transmission skill from Volleyball Fourth preparatory grade adolescents

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Abstract

The aim of this study was to identify the level of critical thinking skills among fourth-grade middle school students and to determine the performance level of the underhand volleyball pass, with the assumption that there is a positive relationship between critical thinking and skill performance. The study population included 281 students from Basra Preparatory School for Girls under the Second Baghdad Education Directorate for the 2024/2025 academic year, of whom 275 students were intentionally selected as the research sample (97.865% of the population). The experimental procedure involved applying a critical thinking scale and a technical performance test for the underhand pass on 25 students per day over 11 days, from February 9 to February 23, 2025, excluding Fridays and Saturdays. During this period, students had already been taught the underhand pass within the curriculum. Data were analyzed using SPSS, and results indicated that students possessed an acceptable level of critical thinking skills and an acceptable level of performance in the underhand pass. Moreover, higher levels of critical thinking were associated with improved skill performance, demonstrating a direct positive impact. The study recommends that physical education teachers incorporate critical thinking assessment and training into volleyball lessons to enhance both cognitive and practical skill development.

Keywords Critical Thinking Skills, Pivotal Thinking, Volleyball, Underhand Serve Performance.

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Introduction

The task of thinking lies in finding appropriate solutions to theoretical and practical problems that learners face in nature and society, and this task is continually renewed, prompting an ongoing search for new methods and strategies to overcome difficulties and obstacles. Therefore, thinking, as a cognitive process, is considered a fundamental element in the learner's cognitive construction, characterized by its social nature and systemic function, which allows it to interact with other cognitive processes such as perception, imagination, and memory, as well as with emotional, affective, and social aspects (Rzouqi et al., 2019, p. 11).

Skill is defined as "a performance characterized by a high degree of quality and consistency, minimizing the effort and time expended by the individual, whether applied mentally or physically" (Zayer et al., 2019, p. 85). Accordingly, critical thinking skills are defined as "a relatively discrete cognitive process that can be considered as building blocks of thinking" (Alwan, 2012, p. 106). They are also described as "a mental process applied uniformly to achieve a specific goal, comprising a list of twenty-one fundamental sub-skills categorized into eight main groups" (Nofal & Al-Rimawi, 2008, p. 33), and as "a set of mental processes that students must possess to understand, comprehend, and recognize the relationships, ideas, and main concepts involved" (Bayoumi, 2023, p. 92).

It is essential that the development of cognitive skills proceeds alongside physical fitness, with skills such as attention, mental visualization, and memory retrieval planned for development like strength, flexibility, and speed. Integrating both mental and physical preparation, especially in early stages, supports the enhancement of physical, skill-based, cognitive, and affective competencies, while neglecting such integration hinders competitive achievement (Basel, 2018, p. 222). Studying thinking, its methods, and structural characteristics is fundamental for applying appropriate thinking strategies to situations encountered in life, with thinking methods reflecting individual preferences and adaptability depending on the context (Al-Fahdawi & Al-Hayani, 2016, p. 219).

Jalabi notes that Robert Marzano and colleagues classified twenty-one central thinking skills into eight main categories, providing students with a framework to organize their thinkin skills and become effective thinkers. Teaching critical thinking skills can occur at any stage of formal education and supports other cognitive dimensions, including critical and creative thinking, with the skills interconnected rather than separate (Jalabi, 2024, p. 5).

The most common classification of critical thinking skills includes: 1) Focus skills: problem identification and goal setting; 2) Information-gathering skills: observation and question formulation; 3) Memory skills: encoding and retrieval; 4) Organization skills: comparison, classification, sequencing, and representation; 5) Analysis skills: identifying features, patterns, main ideas, and errors; 6) Generation skills: inference, prediction, and expansion; 7) Integration skills: summarization and reconstruction; 8) Evaluation skills: setting criteria and verification (Sufih, 2023, pp. 57–59).

The importance of thinking skills for learners and teachers lies in enabling students to consider diverse perspectives, evaluate ideas objectively, enhance learning enjoyment, boost self-confidence and self-esteem, and support teachers in addressing various learning styles, increasing motivation, engagement, and instructional effectiveness (Al-Afoun & Abdul-Sahib, 2012, pp. 37–39).

Volleyball, characterized by its fast-paced skill execution, requires facilitating thinking processes to improve the application of technical skills and achieve multiple objectives simultaneously. The underhand pass is a fundamental skill in volleyball, defined as “the stroke used to start play or resume it after a point or error, typically executed by the player in the back-right position using an open or closed hand or any part of the arm to send the ball over the net to the opponent’s court” (Marwan, 2001, p. 67).

Through observing fourth-grade students, the researchers noted that many need to focus on body movements while performing the underhand pass, necessitating detailed attention to skill execution. Hence, the research problem seeks to answer the question: Do critical thinking skills contribute to the performance of the underhand volleyball pass among fourth-grade students? Accordingly, the study aims to identify the level of critical thinking skills among these students and assess their numerical performance in the underhand pass, hypothesizing a positive relationship and influence of critical thinking on skill performance.

Methodology

The study adopts a descriptive approach with a correlational method according to the specifications of the current research problem. The research population consists of fourth-grade students at Basra Preparatory School for Girls, under the Second Karkh Baghdad Education Directorate for the 2024/2025 academic year, including both scientific and literary branches in the morning study schedule. The total population comprises 281 students, divided naturally into five classes. After excluding six students who did not meet the research criteria for various reasons, 275 students were intentionally selected as the research sample, representing 97.865% of the total population.

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To measure critical thinking skills in volleyball, the study employed the scale developed by Muhammad (2025, p. 115), specifically designed for this sample, which is scientifically validated and has been constructed within the last six months (see Appendix 1). Its detailed components are presented in Table 1.

Table 1: Structure of the Critical Thinking Skills Scale in Volleyball for Fourth-Grade Students

Scale Dimension	Number of Items	Response Options	Scoring Key	Score Range	Hypothetical Mean
Focus Skills Dimension	5	Always applies, Sometimes applies, Does not apply	3 2 1	5 – 15	10
Information-Gathering Skills Dimension	5			5 – 15	10
Memory Skills Dimension	5			5 – 15	10
Information Organization Skills Dimension	5			5 – 15	10
Analysis Skills Dimension	5			5 – 15	10
Generation Skills Dimension	5			5 – 15	10
Integration Skills Dimension	5			5 – 15	10
Evaluation Skills Dimension	5			5 – 15	10
Total	40	3	3	40 – 120	80

Note: The scale includes guiding instructions for the students to answer the items.

To measure the technical performance of the underhand serve, a performance test graded out of ten points was adopted (Nassif et al., 2012, p. 111). The research experiment began with the application of the critical thinking skills scale and the technical performance test of the underhand serve, at a rate of 25 students per day over a period of 11 days, from February 9, 2025, to February 23, 2025, excluding Fridays and Saturdays each week. This timing was chosen based on the fact that, during this period, the students had already received instruction in the underhand serve in volleyball as part of their scheduled curriculum for the first semester of the academic year.

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Statistical Analysis

The research data were processed automatically using the Statistical Package for the Social Sciences (SPSS) to calculate the values of percentages, arithmetic mean, standard deviation, the t-test for independent samples, Pearson's simple correlation coefficient, Cronbach's Alpha equation, Pearson's skewness coefficient, the t-test for a single sample, and the simple linear regression coefficient.

Results

Table 2: Comparison of the Arithmetic Mean with the Hypothetical Mean for Both Variables

Variables	Total Score	Hypothetical Mean	Arithmetic Mean	Standard Deviation	Mean Difference	t	Sig.
Critical Thinking Skills	120	80	84.2	1.954	4.204	35.668	0.000
Underhand Serve Performance in Volleyball	10	5.0	6.78	1.403	1.778	21.015	0.000

Table 3: Results of the Correlation, Simple Linear Regression, Contribution Ratio, and Standard Error

Predictor Variable	Dependent Variable	Simple Correlation Coefficient (R)	Linear Regression Coefficient R^2 (Coefficient of Determination)	Contribution Ratio	Standard Error of Estimate
Critical Thinking Skills	Underhand Serve Performance in Volleyball	0.937	0.879	0.878	0.489

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Table 4: Results of the F-Test for Examining the Goodness of Fit of the Simple Linear Regression Model

Predictor Variable	Dependent Variable	Variance Source	Sum of Squares	df	Mean Square	F	Sig.
Critical Thinking Skills	Underhand Serve Performance in Volleyball	Regression	474.118	1	474.118	1980.595	0.000
		Residual	65.351	273	0.239		

Table 5: Results of the Estimated Values of the Constant Term and the Slope (Effect)

Dependent Variable	Predictor Variable	Beta (β)	Std. Error	t	Sig.
Underhand Serve Performance in Volleyball	Constant	49.896	1.274	39.171	0.000
	Critical Thinking Skills	0.673	0.015	44.504	0.000

Discussion

Referring to the results presented in Table (2), it is evident that the arithmetic means of both investigated variables among fourth-grade secondary school students exceeded their hypothetical means, indicating the availability of the desired level for each. Furthermore, the regression model results shown in Table (3) revealed that critical thinking skills are significantly associated with and contribute to the underhand serve performance in volleyball. This was further confirmed by the regression model fit in Table (4), while the remaining proportion of contribution is attributed to other random, unexamined factors. In addition, Table (5) demonstrated that an increase in critical thinking skills has a direct positive effect on enhancing underhand serve performance in volleyball. These results indicate that critical thinking skills play an essential role in improving the level of performance in underhand serve, as the researchers attribute these findings to the fact that the specific educational objectives in physical education rely on knowledge-based performance. Such knowledge requires detailed and comprehensive thinking to master the requirements of the motor skill and achieve the correct performance in class. Hence, critical thinking skills become a necessity for students to activate information during the practical phases of learning tasks, enabling knowledge-based and meaningful performance after careful thinking through the details of the three stages of the skill, while also avoiding common errors before practical application. This is particularly important for beginners, as it requires teaching

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them to think through practical applications tailored to classroom situations, thereby achieving multiple purposes simultaneously.

Indeed, it has been confirmed that "the brain operates on the principle of 'use it or lose it,' and thus, thinking must be emphasized as it sustains brain activity" (Al-Afoun, 2012, p. 213). Moreover, "many scholars have highlighted the importance of teaching thinking by linking it with academic subjects, as such integration strengthens students' confidence in themselves and enables them to apply it more effectively" (Yousef, 2011, p. 73). In this regard, "teaching critical thinking skills can take place at any educational stage, as these skills are fundamental and indispensable for employing other dimensions of thinking, such as metacognitive thinking, critical thinking, or creative thinking. They serve as the building blocks of cognition and an effective tool for enabling learners to acquire knowledge and cope with the demands of contemporary life. Critical thinking also helps learners independently access information and facts rather than relying on others" (Khalil & Jameel, 2020, p. 180). Furthermore, "the surrounding environment has a clear impact, sometimes even constraining most of one's thinking. A psychologically healthy environment supports sound thinking, whereas a weak or unstable environment may lead to disturbances in one's thought processes" (Mikhail, 2022, p. 42). It has also been emphasized that "all thinking requires an input of information received by the brain through the senses, which is supported by visual stimuli in magnetic field applications. Thus, attention and focus must be increased on relevant stimuli for learners to effectively cope with classroom situations" (Shamoun, 2017, p. 60). Additionally, "when diverse ideas and innovative experiences are exchanged, an environment that fosters creativity can emerge. In the context of volleyball, students can be inspired by the ideas of others to experiment with new and effective techniques" (Capranica & Others, 2020, p. 165). As noted, "the importance of critical thinking lies in deep and deliberate reflection on a topic or situation, analyzing events from multiple perspectives, consolidating learning through meaningful tasks, and fostering creativity in students while enabling them to deal with real-life challenges effectively" (Abdul-Karim & Al-Jarrah, 2021, p. 326). Likewise, "critical thinking can develop diverse abilities and skills among students, such as planning, inference, observation, evaluation, and problem-solving, while also enhancing academic performance and achieving a deeper understanding of content" (Ibrahim, 2021, p. 197).

Conclusions

The study concluded that fourth-grade secondary school students possess an acceptable level of both critical thinking skills and underhand serve performance in volleyball. Moreover, the findings demonstrated that an increase in the level of critical thinking skills directly and positively

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contributes to the improvement of underhand serve performance, indicating a strong and proportional relationship between the two variables.

Recommendations

Based on these conclusions, it is recommended that physical education teachers adopt the critical thinking skills scale in volleyball when applying modern teaching strategies for skill performance. Furthermore, there is a need to emphasize the integration of critical thinking skills into practical volleyball lessons, ensuring that their development goes hand in hand with the enhancement of technical performance in the game.

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Assessment of Lower Limb Joint Postural Deformities Using APECS among Male Physical Education and Sport Science Applicants

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Abstract

The Alignment Posture Evaluation and Correction System (APECS) is a non-radiographic AI-based mobile application designed to assess body posture safely and accurately, unlike X-rays, which may be harmful and less precise. This study used APECS version 2.0 (DXM model) to detect lower limb deformities in hip, knee, and foot joints among 60 male applicants to the College of Physical Education and Sports Science. Full-limb images with anatomical markers were captured, and joint angles were automatically calculated by the software. Results indicated deformities in the hip (18.35%), knee (26.61%), and foot (41.28%). The program demonstrated high accuracy, with a 98.74% matching rate and 94.64% agreement, confirming its validity as a reliable, non-invasive tool for assessing lower limb postural deformities in prospective students.

Keywords: Artificial intelligence, software applications, lower limb joints.

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Introduction

Advanced countries care for all segments of their population and strive to provide healthcare to maintain a well-proportioned, balanced, and healthy human physique. Physical education is considered a component of general education and represents a fertile field for preparing individuals in terms of health, physical fitness, mental, emotional, and social aspects. This is achieved through learning and practicing various types of physical and sports activities to accomplish these objectives.

The field of rehabilitation, encompassing both physical and psychological aspects, plays a significant role in the selection process and early detection of practitioners' readiness for sports before engagement. This is a key factor in preventing adverse outcomes from participating in physical activities. Moreover, maintaining a healthy body posture has become an essential requirement in daily life.

Postural deformities, including deformities of the lower limb joints, constitute a fundamental aspect of the human body around which movement revolves. The alignment of the body and the coordination of all its parts depend on the health, integrity, and balance of the muscles acting on the lower limbs, represented by the hip, knee, and foot joints.

The use of the APECS (Automated Posture Evaluation and Correction System) program, a non-radiative mobile application, is designed to assess the entire body posture. It is part of artificial intelligence programs that have emerged as an alternative to visual inspection or X-ray diagnosis, providing a safe, accurate, and valid method for measuring postural deformities. On the other hand, relying solely on visual assessment in faculties of physical education and sports science to examine prospective students and detect lower limb deformities does not provide an accurate evaluation of the applicant's condition. One of the primary admission requirements is for candidates to possess proper posture to be able to meet the academic and practical demands of the curriculum.

The aim of this study is to utilize the non-radiative APECS program to detect postural deformities of the lower limbs (hip, knee, and foot joints) and to examine the relationships between these deformities.

Theoretical significance: This research contributes to the academic literature on studies that promote the adoption of artificial intelligence tools and applications, including the non-radiative APECS program, which can assist in detecting postural deformities and thus serve the field of sports.

Practical significance: This study is distinguished by its use of artificial intelligence applications to detect postural deformities, including lower limb deformities, in order to obtain precise data that can be relied upon to accurately determine the degree of deformities. According to the researchers' knowledge, this study is the first to apply such an approach within examination and testing committees.

Based on the work of researchers in faculties of physical education and sports sciences, and their study of postural deformities among individuals of both genders and various ages, as well as their previous participation in health fitness examination committees for applicants to physical education and sports programs, it is noted that health and postural assessments are typically conducted through visual inspection, including the identification of postural deformities. Students applying to physical education faculties must be free from such deformities that could impede their ability to perform the required coursework and various physical and sports activities. Consequently, this study proposes the use of a modern artificial intelligence application, the non-radiative APECS program, to conduct the screening and diagnosis process in a practical and precise manner.

Research Questions

What are the common postural deformities of the lower limbs among applicants to the Faculty of Physical Education and Sports Sciences?

What is the correlation between the common lower limb postural deformities among applicants to the Faculty of Physical Education and Sports Sciences?

Research Objectives

To detect, diagnose, and identify the degrees of postural deformities in the lower limb joints (hip, knee, and foot) and examine the relationships between them.

Research Hypothesis

There is a statistically significant positive correlation between the angular variables and deformities of the lower limb joints (hip joint angles, knee joint angles, and foot angles).

Research Scope

Human Scope: A sample of applicants to Al-Mustansiriya University – Faculty of Physical Education and Sports Sciences for the academic year 2024–2025, consisting of 60 male applicants.

Temporal Scope: From September 11, 2024, to September 25, 2024.

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Spatial Scope: The medical examination hall at the Faculty of Physical Education and Sports Sciences – Al-Mustansiriya University.

Methodology

The researchers employed the descriptive method, as it is suitable for the nature and problem of the study, allowing them to achieve the research objectives and test the proposed hypotheses.

Research Population and Sample

The research population was deliberately defined as the applicants for preliminary admission to the Faculty of Physical Education and Sports Sciences for the academic year 2024–2025, totaling 60 male applicants.

The research sample was then selected randomly from the population, comprising 90 applicants, representing 60% of the original population.

The researchers ensured the homogeneity of the research sample in the variables of body mass, height, and chronological age by using skewness values, as shown in Table (1).

Table (1): Show Sample Homogeneity

No.	Variable	Unit of Measurement	Sample (n)	Mean	Standard Deviation	Skewness
1	Body Mass	Kilogram (kg)	60	72.557	10.132	0.032
2	Height	Centimeter (cm)	60	174.2	6.569	0.226
3	Chronological Age	Year (yr)	60	18.443	0.5	0.235

Research Tools

- The medical examination hall at Al-Mustansiriya University.
- An electronic calculator: MacBook Air laptop.
- A mobile device: iPhone 15 installed with the APECS program.
- Rastameter device for measuring height (cm) and body mass (kg).

Data Collection

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- References and sources in Arabic and English, previous related studies, and the Internet.
- Personal interviews.
- Data collection forms.
- Observation and experimentation.

Procedures

This study was conducted on a sample of male applicants (n = 60) to the Faculty of Physical Education and Sports Sciences. Joint angles were determined using APECS software, version 2.0, model DXM. Full-limb photographs were captured, anatomical landmarks were marked, and angles were automatically generated by the program.

The location and procedures for photographing the applicants were set according to the software requirements as follows:

- The subject stood facing the camera at a distance of 120 cm, ensuring equal spacing on both sides so that the subject was centered in the frame.
- The subject stood upright with knees fully extended, chest open, head raised, eyes looking forward, palms facing the sides of the body, feet together, and thumbs pointing forward.
- Placement of Anatomical Points:
- Top of the iliac crest (right and left sides).
- Midpoint of the knee (right and left sides).
- Point below the knee (right and left sides).
- Lateral point on the calcaneus (right and left sides) at the subtalar joint.

Examined Deformities

First: Pelvic Deformities – Hip

- Pelvic tilt (general): Includes lateral pelvic tilts as follows:
- Tilt to the right side.
- Tilt to the left side.
- Pelvic tilt usually refers to the angle formed between a horizontal line and the line connecting the anterior superior iliac spine (ASIS) and posterior superior iliac spine (PSIS) in the sagittal plane.

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Second: Knee Joint Deformities (General)

- The range of motion (ROM) of the knee joint was measured in degrees of flexion. In males, the normal ROM is -6° to 140°, and in females, it is -5° to 143°. Specific knee deformities include:
- Genu valgum (knock-knees): Characterized by a noticeable gap between the feet when the knees are together.
- Genu varum (bowlegs): Outward curvature of the legs causing the knees to remain apart while the ankles touch, creating a noticeable gap between the knees.
- Third: Foot Deformities (General):
- Out-toeing: Deviation of the foot outward.
- In-toeing: Deviation of the foot inward.

Statistical Analysis

After collecting the raw data, the researchers analyzed it using IBM SPSS statistical software (version 26) (Statistical Package for the Social Sciences). The analysis included calculating the mean, standard deviation, percentage, skewness, and Spearman's correlation coefficient to obtain a comprehensive understanding of the data and examine the relationships between the studied variables.

Results

Table (2): Frequencies, Percentages, and Rankings of Lower Limb Postural Deformities in the Research Sample

Main Deformity	Sub-Deformity	Unit	Frequency	% Frequency	% Total	Internal Rank	Deviation Degree	External Rank
Pelvis – Hip	Pelvic tilt to the right	Degree	8	7.34%	18.35	2	8	1
	Pelvic tilt to the left	Degree	12	11.01%		4	15	2
Knee	Right knee valgum (outward)	Degree	14	12.84%	26.61	5	33	6

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	Left knee valgum (outward)	Degree	15	13.76%		6	23	5
	Right knee varum (inward)	Degree	6	5.50%	13.76	1	18	3
	Left knee varum (inward)	Degree	9	8.26%		3	21	4
Foot	Right foot deviation	Degree	23	21.10%	41.28	8	285	8
	Left foot deviation	Degree	22	20.18%		7	276	7
Total			109	100%		8	679	8

Table (3): Postural Deformities and Their Correlations in the Lower Limbs of the Research Sample

No.	Postural Deformity Correlation	Correlation Coefficient	Postural Deformity Correlation	Correlation Coefficient
1	Right ankle – Right knee	0.18	Left ankle – Left knee	0.23
2	Right ankle – Left knee	0.16	Left ankle – Right knee	0.12
3	Right ankle – Right pelvis	0.10	Left ankle – Right pelvis	-0.09
4	Right ankle – Left pelvis	-0.20	Left ankle – Left pelvis	0.67
5	Right knee – Right pelvis	0.17	Left knee – Right pelvis	-0.39
6	Right knee – Left pelvis	-0.33	Left knee – Left pelvis	0.18

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Discussion

Upon reviewing the results presented in Tables (2) and (3), the findings for the study sample can be discussed as follows: Prior to the discussion, it is necessary to provide a brief overview of the components of the lower limb. The lower limb is divided into three regions: the thigh, the leg, and the foot. Each lower limb contains 30 bones connected by joints that contribute to movement, balance, and motor coordination through specific joint angles and ranges of motion. The anatomical angles of the lower limb joints play a crucial role in maintaining body stability and equilibrium. The strength of the lower limb muscles substantially contributes to preserving the normal angular values of the lower limb within the human body. Any alterations or deviations in these angular values from the body's midline may expose the individual to disorders and injuries in the joints and muscles of the lower limb, in addition to the development of certain postural deformities (Butler, el al, 2011).

The internal femoral angle (MNSA) is 130°, and the lateral femoral angle (LPFA) is 90°. The medial proximal tibial angle (MPTA) is 87°, and the lateral distal femoral angle (ALDFA) is 81°. The lateral distal tibial angle (LDTA) is 89°, and the medial distal tibial angle (ADTA) is 80° (Kaufman KR, Hughes C, Morrey BF, 2021).

Sports injuries are often accompanied by changes in anthropometric and morphological measurements. Therefore, professionals in sports training must carefully consider the outcomes of these measurements, whether they pertain to external body dimensions or body levers, including the upper limb or its components, as well as the lower limb or its respective segments (Mohamed Bakry and Siham El-Sayed, 2011).

There is a strong correlation and motor integration among the movements of the lower limb joints, such that any deformity in one joint can have negative repercussions on all lower limb joints. Dynamic lower limb deviation, for example, involves a combined movement of hip adduction, internal rotation, knee abduction, and ankle/foot flexion, which places increased abnormal forces on the knee (Ford KR, el al, 2015). Compensatory movements resulting from ankle insufficiency may manifest as foot/ankle flexion, knee abduction, or hip adduction (Bell DR, et al, 2008).

According to the results presented in Tables (2) and (3), the researchers attribute some causes of pelvic tilt to lifestyle patterns, poor postural habits, and certain sports activities that require lateral body leaning or favoring one side over the other. This deviation may be associated with lower back pain and muscular weakness, as well as contributing to knee or foot misalignments. The orientation of the pelvis relative to the femur, within its designated anatomical space, can tilt either to the right or left. A significant degree of pelvic tilt may lead to knee pain, lower back pain, other musculoskeletal disorders, and a reduced capacity for athletic performance.

Pelvic tilt is typically assessed in a static manner, such as observing an individual's pelvis while standing in a relaxed posture. It can also be evaluated actively, for example, by measuring the individual's ability to move the pelvis through its maximum range while maintaining an upright stance. Additionally, pelvic tilt can be assessed during functional movements, such as changes in the pelvic tilt angle during downward motion. While there are various descriptions of pelvic tilt, for the purposes of this discussion, pelvic tilt refers to the spatial position or movement of the pelvis in the sagittal plane around an anterior–posterior horizontal axis.

According to the results presented in Tables (2) and (3), one of the most significant problems resulting from knee deformities, regardless of the type, is that the patient's body weight is not evenly distributed across the entire joint surface. Instead, it is concentrated on a small portion of the surface, which, over time, leads to cartilage damage in that area and early onset osteoarthritis in the knee joint(Abdulghani et al., 2025; Abdulkareem & Ali Hassan, 2025).

This occurs when the knees move closer together while the ankles move apart as the legs remain extended in a straight line. Knee contact, or genu valgum, is characterized by medial approximation of the knees with increased distance between the feet in a normal standing position, resulting from lateral displacement of the body's center of gravity relative to the knee joint (Al-Kharboutly, 2011). Individuals with a severe degree of this congenital deformity are typically unable to bring their feet together while standing upright. Causes of knee contact deformity include weakness of the ligaments and muscles supporting the knee joint, poor daily habits such as walking and standing incorrectly, and participation in improperly regulated sports activities or exercises, as well as the use of unsuitable surfaces or equipment. These factors lead to shortening and strengthening of the lateral (external) knee muscles and ligaments, accompanied by weakening and elongation of the medial structures, which results in excessive pressure on the knee cartilage. Consequently, the legs lose their alignment, causing the femur to tilt inward(Abdulhussain et al., 2025).

This misalignment significantly affects the body's weight transfer line and the distribution of forces on the ankle and foot arches, leading to various foot deformities and impacting the stability and function of other lower limb joints. One such deformity is bowing of the tibia, where the knees remain apart while the ankles touch during standing, creating a noticeable gap between the knees. This condition can affect both children and adults. Furthermore, this deformity may result in malformations of the hip joint and ankle, as well as inward or outward deviation of the feet (Blevins, 2021).

When the foot contacts the ground during walking, running, or jumping, the body weight exerts a substantial amount of pressure and force on the foot. The force applied to each foot during running can reach up to 2.5 times the body weight upon ground contact. The bones, joints, ligaments, and muscles of the foot absorb this force, thereby significantly reducing the impact transmitted from the lower limb to the upper body. The arches of the foot play a crucial role in shock absorption, as they slightly flatten under load to absorb energy and return to their natural shape once the weight is removed (Abdulkareem & Sattar Jabbar, 2025).

Causes of this deformity include genetic factors, motor performance deficits from repetitive exercises with resistance in an unscientific or unregulated manner, or association with other postural deformities of the skeletal system. This deformity is linked to other lower limb malformations. Foot deformity often manifests as lateral bending with the foot twisted downward and inward, which increases the curvature of the foot and causes inward rotation of the heel (Al-Kharboutly, 2011).

One of the causes of this deformity is the high loads applied to the feet, particularly body weight, as well as performing exercises or movements that involve repeated jumping and landing on the feet. Flatfoot is a common deformity affecting many individuals, including athletes across different age groups, due to weakness of the foot muscles and ligaments on one hand, and continued misuse on the other (Gad, 1989).

There is a relationship between deformities of the hip and knee joints and the development of flatfoot. During movement, whether walking or running, body weight is transferred through the lower limb joints (hip, knee, and foot). In individuals with flatfoot, the foot's load-bearing phase is compromised, leading to a disruption in the body weight transfer line and consequent collapse of the foot arch. In flatfooted individuals, when lifting the foot, the heel, ball of the foot, and toes rise simultaneously, unlike the normal pattern where the heel can lift while the forefoot bears weight. This abnormal movement causes fatigue and pain, resulting in an altered gait pattern (Hindi, n.d).

Conclusions

The APECS program demonstrated a high match rate (98.74%) and agreement (94.64%), indicating its excellent validity for measuring lower limb joint angles. The angular values of the femur, knee, and ankle are highly important for maintaining the stability, balance, and equilibrium of the lower limb, thereby preventing the progression of postural deformities or the occurrence of lower limb injuries. Furthermore, there is a strong correlation among postural deformities of the lower limb joints, with each potentially influencing the others.

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Recommendations

It is important to conduct morphological and biomechanical measurements and screen for postural deformities when assessing applicants for admission to faculties of physical education and sports sciences, and to repeat these assessments throughout the academic years while addressing any issues promptly to prevent student injuries. Monitoring postural deformities resulting from daily habits that require prolonged postures is also essential. Attention should be given to appropriate equipment, such as using specialized footwear or floors with specific specifications. Additionally, promoting a culture of exercise and athletic performance based on sound principles of sports training is crucial.

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Evaluating the performance of the coaches of the Iraqi Gymnastics Federation from the point of view of players and experts

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Abstract

This study focuses on evaluating the performance of coaches of the Iraqi Gymnastics Federation from the perspectives of both athletes and experts, emphasizing the critical role of gymnastics as a foundation for many other sports. The significance of the research lies in improving evaluation mechanisms for gymnastics coaches through the use of validated questionnaires and scientific models, thereby enhancing coaches' effectiveness and consequently the athletes' performance. The study employed a descriptive–survey method and included a statistical population of 340 participants, comprising athletes and experts from the Iraqi Gymnastics Federation. Data collection was conducted using the Performance Evaluation Questionnaire developed by Rouhani et al. (2012), which demonstrated high reliability with a Cronbach's alpha of 0.943. The findings revealed that the average performance evaluation of coaches from both athletes (M = 4.23) and experts (M = 4.24) was significantly higher than the theoretical mean (3), indicating satisfactory coaching performance. Among the evaluated dimensions, the "technical-educational factor" emerged as the most important, followed by team and individual management, team retention, experience, and behavioral-educational aspects. Furthermore, results indicated no significant differences between athletes' and experts' evaluations. In conclusion, the overall performance of Iraqi Gymnastics Federation coaches was found to be within the expected standards, with technical-educational factors playing the most critical role in performance evaluation. The study recommends prioritizing the enhancement of coaches' technical and educational competencies, alongside strengthening behavioral and managerial skills, to ensure comprehensive improvement in both coaching practices and athletes' achievements.

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Keyword: Performance Evaluation, Gymnastics Coaches, Athletes' Perspectives, Experts Perspectives.

Introduction

Gymnastics is one of the most attractive and dynamic sports, presented by experts as the mother and foundation of other sports, so effective gymnastics coaches are able and willing to meet the individual needs of their athletes and realize that they can make a difference in their athletic achievements through the behaviors and training methods they adopt. Coaches must be able to prepare for a wide range of situations and set an example for athletes (Abdulhussain et al., 2025; Abdulkareem & Ali Hassan, 2025). They have to build functional relationships with athletes, encourage them to be assertive, enhance their potential in sports, and for a coach to be effective in their role, a very diverse range of appropriate coaching jobs are needed. Gymnastics coaches can adopt beneficial behaviors to achieve the best psychosocial and performance improvements with athletes (Waleed Abdulkareem & Sattar Jabbar, 2025).

The importance of gymnastics justifies the need for more attention and precision in the selection of gymnastics federation officials and national team coaches respectively, in order to better select and evaluate the performance of national team coaches and players (Abdulkareem et al., 2025). However, coaches and players are always evaluated and judged by club managers, athletes, the media, board officials and other coaches during the season, and not only their job performance is evaluated but also their behaviors are evaluated; If a coach and player discover how others think about their behaviors, decisions, communication styles, and how they evaluate them, they can measure their opinions through their performance and plan for their improvement (Abdulghani et al., 2025; Zureigat et al., 2023).

The importance of the research lies in improving the process of evaluating the performance of gymnastics coaches, through the use of scales, models and studies to evaluate their performance, and it is necessary to point out that their model must take into account the amount of weight that should be assigned to each category in the sport of gymnastics and determine it, in this case it is necessary to evaluate the performance of the coaches of the Gymnastics Federation according to the criteria we reach in this research in order to improve their performance as well as the performance of their players (Ghanim, 2025).

The evaluation and review of performance in different parts of the sports industry is an important issue that has attracted the attention of many researchers (Muttib et al., 2024). Coaches are important human resources that play a prominent role in the success of sports institutions, especially team coaches whose decisions affect the performance of their players on the one hand,

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as well as their institutions related to them, so coaches should be selected and evaluated on the basis of specific and normative factors. Coaches also have to select and evaluate athletes based on a set of predetermined conditions.

In order to make a thorough and good evaluation of the performance of gymnastics coaches, the opinions of all people related to their careers should be used, such as coaches, experts, and even athletes. Therefore, the present study was conducted with the aim of evaluating the performance of the coaches of the Iraqi Gymnastics Federation from the point of view of athletes and experts.

Research Objectives

1- Evaluating the performance of the coaches of the Iraqi Gymnastics Federation from the point of view of players and experts

2. Comparing the level of performance evaluation of Iraqi Gymnastics Federation coaches from the point of view of players and experts.

Research Areas

Human Field: Iraqi Gymnastics Coaches and Athletes

Time Zone: 2024 Season

Spatial Field: Iraqi Sports Institutions

Methodology

The survey-descriptive method was used in terms of its purpose, applied nature, and research method.

Research Sample and Society

The statistical community for this study was formed by all the athletes and experts of the Iraqi Gymnastics Federation. The number of (340) athletes and experts from the Iraqi Gymnastics Federation

Measuring Instruments

In this research, the following tools were used to collect data:

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Questionnaire

The Rouhani et al. (2012) Performance Evaluation Questionnaire includes 57 items and 5 subscales of technical-pedagogical factors (questions 32-46), behavioral and educational factors (questions 1-13), and group and individual management (questions 57-47).). , team retention and promotion (questions 14-23) and experience factor (questions 24-31) on the Likert 5 scale. Rouhani (2013) reported that the validity and reliability of this questionnaire were favorable and the value of Cronbach's alpha coefficient was 0.89 in the research of Rouhani et al. (2013).

The questionnaire was prepared online and sent to the athletes and experts of the Iraqi Gymnastics Federation in virtual groups (WhatsApp, Telegram), the purpose and method of answering the questions were explained. After providing preliminary explanations and reassuring the subjects about the confidentiality of the information.

Data Analysis

In this research, descriptive and inferential statistics were used to analyze the data.

The internal consistency of the questionnaire was examined by Cronbach's alpha test (Table 1) As can be seen from Table (1), the internal reliability of the entire questionnaire was equal to 0.943, the reliability of the behavioral and educational components, team retention, background and experience, instructional technology and team and individual management and improvement respectively were 0.866, 0.832, 0.854, 0.849, and 0.822.

Table 1: Cronbach's Alpha Values for the Trainers Performance Evaluation Questionnaire and Related Components

Item	Number	Alpha Kornbach
Behavioral and Educational	13	866/0
Maintaining and improving the team	10	832/0
Background & Experience	8	854/0
Educational Technology	15	849/0
Team and individual management	11	822/0
Total	57	943/0

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Table (2): Shows the distribution of the mean, standard deviation, twisting, convolution, and openness related to the research variables

Variable	boomer	Viewpoint	Number	Average	S.D.	Deviation	Symmetry and blooming
Performance Evaluation	Behavioral and Educational	player	241	20/4	62/0	19/1-	27/1
		Expert	99	22/4	45/0	12/1-	15/1
	Maintaining and improving the team	player	241	22/4	56/0	90/0-	40/0
		Expert	99	20/4	43/0	26/1-	74/1
	Expertise and Experience	player	241	20/4	60/0	06/1-	17/1
		Expert	99	19/4	49/0	80/1-	62/1
	Educational Technology	player	241	25/4	54/0	92/0-	35/0
		Expert	99	24/4	43/0	20/1-	66/1
	Team and individual management	player	241	26/4	56/0	06/1-	51/0
		Expert	99	26/4	43/0	59/1-	87/1
	Coaches Performance Evaluation Clients	player	241	23/4	53/0	05/1-	48/0
		Expert	99	24/4	41/0	57/1-	64/1

It can be seen from Table (2) that the data deviation and deviation are between -2 and -2, so the research variables have a normal distribution.

Table 3: Cronbach's Alpha Values of the Trainers Performance Evaluation Questionnaire and Related Components

Item	Number	Alpha Kornbach
Behavioral and Educational	13	866/0
Maintaining and improving the team	10	832/0
Background & Experience	8	854/0
Educational Technology	15	849/0
Team and individual management	11	822/0
Total	57	943/0

Table (4): Repeated Distribution of Participants' Sex

Sex	Repetitions	Percentage
female	113	2/33
remembrance	227	8/66
Total	340	100

It is clear from Table (4) that the gender of 113 persons (33.2 percent) of the participants is female. The gender of 227 participants (66.8%) is male

Table (5) shows the mean and standard deviation of the values related to the components of performance evaluation of Iraqi Gymnastics Federation coaches from the point of view of athletes and experts. Also, in this table, the deviation and elongation of the research variables are presented to check the natural state of the data distribution.

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Table (5): Distribution of mean, standard deviation, twisting, convolution, and openness related to the research variables

Variable	boomer	Viewpoint	Number	Average	S.D.	Deviation	Symmetry and blooming
Performance Evaluation	Behavioral and Educational	player	241	20/4	62/0	19/1-	27/1
		Expert	99	22/4	45/0	12/1-	15/1
	Maintaining and improving the team	player	241	22/4	56/0	90/0-	40/0
		Expert	99	20/4	43/0	26/1-	74/1
	Expertise and Experience	player	241	20/4	60/0	06/1-	17/1
		Expert	99	19/4	49/0	80/1-	62/1
	Educational Technology	player	241	25/4	54/0	92/0-	35/0
		Expert	99	24/4	43/0	20/1-	66/1
	Team and individual management	player	241	26/4	56/0	06/1-	51/0
		Expert	99	26/4	43/0	59/1-	87/1
	Coaches Performance Evaluation Clients	player	241	23/4	53/0	05/1-	48/0
		Expert	99	24/4	41/0	57/1-	64/1

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It is clear from Table 5 that the data deviation and deviation are between -2 and -2, so the research variables have a normal distribution.

Statistical Methods

- Model t-test, Friedman test, and multivariate analysis of variance (MANOVA) to examine research questions.
- Cronbach's alpha to check for internal consistency
- SPSS statistical software version 26 was used to analyze the data.
- The default alpha was made at the significance level of 0.05.

Results

Evaluation of Trainers and Related Components

Table 6: Results of the T-Test Model to Evaluate the Performance of Coaches from the Players' Point of View

worker	Average	Standard Deviation	Test value	Writing Degree	Value t	Significance Level
Behavioral and Educational	20/4	62/0	3	240	69/29	001/0
Maintaining and improving the team	22/4	56/0	3	240	83/33	001/0
Background & Experience	20/4	60/0	3	240	06/31	001/0
Technical & Educational	25/4	54/0	3	240	93/35	001/0
Team and individual management	26/4	56/0	3	240	85/34	001/0
Performance Evaluation	23/4	53/0	3	240	95/35	001/0

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It is clear from Table (6) that the average performance evaluation of the Iraqi Gymnastics Federation's coaches from the players' point of view (4.23) is higher and important than the average theoretical value (3). Therefore, the performance of the Iraqi Gymnastics Federation's coaches is expected from the players' point of view. The average components of "behavioral and educational, team retention, history and experience, technical and educational, and collective and individual management and improvement" are respectively equal to 4.20, 4.22, 4.20, 4.25, and 26.4 higher and statistically significant than the average theoretical value (3). Therefore, the behavioral and educational components, team preservation, history and experience, technical and educational, collective and individual management and improvement of Iraqi Gymnastics Federation coaches are within the expected range from the athletes' point of view.

Table 7: Results of the T-Test Model to Verify the Performance of Trainers from the Expert Perspective

worker	Average	Standard Deviation	Test value	Writing Degree	Value t	Significance Level
Behavioral and Educational	22/4	45/0	3	98	44/31	001/0
Maintaining and improving the team	20/4	43/0	3	98	68/32	001/0
Background & Experience	19/4	49/0	3	98	55/27	001/0
Technical & Educational	24/4	43/0	3	98	16/33	001/0
Team and individual management	26/4	43/0	3	98	86/33	001/0
Performance Evaluation	24/4	41/0	3	98	22/34	001/0

It is clear from Table (7) that the average performance of the Iraqi Gymnastics Federation's coaches from the point of view of experts (4.24) is higher and significant than the average theoretical value (3). Therefore, the performance of the coaches of the Iraqi Gymnastics Federation is expected from the point of view of experts. Also, the average components of "behavioral and

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educational, team maintenance, background and experience, technical and educational, and group and individual management and improvement" respectively are equal to 4.22, 4.20, 4.19, 4.24 and 26.4 higher and statistically significant than the average theoretical value (3). Therefore, the behavioral and educational components, team preservation, history and experience, technical and educational, and collective and individual management of the Iraqi Gymnastics Federation's coaches, are within the expected range from the point of view of experts.

Table (8): The results of the Friedman test to prioritize the evaluation of coaches' performance from the players' point of view

worker	Medium Grade	Priority	Number	Writing Degree	brother square	Significance Level
Behavioral and Educational	86/2	5	241	4	29/9	048/0
Maintaining and improving the team	95/2	3				
Background & Experience	90/2	4				
Technical & Educational	16/3	1				
Team and individual management	13/3	2				

It is clear from Table (8) that the "technical and educational" factor with an average rating of 3.16 is the most important factor in evaluating the performance of the Iraqi Gymnastics Federation's coaches from the players' point of view. After this factor, respectively, factors of team management, personnel, team preservation, background, experience, behavioral and educational factors play a role in evaluating the performance of Iraqi Gymnastics Federation coaches from the player's point of view.

Discussion

The average performance rating of the Iraqi Gymnastics Federation's coaches from the point of view of the players (4.23) is higher than the average theoretical value (3) and is significant.

Therefore, the performance of the Iraqi Gymnastics Federation's coaches is expected from the players' point of view. The average components of "behavioral and educational, team retention, history and experience, technical and educational, and collective and individual management and improvement" are respectively equal to 4.20, 4.22, 4.20, 4.25, and 26.4 higher and statistically significant than the average theoretical value (3).

Therefore, the behavioral and educational components, team preservation, history and experience, technical and educational, collective and individual management and improvement of Iraqi Gymnastics Federation coaches are within the expected range from the athletes' point of view.

The average performance of the Iraqi Gymnastics Federation's coaches from the experts' point of view (4.24) is higher and significant than the theoretical average (3). Therefore, the performance of the coaches of the Iraqi Gymnastics Federation is expected from the point of view of experts. Also, the average components of "behavioral and educational, team maintenance, background and experience, technical and educational, and group and individual management and improvement" respectively are equal to 4.22, 4.20, 4.19, 4.24 and 26.4 higher and statistically significant than the average theoretical value (3). Therefore, the behavioral and educational components, team preservation, history and experience, technical and educational, and collective and individual management of the Iraqi Gymnastics Federation's coaches, are within the expected range from the point of view of experts (Abdulkareem et al., 2024).

The "technical and educational" factor with an average rating of 3.16 is the most important factor in evaluating the performance of the Iraqi Gymnastics Federation's coaches from the players' point of view. After this factor, respectively, factors of team management, personnel, team preservation, background, experience, behavioral and educational factors play a role in evaluating the performance of Iraqi Gymnastics Federation coaches from the player's point of view.

The "technical and educational" factor with an average rating of 3.05 is considered the most important factor in evaluating the performance of the Iraqi Gymnastics Federation's coaches from the point of view of experts. After this factor, respectively, team and personnel management factors, team retention, background and experience, behavioral and educational factors play a role in evaluating the performance of Iraqi Gymnastics Federation coaches from the point of view of experts (Adnan et al., 2024).

There is no significant difference between the performance evaluation of the Iraqi Gymnastics Federation's coaches from the point of view of athletes and experts ($\eta 2 = 0.001$, sage $= 0.83$, $F = 0.21$).

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Conclusions

1. Behavioral and educational factors, team retention, background, technical and educational experience, and individual and team management played a role in evaluating the performance of gymnastics federation coaches.
2. The educational technical factor was the most important factor in evaluating the performance of gymnastics coaches
3. The behavioral and educational components and their maintenance, team improvement, background, technical and educational expertise, and the collective and individual management of the Iraqi Gymnastics Federation's coaches are within the expected range from the experts' point of view.
4. The performance of the Iraqi Gymnastics Federation's coaches is within the expected limits and the behavioral and educational components are maintained and improved.
5. The educational technical factor plays a role in evaluating the performance of the coaches of the Gymnastics Federation from the point of view of experts and players.
6. Having confidence, self-belief, face-to-face verbal communication with athletes, and the use of mathematical knowledge and psychological principles are important issues in the form of work and the technical behaviors of the coach.

Recommendations

1. The Federation and the relevant authorities. Councils that each pays special attention to these factors in order to improve the performance of trainers.
2. Hold relevant seminars and workshops to advance and improve these skills.
3. Taking steps towards upgrading the technical promotion of trainers and their recent experience and knowledge in this field.
4. Use new approaches to performance evaluation in future research such as a multi-level multi-source feedback system (360-degree feedback)
5. Results-based evaluation or goal-based management (MBO) and evaluation based on behavior-based rating measures compared the results with traditional methods.
6. In future research, the perspectives of managers and coaches themselves should be examined.
7. "Coaches need to be aware that their influence on athletes can be exerted through athletes' perceptions.

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Analysis of Training Load During the Special Preparation and Competition Periods Using Physiological Indicators in U19 Football Players via Smart Bracelet

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Abstract

The importance of the study lies in highlighting the role of smartwatches as a modern tool for analyzing training load based on functional indicators, such as heart rate and calorie consumption. This allows coaches to monitor individual players' responses during different training periods, helping to improve physical performance efficiency and reduce the risk of overload-induced fatigue. The study aimed to analyze calorie consumption at different heart rate levels between the special preparation and competition periods for youth football players, with the goal of determining the effect of physiological adaptation on energy efficiency. To achieve this objective, the researcher adopted the descriptive method due to its suitability for the nature of the study. A purposive simple sample of 20 youth players representing the youth team of Al-Quwa Al-Jawiya Club was selected, with weights ranging between 60–75 kg. A pilot experiment was conducted on a small sample of players to test the accuracy of smartwatches in measuring heart rate and calorie consumption by comparing them with standard measurement devices. The results showed good agreement in heart rate measurement and a slight deviation in calorie consumption, confirming their validity for use in the study after calibration.

Keywords: Training load, smartwatches, heart rate, calories, training periods.

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Introduction

Monitoring and analyzing training load is a fundamental factor in developing athletic performance, especially in football, which requires high physical capacity and long-term endurance. With the advancement of wearable technology, smartwatches have become important tools for measuring players' physiological indicators, such as heart rate and calorie consumption, providing data that can be used to analyze the effects of different training sessions on athletes' bodies.

In this context, many previous studies have focused on measuring heart rate as a key indicator for understanding the body's response to training load. For example, Jones et al. (2020, p.112) indicated that using smartwatches provides accurate data on heart rate during various exercises, helping to improve training programming. However, this study did not examine calorie consumption, which represents a gap requiring further research. Our study addresses this by not only analyzing heart rate but also including calorie consumption, providing a comprehensive view of the training load's impact on players.

Football teams go through special preparation periods focused on developing specific physical fitness, followed by competition periods that require adaptation and specialized endurance. Li et al. (2019, p.87) studied the effects of different training periods on players and found that cardiorespiratory adaptation is more pronounced during the competition period. However, this study did not analyze differences in calorie consumption between the two periods, making our research a novel contribution by providing a comprehensive analysis combining heart rate and calorie consumption, reflecting physiological differences between the special preparation and competition periods.

Furthermore, Ahmed and Mohamed (2021, p.134) demonstrated a direct relationship between training load intensity and increased heart rate, showing that players exposed to high training loads experience significant increases in heart rate, necessitating adequate recovery periods. Yet, this study did not address the effect of training load on calorie consumption, which our research analyzes in detail, helping to improve nutrition and recovery strategies for players.

On the other hand, Al-Jabouri (2022, p.156) examined the use of smartwatches in measuring calorie consumption and noted that this indicator can be an effective tool for evaluating training load. However, it was not previously used to compare two different training periods, as our study does, aiming to determine differences between the special preparation and competition periods using this indicator alongside heart rate.

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Moreover, recent studies have shown that smartwatches are not only useful for measuring physiological indicators but can also help assess physical stress levels and predict the likelihood of injuries, especially during intensive training periods. According to Miller et al. (2023, p.45), analyzing data from smartwatches can assist coaches in adjusting training loads based on individual player responses, reducing the risk of overtraining and improving performance efficiency. This emphasizes the importance of our study, which seeks to understand how players respond to training load by combining heart rate and calorie consumption as key factors in evaluating physical stress and readiness for competition.

Methodology

The researchers adopted a descriptive method in their study. A purposive sample of 20 players from the youth team of Al-Quwa Al-Jawiya Club was selected, with body weights ranging between 65–70 kg. The study aimed to analyze training load using smartwatches by measuring heart rate and calorie consumption during the special preparation and competition periods.

Data Collection

Measurement was used as the primary method for collecting information to ensure the accuracy of data obtained from smartwatches and to compare it with various physiological indicators of the players.

Tools and Equipment Used in the Study

1. **Electronic Scale (kg):** To measure body mass, which is entered into the application for each player.
2. **Measuring Tape (cm):** To accurately measure players' height before entering data into the program.
3. **Smartwatches (Smart Bracelet):** Used to measure calorie consumption and heart rate levels.
4. **Smartwatch Application:** The app was installed on players' smartphones. Player data such as body mass, height, age, and sport type were entered. Once the data was recorded, the smartwatch tracked training load and sent the results to the app.
5. The device was activated at the **start of the training session** and, after completing the session, the player ended the recording via the watch to save the data.

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6. Training data (physiological indicators) were sent through the player's smartphone.

Measurement Procedures

1. A measuring tape was used to determine players' height to accurately input their basic data into the application before starting the experiment.
2. An electronic scale was used to measure body mass, which is essential for calculating physiological indicators through the smartwatch application.
3. Heart rate and calorie consumption were recorded during training and matches using the smartwatches.

Table 1: Show players Heights and Weights

Player No.	Height (cm)	Weight (kg)
1	175	68
2	180	72
3	178	70
4	173	65
5	185	75
6	176	69
7	182	74
8	177	68
9	170	62
10	183	76
11	174	66
12	179	71
13	172	64
14	181	73
15	176	67
16	184	77
17	175	69
18	178	70
19	171	63
20	180	72

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Main Experiment

The main experiment began on Sunday, 3/11/2024, coinciding with the special preparation period. During this period, the team trained four training units per week on the club's field, with each session lasting 90–120 minutes. On the fifth day, a match was held. Players activated the smart bracelet application on their devices before starting training, and after finishing, they ended the session via the app so that the device could store the physiological indicators collected during the training.

During the special preparation period, the team completed 16 training units and participated in four matches, as shown in Table 2.

After the special preparation period, the competition period began on Thursday, 5/12/2024. The team continued with four training units per week, each lasting 90–120 minutes, and played a match every six days as part of the league, as shown in Table 3. After the first phase of the competition period, 16 training units were completed. The total number of training units for both periods was 32 units. Afterward, the data were stored and analyzed to compare the special preparation and competition periods.

Table 2: Matches During the Special Preparation Period

Sequence	Match	Result
1	Al-Quwa Al-Jawiya Youth – First Team of Al-Maslahah	0–1
2	Al-Quwa Al-Jawiya Youth – Al-Karkh Youth	2–4
3	Al-Quwa Al-Jawiya Youth – Al-Hudood	3–4
4	Al-Quwa Al-Jawiya Youth – Baghdad Amanah	3–2

Table 3: Matches During the Competition Period

Sequence	Match	Result
1	Al-Quwa Al-Jawiya – Al-Shorta	0–2
2	Al-Quwa Al-Jawiya – Al-Naft	3–4
3	Al-Quwa Al-Jawiya – Al-Karma	1–0
4	Al-Quwa Al-Jawiya – Al-Sinaat	0–1

Experiment Duration

- Pilot Experiment Start: Monday, 28/10/2024

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- Main Experiment Start: Sunday, 3/11/2024, continuing until 6/1/2025, which marks the end of the experiment after the first half of the league matches.

Statistical Analysis

The researcher used the SPSS statistical analysis program to process the data obtained from the smartwatches by applying the following statistical tests: the arithmetic mean to calculate the average physiological values recorded during training sessions and matches; the standard deviation to measure the variability of the recorded values among players; and the paired-samples T-test to compare the differences in physiological indicators between the special preparation and competition periods.

Results

Table 4: Physiological Variables During the Special Preparation Period

Week	Heart Rate (bpm)	Calorie Consumption (kcal)
Week 1	170	900
Week 2	168	890
Week 3	172	880
Week 4	170	875
Mean	170.00	886.25
SD	1.83	10.31

Table 5: Physiological Variables During the Competition Period

Week	Heart Rate (bpm)	Calorie Consumption (kcal)
Week 1	165	870
Week 2	163	860
Week 3	160	850
Week 4	158	885
Mean	161.50	856.25
SD	3.20	10.31

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Table 6: Mean, Standard Deviation, t-values, and Significance Between Special Preparation and Competition Periods

Variable	Mean (Special Preparation)	Mean (Competition)	t-value	Significance	Type of Difference
Heart Rate	170.00	161.50	4.58	0.00	Significant
Calorie Consumption	886.25	856.25	4.89	0.005	Significant

Discussion

The results showed a gradual decrease in both heart rate and calorie consumption during the competition period compared to the special preparation period. This reduction reflects an improvement in the players' energy efficiency, indicating physiological adaptations resulting from the change in training load between the two periods.

These findings highlight the principle of energy economy, as intensive training during the special preparation phase enhances cardiorespiratory and muscular efficiency, allowing the body to use energy more effectively during competitions. This aligns with Jones et al. (2021, p.112), who confirmed that increased training load during preparation periods enhances cardiorespiratory adaptations, reducing energy cost during performance in competitive conditions. Similarly, Helgerud et al. (2007, p.87) noted that improving aerobic efficiency through endurance programs lowers heart rate during competition, consistent with our current findings.

The noticeable reduction in calorie consumption at different heart rates indicates increased energy efficiency, meaning that performance has become more economical. Buchheit & Laursen (2013, p.134) emphasized that improving energy economy allows athletes to maintain high performance for longer periods without rapid depletion of energy, which is essential in football, a sport that requires repeated efforts of varying intensity.

The analysis showed that weekly training intensity during both the special preparation and competition periods remained roughly within a moderate range across all weeks, reflecting stability in training load distribution. Although this stability did not produce sharp differences between periods, it contributed to clear physiological adaptations, manifested in lower heart rates and reduced calorie consumption during the competition period, indicating improved energy economy.

This suggests that stable moderate intensity helped achieve the desired functional adaptations, particularly with a consistent training program. However, adopting greater variation

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in intensity could further enhance training responses and optimize peak performance during competitions, as noted by Issurin (2010, p.79), who emphasized that gradual and varied distribution of training load is essential for maximizing physiological adaptation and reducing the risk of chronic fatigue.

Smartwatches proved highly effective in tracking physiological indicators such as heart rate and calorie consumption, allowing accurate and objective data collection. Plews et al. (2017, p.156) reported that wearable devices provide reliable data on internal load, contributing to improved training and recovery strategies. Similarly, Gatterer et al. (2014, p.98) found that using modern performance monitoring technologies enhances coaches' ability to analyze players' responses to training load, facilitating the design of more effective training programs.

The results reflect the role of each training period in developing physiological performance. The special preparation period is an intensive phase aimed at building a strong physical foundation and enhancing both aerobic and anaerobic endurance. Issurin (2010, p.79) noted that this period requires higher energy expenditure due to increased training load. In contrast, during the competition period, training load is managed to ensure full recovery, resulting in lower energy consumption while maintaining performance efficiency. Meeusen et al. (2013, p.101) emphasized the importance of appropriate training load during competitions to support positive physiological responses.

These findings are consistent with Smith & Veron (2023, p.165), who indicated that training improves energy efficiency by enhancing cardiac and muscular adaptations. They are also supported by Mujika & Padilla (2003, p.142), who suggested that training load during competitions contributes to reduced energy consumption and increased positive physiological responses in athletes.

Conclusions

1. Training adaptations improve energy efficiency, as shown by decreases in heart rate and calorie consumption during competitions, reflecting enhanced physiological economy resulting from training during the special preparation period.

2. Physiological measurements using smartwatches provide accurate and objective data on training load, enhancing coaches' ability to optimize athletic performance and reduce overtraining risks during competitions.

Recommendations

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1. Apply progressive training load strategies to ensure optimal physiological adaptations during the special preparation period while maintaining carefully controlled loads during competitions to preserve performance and reduce fatigue.
2. Promote the use of wearable technologies, such as smartwatches, to monitor physiological responses and analyze training load accurately, supporting data-driven adjustments to training programs for each player.
3. Extend the application of this study's variables to different age groups and both genders.

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The Contribution of Leadership Vigilance to the Implementation of Functional Tasks by Administrators of Local Volleyball Championships

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Abstract

The present study aimed to develop two measurement scales—one for leadership vigilance and another for the implementation of functional tasks—in the context of managing local volleyball championships. It further sought to assess the levels of these two variables from the perspective of administrators, and to examine the contribution and effect of leadership vigilance on task execution. The descriptive correlational method was employed in line with the nature of the research problem. The study population comprised 141 administrators of local volleyball championships during the 2024/2025 sports season, all of whom were deliberately included (100%) through comprehensive enumeration and divided into three subsamples according to the study requirements. After constructing the two scales, they were applied to the participants, and the results were analyzed using SPSS. The findings confirmed the validity of the scales for measuring leadership vigilance and functional task implementation. Results revealed that administrators demonstrated acceptable levels in both domains, and that higher leadership vigilance was significantly and positively correlated with improved task implementation. The study concluded that leadership vigilance plays an essential role in enhancing administrators' effectiveness in managing volleyball championships. Accordingly, the researcher recommended focusing on specialized measurement and professional development programs to strengthen leadership vigilance, thereby improving task performance and contributing to the overall advancement of federation management.

Keywords: Leadership Vigilance, Functional Task Implementation, Sports Management, Volleyball Championships.

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Introduction

The success of organizing local championships reflects the effectiveness of the central federation's administrative coordination between those responsible for managing tournaments and the federation's leadership, and it serves as a clear indicator of the proper assignment of functional tasks. For administrative work to advance and sustain success, however, it must rely on continuous academic support derived from research in sports management and its applications, which gain their strength from quantitative data and measurement, ensuring objectivity in addressing critical issues in the sports sector. Sports federations are regarded as the primary bodies responsible for developing administrative work in any sport, as they bear responsibility for their teams in all areas (Reda & Saleh, 2018, p.194). The ability to implement functional tasks is closely linked to organizing the work environment and ensuring fair task distribution according to employee specializations (Al-Ibrahimi, 2024, p.11).

Positive workplace attitudes enhance performance, increase job satisfaction, reduce turnover, and support organizational and individual success (Peláez-Fernández et al., 2020, p.2). Research further suggests that differences in mechanisms of coordination and integration among job functions can strengthen organizational structures and role performance (Al-Khafaji & Al-Ghalibi, 2009, p.118), while employees' attitudes toward their work are influenced by multiple factors such as work environment, compensation systems, and management practices, all of which affect their effectiveness and satisfaction (Kim, 2020, p.83).

Comprehensive management approaches today also emphasize employee engagement in daily and strategic processes, fostering collaboration, innovation, and inclusion (Brogan, 2018, p.8). Within this context, leadership vigilance emerges as a crucial trait that enables leaders to maintain awareness, interact effectively with present challenges, and complete assigned duties with minimal errors while pursuing organizational goals (Al-Arifi, 2006, p.118; Al-Anani, 2021, p.83).

Leadership is essentially a process of influencing others to achieve shared goals in a persuasive and respectful manner (Al-Abdulrahman, 2021, p.26), and effective leaders must also be able to delegate authority and support role specialization within their institutions (Čirjevskis, 2021, p.385). Against this background, the present study seeks to construct scales for leadership vigilance and functional task implementation in the management of local volleyball championships, to identify their levels among administrators, and to examine the contribution and impact of leadership vigilance on task execution. The study hypothesizes that leadership vigilance significantly contributes to, correlates with, and influences functional task implementation,

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thereby providing scientific evidence to support the improvement of administrative practices and alignment with international standards in sports management.

Methodology

The researcher adopted the descriptive research method using the correlational approach in accordance with the parameters of the current problem under investigation. The research population consisted of the administrators of local volleyball championships for the 2024/2025 sports season, totaling 141 individuals, who represent the community of the two observed phenomena whose opinions were to be explored regarding the present research problem. The entire population (100%) was deliberately selected as the total research sample through a comprehensive enumeration method, after which they were divided into three sub-samples according to the requirements of the current study, as detailed in Table (1).

Table 1. *Numerical Description of the Research Population and Its Three Sub-Samples*

Community Description	Population (Individuals)	Exploratory Sample	Construction Sample	Application Sample
President and Members of the Central Federation	8	0	4	4
President and Members of Sub-Federations	54	2	26	26
Central Referees Committee	5	0	3	2
Local Referees	25	1	13	11
Club Coaches, Assistants, and Administrators	40	2	19	19
Central Competitions Committee	5	0	2	3
Central Media Committee	4	0	2	2
Total	141	5	69	67
Percentage	100%	3.55%	48.94%	47.52%

Preliminary Preparation of the Scale Items

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Following the principles of item formulation and considering the specific context of sports administration as well as the target sample consisting of administrators of local volleyball championships, the researcher developed 22 items for the Leadership Vigilance Scale and 20 items for the Functional Task Implementation Scale. Each item employed a three-point response format: “Always Applies,” “Sometimes Applies,” and “Does Not Apply,” scored on a Likert scale (3, 2, 1) respectively, where higher scores indicated a greater presence of the phenomenon in the respondent.

Validation of Face and Content Validity

The researcher prepared a paper-based questionnaire to collect the opinions of 17 experts in sports management, testing, and measurement in physical education. The two scales were provided to the experts to obtain their agreement on the content, and full consensus (100%) was achieved, with no modifications required to the initial versions. These procedures were carried out between Tuesday, January 7, 2025, and Thursday, January 16, 2025, ensuring the face and content validity of the Leadership Vigilance and Functional Task Implementation Scales.

Pilot Testing of the Scales

The scales were applied to a pilot group of five individuals at the Iraqi Central Volleyball Federation between Sunday, January 19, 2025, and Thursday, January 22, 2025. The objectives were to identify potential obstacles in applying the scales to the main samples and to calculate the average completion time, which was 8 minutes for the Leadership Vigilance Scale and 7 minutes for the Functional Task Implementation Scale.

Verification of Construct Validity (Discriminatory Power – Internal Consistency)

To ensure psychometric adequacy, the scales were administered to the construction sample of 69 individuals between Sunday, January 26, 2025, and Thursday, February 6, 2025. The item scores were coded and statistically analyzed as follows:

Discriminatory Power of the Scales

The extreme groups method was used. After ranking item scores in descending order, the top and bottom 27% were selected, yielding approximately 19 individuals per group. Statistical analysis was then performed using the independent samples t-test for each item of both scales, as presented in Tables (2) and (3).

Table 2. *Discriminatory Power Results for the Leadership Vigilance Scale Items*

Item No.	Extreme Groups	Mean	SD	t	Sig.
1	High	2.84	0.375	9.823	0.000
	Low	1.42	0.507		
2	High	2.89	0.315	17.493	0.000
	Low	1.11	0.315		
3	High	2.95	0.229	13.423	0.000
	Low	1.32	0.478		
4	High	2.53	0.513	8.660	0.000
	Low	1.21	0.419		
5	High	2.42	0.507	10.714	0.000
	Low	1.05	0.229		
6	High	2.37	0.496	9.374	0.000
	Low	1.11	0.315		
7	High	2.47	0.513	7.714	0.000
	Low	1.26	0.452		
8	High	2.58	0.507	7.903	0.000
	Low	1.32	0.478		
9	High	2.63	0.496	10.340	0.000
	Low	1.16	0.375		
10	High	2.79	0.419	9.546	0.000
	Low	1.37	0.496		
11	High	2.68	0.478	7.903	0.000
	Low	1.42	0.507		
12	High	2.74	0.452	7.714	0.000
	Low	1.53	0.513		
13	High	2.37	0.496	8.493	0.000
	Low	1.16	0.375		
14	High	2.63	0.496	8.889	0.000
	Low	1.26	0.452		
15	High	2.84	0.375	10.961	0.000
	Low	1.32	0.478		
16	High	2.95	0.229	11.431	0.000
	Low	1.47	0.513		
17	High	2.47	0.513	11.023	0.000
	Low	1.05	0.229		
18	High	2.74	0.452	12.897	0.000
	Low	1.11	0.315		
19	High	2.58	0.507	7.036	0.000
	Low	1.42	0.507		
20	High	2.53	0.513	8.660	0.000
	Low	1.21	0.419		
21	High	2.68	0.478	9.416	0.000
	Low	1.26	0.452		
22	High	2.89	0.315	11.326	0.000
	Low	1.37	0.496		

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Note. Item discrimination is considered significant when Sig. < 0.05 at a 0.05 significance level and 36 degrees of freedom.

Table 3. *Discriminatory Power Results for the Functional Task Implementation Scale Items*

Item No.	Extreme Groups	Mean	SD	t	Sig.
1	High	2.79	0.419	8.660	0.000
	Low	1.47	0.513		
2	High	2.84	0.375	13.856	0.000
	Low	1.16	0.375		
3	High	2.89	0.315	11.326	0.000
	Low	1.37	0.496		
4	High	2.47	0.513	7.714	0.000
	Low	1.26	0.452		
5	High	2.37	0.496	9.374	0.000
	Low	1.11	0.315		
6	High	2.63	0.496	8.333	0.000
	Low	1.32	0.478		
7	High	2.42	0.507	6.470	0.000
	Low	1.37	0.496		
8	High	2.53	0.513	8.050	0.000
	Low	1.26	0.452		
9	High	2.58	0.507	9.067	0.000
	Low	1.21	0.419		
10	High	2.74	0.452	8.438	0.000
	Low	1.42	0.507		
11	High	2.63	0.496	7.076	0.000
	Low	1.47	0.513		
12	High	2.68	0.478	6.915	0.000
	Low	1.58	0.507		
13	High	2.84	0.375	9.823	0.000
	Low	1.42	0.507		
14	High	2.58	0.507	7.903	0.000
	Low	1.32	0.478		
15	High	2.79	0.419	9.546	0.000
	Low	1.37	0.496		
16	High	2.89	0.315	9.906	0.000
	Low	1.53	0.513		
17	High	2.42	0.507	9.603	0.000
	Low	1.11	0.315		
18	High	2.68	0.478	10.961	0.001
	Low	1.16	0.375		
19	High	2.53	0.513	6.325	0.000
	Low	1.47	0.513		
20	High	2.47	0.513	7.714	0.000
	Low	1.26	0.452		

Note. Item discrimination is considered significant when Sig. < 0.05 at a 0.05 significance level with 36 degrees of freedom.

Internal Consistency of the Scales

The scores of the construction sample were statistically analyzed using the Pearson correlation coefficient to examine the relationship between each item score and the total scale score to which it belongs. This procedure was conducted to verify the second criterion of construct validity for both the Leadership Vigilance Scale and the Functional Task Implementation Scale. The results of this analysis are presented in Tables (4) and (5).

Table 4. *Internal Consistency of the Leadership Vigilance Scale Based on Item-Total Correlations*

Item No.	Pearson Correlation with Total Score	Sig.	Item No.	Pearson Correlation with Total Score	Sig.
1	0.655*	0.000	12	0.628*	0.000
2	0.492*	0.000	13	0.526*	0.000
3	0.552*	0.000	14	0.804*	0.000
4	0.532*	0.000	15	0.638*	0.000
5	0.693*	0.000	16	0.601*	0.000
6	0.782*	0.000	17	0.742*	0.000
7	0.466*	0.000	18	0.497*	0.000
8	0.595*	0.000	19	0.555*	0.000
9	0.662*	0.000	20	0.521*	0.000
10	0.841*	0.000	21	0.606*	0.000
11	0.704*	0.000	22	0.742*	0.000

Note. All correlations are significant at $p < 0.05$ with df = 67, indicating high internal consistency for all items.

Table 5. *Internal Consistency of the Functional Task Implementation Scale Based on Item-Total Correlations*

Item No.	Pearson Correlation with Total Score	Sig.	Item No.	Pearson Correlation with Total Score	Sig.
1	0.876*	0.000	11	0.566*	0.000
2	0.635*	0.000	12	0.551*	0.000
3	0.852*	0.000	13	0.605*	0.000
4	0.545*	0.000	14	0.666*	0.000
5	0.553*	0.000	15	0.678*	0.000
6	0.592*	0.000	16	0.623*	0.000
7	0.551*	0.000	17	0.827*	0.000
8	0.562*	0.000	18	0.644*	0.000
9	0.525*	0.000	19	0.612*	0.000
10	0.658*	0.000	20	0.505*	0.000

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Note. All correlations are significant at $p < 0.05$ with df = 67 (n–2), confirming high internal consistency for all items.

Reliability of the Scales

The researcher verified the reliability of both the Leadership Vigilance Scale and the Functional Task Implementation Scale by statistically analyzing the scores obtained from administering the paper versions of both scales to the construction sample in the previous procedure. Cronbach's alpha coefficient was used to assess internal consistency, yielding a reliability coefficient of 0.914 for the Leadership Vigilance Scale and 0.902 for the Functional Task Implementation Scale, with df = 67 and significance level of 0.05.

Normality of the Scales

The scores of both scales were analyzed to examine their suitability for the target sample by assessing the normality of their distribution in the construction sample, as presented in Table (6).

Table 6. *Descriptive Statistics and Normality Values for the Two Administrative Scales*

Scale Name	Construction Sample (n)	Number of Items	Total Score	Mean	SD	Skewness
Leadership Vigilance of Local Volleyball Tournament Managers	69	22	66	46.64	1.435	-0.562
Functional Task Implementation of Local Volleyball Tournament Managers	69	20	60	48.58	1.418	-0.485

Note. The skewness values indicate that both scales have approximately normal distributions, as skewness values fall within the acceptable range of ±1.

Final Versions of the Scales

Upon completing the construction procedures and statistical analyses on the construction sample, both scales were finalized. The Leadership Vigilance Scale has a total score range of 22–66 with a midpoint of 44, while the Functional Task Implementation Scale has a total score range of 20–60 with a midpoint of 40. Higher individual scores on either scale indicate a higher level of the respective phenomenon as perceived by the respondents, who are the managers of local volleyball tournaments.

Main Survey Procedure (Scale Administration)

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The main survey was conducted from Sunday, February 9, 2025, to Thursday, February 27, 2025, on the main application sample consisting of 67 participants. The survey directly measured the perspectives of the local volleyball tournament managers regarding the two examined administrative phenomena. Data from the paper versions of both scales were separately processed for analysis.

Statistical Analysis

The data were processed electronically using SPSS to calculate descriptive and inferential statistics. The analyses included percentages, means, standard deviations, independent-samples t-tests, Pearson's correlation coefficients, Cronbach's alpha for reliability, skewness coefficients, one-sample t-tests, and linear regression analysis.

Results

Table 7. *Comparison of the Mean Scores for Each Scale with Its Hypothetical Midpoint*

Scale	Total Score	Hypothetical Midpoint	Mean	SD	Mean Difference	t	Sig.
Leadership Vigilance of Local Volleyball Tournament Managers	66	44	46.87	1.266	2.866	18.527	0.000
Functional Task Implementation of Local Volleyball Tournament Managers	60	40	48.81	1.258	8.806	57.289	0.000

Table 8. *Correlation, Simple Linear Regression, Contribution Percentage, and Standard Error between the Two Scales*

Predictor	Outcome	Pearson Correlation (R)	Linear Regression Coefficient (R^2)	Determination Coefficient	Contribution (%)	Standard Error of Estimate
Leadership Vigilance	Functional Task Implementation	0.963	0.928	0.926	92.6%	0.341

Table 9. *ANOVA Results for the Effect of Leadership Vigilance on Functional Task Implementation*

Predictor	Outcome	Source	Sum of Squares	df	Mean Square	F	Sig.	Significance

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Leadership Vigilance	Functional Task Implementation	Regression	96.911	1	96.911	832.504	0.000	Significant
		Residual	7.567	65	0.116			

Table 10. *Estimates of the Intercept and Slope (Effect) for the Two Scales*

Dependent Variable	Predictor	Beta (β)	Standard Error	t	Sig.
Functional Task Implementation	Intercept	3.95	1.555	2.54	0.013
Functional Task Implementation	Leadership Vigilance	0.957	0.033	28.853	0.000

Discussion

The results presented in Table (7) indicate that the mean scores for both studied phenomena—leadership vigilance and functional task implementation—exceeded the hypothetical mean for each respective scale. Furthermore, as shown in Table (8), leadership vigilance among those responsible for managing local volleyball tournaments positively and proportionally contributes to enhancing the level of functional task implementation. This finding is further corroborated by Table (9), which confirms the high model fit of the regression analysis, and Table (10), which demonstrates the significant effect of leadership vigilance on improving functional task execution.

The researcher attributes these results to the heightened awareness of the external and internal environmental factors among the participants in the application sample. This awareness enabled strategic foresight in their leadership of tournament operations, promoting proactive engagement and leadership vigilance, which translated into enhanced functional task performance. Participants exhibited professional competence, administrative efficiency, and task proficiency within the management framework responsible for executing these tasks. They frequently anticipated potential obstacles, fostering teamwork and collaboration based on clear role definition, non-overlapping authority, and structured accountability. Knowledge sharing among administrators and attention to psychological factors among peers further supported cooperative management within local volleyball tournaments.

As highlighted in the literature, institutions committed to a culture of continuous improvement encourage new ideas, initiatives, and ongoing enhancements in administrative processes, strengthening teamwork and knowledge exchange (Linda, 2016, p. 199). Granting authority to employees fosters commitment, satisfaction, and support for organizational objectives, while ensuring accountability for delegated responsibilities (Ongori, 2009, p. 10). Effective management entails proper scheduling and coordination of tasks (Al-Ajmi, 2013, p. 66), equitable distribution of resources (Atif, 2011, p. 312), and attention to employees' emotional states (Al-

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Fahd, 2019, p. 40). Successful leadership influences groups to achieve objectives respectfully and persuasively (Abdel Rahman, 2021, p. 26), enhances motivation, reduces frustration (Al-Saad, 2016, p. 102), and cultivates collaboration while preventing divisive behaviors (Al-Barghouthi, 2021, p. 15). Collectively, these factors explain the observed positive impact of leadership vigilance on the effective implementation of functional tasks in the administration of local volleyball tournaments.

Conclusions

The study concludes that both the Leadership Vigilance Scale and the Functional Task Implementation Scale are valid and reliable tools for assessing the respective phenomena among those responsible for managing local volleyball tournaments. The results indicate that participants demonstrate an acceptable level of leadership vigilance as well as functional task performance. Furthermore, an increase in leadership vigilance is positively and directly associated with enhanced execution of functional tasks, highlighting the significant role of proactive and attentive leadership in improving administrative performance within local volleyball tournament management.

Recommendations

It is essential to focus on specialized measurement of leadership vigilance among those managing local volleyball tournaments, given its critical role in supporting and enhancing the execution of functional tasks in tournament administration. Additionally, providing training and development programs for these administrators is crucial to strengthen their leadership vigilance, which directly contributes to improving the performance of functional tasks and, consequently, advancing the overall effectiveness of the federation’s administrative operations.

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The effect of the Appleton model on learning to perform the long jump for first-year students in the College of Basic Education

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Abstract

The research aimed to prepare educational units according to the Appleton model for teaching the long jump skill to first-stage students and to identify its impact on learning. The researcher adopted the experimental method with two equal groups (experimental and control) using pre- and post-tests. The population consisted of 115 first-stage students in the Department of Physical Education and Sports Sciences, College of Basic Education, Al-Mustansiriya University, for the academic year 2023–2024, distributed across six divisions (A–F). By lottery, two divisions were selected: Division (B) as the experimental group and Division (E) as the control group, with 25 students each (total 50, representing 43.47% of the population). The experimental group learned the long jump according to the Appleton model, while the control group followed the traditional imperative method used in the curriculum. After applying the pre- and post-tests and conducting statistical analyses, results showed that the Appleton model had a significant effect on learning the long jump, as it enhanced motivation through excitement, competition, and engagement, making the learning process easier and more effective. The study recommends adopting the Appleton model in teaching long jump and other sports skills, given its role in achieving educational objectives and improving performance at different age and educational levels.

Keywords: Appleton model, long jump effectiveness.

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Introduction

Many educational theorists believe that today's learner differs from that of the past due to the remarkable development of cognitive abilities in recent years, driven by technological and electronic openness. This has posed a challenge for both educators and learners to develop instructional models that correspond with learners' cognitive capacities, fostering greater activity and effectiveness to keep pace with rapid progress and adapt to life's accelerating changes and growing demands. The aim is to encourage learners to think and inquire, leading them toward the desired stage of development. Consequently, the teacher's role is no longer confined to transmitting information; rather, it has extended to shaping learners' personalities and broadening their horizons independently. Among the most prominent models are constructivist ones, including the Appleton model, which is an active constructivist educational model that helps learners solve problems, take ownership of their thinking, and promotes inquiry, exploration, and questioning to find solutions by utilizing their cognitive abilities. This, in turn, develops various learner skills, especially decision-making and problem-solving, through steps such as (sorting ideas, processing information, exploring data, and considering the social context) to reach effective learning.

Since the subject of athletics (long jump) in the College of Physical Education and Sports Sciences relies on mastering fundamental skills as a critical basis for progress in performance, attention must be directed to the stages of learning and improving performance by engaging students in problem-solving and developing solutions. Mastery of these skills requires effort and practice; therefore, it is necessary to search for strategies and new teaching models, such as the Appleton constructivist model, to facilitate accurate learning and significantly contribute to skill acquisition.

Based on the above, the importance of the research lies in experimenting with a new constructivist model in physical education in general, and in learning long jump skills in particular, as a scientific attempt to provide broader opportunities for participatory learning and to give students a greater role in stimulating cognitive processes, thus making them more active in learning the long jump skill at the first stage.

The problem lies in the fluctuation of the learning level of the long jump skill among first-stage students at the College of Basic Education – Al-Mustansiriya University. Through the researcher's observation of students' results, particularly in practical lessons, it became clear that learners face difficulties in acquiring the long jump skill despite the teacher's efforts. The researcher therefore believes that mastering this skill requires adopting interactive instructional models that enable students to participate effectively in solving problems that hinder their learning. Accordingly, the study focuses on employing the Appleton constructivist model to examine its

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impact on the research sample, aiming to transform performance toward the ideal level through educational units that increase learners' motivation and place them at the center of the learning process, shifting from the traditional method to a more effective and engaging one.

Research Objectives

1. To design educational units according to the Appleton model for learning the long jump skill among first-stage students.
2. To identify the effect of the Appleton model on learning the long jump skill among the research sample.

Research Hypotheses

1. There are statistically significant differences between the pre- and post-tests of both the experimental and control groups, in favor of the experimental group, in learning the long jump skill among first-stage students.
2. There are statistically significant differences between the post-tests of the experimental and control groups in learning the long jump skill among the research sample.

Research Fields

1. Human field: First-stage students, College of Physical Education and Sports Sciences – College of Basic Education.
2. Time field: From February 1, 2024, to May 16, 2024.
3. Place field: Athletics field, College of Basic Education, Department of Physical Education and Sports Sciences.

Methodology

Research Sample

The research population was defined as the first-stage morning study students in the Department of Physical Education and Sports Sciences – College of Basic Education – Al-Mustansiriya University for the academic year 2023–2024, totaling (115) students distributed across six sections (A, B, C, D, E, F). The research population was limited to first-stage students, as this stage includes the study of the long jump event. The research sample was selected randomly by lottery among the sections to determine the experimental and control groups. The researcher then randomly selected (25) students from each section as follows: Section (B) with (25) students and Section (E) with (25) students, for a total of (50) students, representing (43.47%) of the research population. The sample was divided into two groups: the experimental group (Section B),

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which learned the shot put event according to the Appleton model, and the control group (Section E), which was taught using the method followed by the teacher (the imperative style) according to the prescribed physical education curriculum.

Data Collection, Devices, and Tools Used in the Research

The researcher relied on several means of data collection, including Arabic and foreign references and sources, personal interviews, expert and specialist opinion survey forms for grading, data recording forms, the internet, tests and measurement, as well as the exploratory experiment. The devices and tools used in the research included three digital electronic stopwatches (Casio), a Lenovo laptop computer, an athletics field, ten iron balls, a Japanese-made whistle, CDs, and twenty markers.

Procedures

Long Jump Test (Technical Performance Test) (Ibtisam Haider Baktash, 2002)

This test aims to measure the technical performance of the long jump. The tools used include a measuring tape, a take-off board, and a video camera (210 frames/sec). The participant runs a distance of approximately 45 meters as the approach, then takes off without crossing the take-off line and performs the jump forward for the longest possible distance. The test instructions require that the participant does not overstep the take-off board, lands with both feet, and that the jump distance is measured from the take-off board to the nearest mark left by any part of the body in the sand pit. Each participant is allowed three attempts, with the best attempt recorded. The result is measured in meters and parts thereof, and a special form is prepared to evaluate the technical performance.

The researcher conducted the first pilot experiment of the test on a sample of six first-stage students from the pilot study on Sunday, 4/2/2024, at 10:00 a.m., on the athletics field at the College of Basic Education, Al-Mustansiriya University, Department of Physical Education and Sports Sciences. The objectives of the pilot experiment were to:

- Determine the time required to perform the test.
- Verify the validity of the tools used in the research.
- Identify and overcome errors and obstacles that may arise during the pilot experiment.

The researcher conducted the second pilot experiment related to the educational units according to the Appleton model on a sample of first-stage students for the academic year (2023–2024), on Tuesday, 6/2/2024, at 10:00 a.m. The purpose was to determine the suitability of the model for the students, as well as to organize the time frame of the educational units. Based on

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this, the duration of activities in the other units would be calculated approximately, in addition to assessing the appropriateness of the time allocated to the preparatory, main, and concluding parts of the lesson.

The researcher conducted the pre-test for the shot-put event on the research sample on Thursday, 8/2/2024, at the athletics field, after explaining the necessary instructions and steps for performance and application, as well as preparing all the requirements and materials needed for the tests.

The researcher conducted equivalence testing between the experimental and control groups in the variables related to the study before implementing the educational units on the main research sample. The results showed that the two groups (experimental and control) were equivalent, which is a positive indicator confirming that they are comparable in the research variables. This also indicates that there were no significant differences between the two groups in all pre-tests, as presented in Table (1).

Table 1. *Equivalence of the research groups in the pre-test*

Test	Control (Mean ± SD)	Experimental (Mean ± SD)	T-Value	Sig.	Significance
Approach run	1.9692 ± 0.431	1.931 ± 0.487	1.597	0.204	Not significant
Take-off stage	1.4133 ± 0.356	1.4417 ± 0.328	0.962	0.341	Not significant
Rising	1.1508 ± 0.305	1.054 ± 0.146	1.164	0.335	Not significant
Flight	1.0400 ± 0.213	1.0533 ± 0.178	0.653	0.586	Not significant
Overall performance	5.4708 ± 0.985	5.397 ± 0.836	0.514	0.675	Not significant

Note. Significant at the 0.05 level, df = 48

The Main Experiment

The main experiment was conducted from Sunday, 11/2/2024, until 3/4/2024, during the second semester, for a period of eight weeks at a rate of two educational units per week, making a total of sixteen units. The duration of each unit was 45 minutes, divided as follows: preparatory part – 7 minutes, main part – 35 minutes, and concluding part – 3 minutes. The educational units were implemented on the research sample by the course instructor under the direct supervision of the researcher, and the designed units using the Appleton model were applied to the experimental group.

- **Number of educational units:** 16 for each system
- **Duration of each unit:** 45 minutes
- **Weekly sessions:** 2 educational units per group

Before implementing the prepared educational units, the researcher delivered two introductory units on the long jump skill according to the Appleton model for the experimental group students. These introductory sessions aimed to familiarize them with the new instructional approach represented by the Appleton model, clarify the application of its four stages, and show how they were distributed across the sections of the lesson with appropriate timing. The students were also introduced to the procedures, steps, and objectives of each stage, the teaching aids used (visual aids), and the tools, devices, and exercises involved in the units to ensure clarity for future implementation.

The application of the educational units according to the Appleton model for the experimental group began on Sunday, 11/2/2024, and continued until 3/4/2024 during the second semester, for a total of eight weeks. In case of official holidays, the sessions were compensated on another day. Both the experimental and control groups received their respective units from the same instructor to avoid external influences and ensure accurate results.

After completing the educational units for both the experimental and control groups, the researcher conducted the post-test on Sunday, 7/4/2024, to measure the students' learning of the shot put event. The same test used in the pre-test was applied under identical conditions, supervised by the researcher and the assisting team.

Statistical Analysis

The researcher used Microsoft Excel to enter, organize, and separate the data, as well as to calculate standardized scores sequentially. Additionally, IBM SPSS (Version 20) was employed to obtain statistical measures, including the arithmetic mean, standard deviation, skewness coefficient, independent-samples t-test, and paired-samples t-test.

Results

Table 2. *Shows the means, standard deviations, t-values, and significance of the pre- and post-tests for the experimental group*

Test	Pre-test (Mean ± SD)	Post-test (Mean ± SD)	T-Value	Sig.
Approach run	1.931 ± 0.487	2.385 ± 0.378	3.090	0.010
Take-off stage	1.4417 ± 0.328	2.135 ± 0.361	6.182	0.000
Rising	1.054 ± 0.146	1.9542 ± 0.517	6.259	0.000
Flight	1.0533 ± 0.178	1.3158 ± 0.248	3.669	0.004
Overall technical performance	5.397 ± 0.836	7.790 ± 1.151	6.779	0.000

Note. *Significant at the 0.05 level, df = 24*

Table 3. *Shows the means, standard deviations, t-values, and significance of the pre- and post-tests for the control group*

Test	Pre-test (Mean ± SD)	Post-test (Mean ± SD)	T-Value	Sig.
Approach run	1.9692 ± 0.431	2.3983 ± 0.505	2.301	0.042
Take-off stage	1.4133 ± 0.356	2.0533 ± 0.444	3.400	0.006
Rising	1.1508 ± 0.305	1.8308 ± 0.334	5.030	0.000
Flight	1.0400 ± 0.213	1.468 ± 0.298	3.866	0.003
Overall technical performance	5.4708 ± 0.985	7.7508 ± 1.376	4.937	0.000

Note. Significant at the 0.05 level, df = 24

Table 4. *Shows the means, standard deviations, t-values, and significance of the post-tests for the experimental and control groups*

Test	Experimental (Mean ± SD)	Control (Mean ± SD)	T-Value	Sig.
Approach run	2.3850 ± 0.378	2.3983 ± 0.505	5.838	0.002
Take-off stage	2.1350 ± 0.361	2.0533 ± 0.444	6.704	0.001
Rising	1.9542 ± 0.517	1.8308 ± 0.334	8.600	0.000
Flight	1.3158 ± 0.248	1.468 ± 0.298	3.264	0.030
Overall technical performance	7.7900 ± 1.151	7.7508 ± 1.376	7.198	0.001

Note. Significant at the 0.05 level, df = 48

Discussion

It is evident from Table (2) that there are statistically significant differences between the pre- and post-test results in favor of the post-test for the experimental group across all measured tests. The researcher attributes these significant differences to the positive impact of the Appleton model applied to the experimental group. This effect is due to the structured and organized sequence of the educational material according to the model's four stages, each including specific procedures and steps carried out by the students or teacher to achieve the objectives of that stage. Teaching according to this model also involved using visual aids, such as educational posters and instructional videos for each stage, which made the lessons more engaging and reduced boredom, while providing students with sufficient space for individual and collaborative problem-solving. This aligns with Mohamed Saad Zaghloul et al. (2001:32), who emphasized that the use of modern educational tools with diverse capabilities can enhance the effectiveness of teaching methods, increase students' positivity toward the lesson, and stimulate engagement and the acquisition of knowledge more effectively, making lessons more dynamic and providing students with cumulative experiences.Furthermore, teaching the experimental group using the Appleton model positioned the students as the central focus of the learning process, making them active participants. Their engagement in the four stages—sorting existing knowledge, processing new

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information, exploring additional information, and considering the social context—independently encouraged motivation, autonomy in performing activities, and practical application. This fostered self-confidence and enhanced students' self-perception, which in turn increased their motivation, boldness, and readiness to face skill performance demands, leading to improved performance. This is consistent with Al-Mousawi Abdullah Hassan (2005:119), who highlighted that focusing on the learner, making them the center of activity, respecting their opinions and abilities, and providing encouragement and support are key factors in effective learning. Overall, these factors and procedures contributed to the improvement of the experimental group's post-test performance, confirming that the Appleton model has a positive effect on learning the long jump skill and thereby achieving the study's objectives. It is evident from Table (3) that there are statistically significant differences between the pre- and post-test results in favor of the post-test for the control group across all measured tests. The researcher attributes these differences to the effect of the instructional exercises applied according to the teaching method used, provided that these exercises are scientifically valid in terms of content and implementation to achieve both theoretical and skill-based learning objectives. As Mahmoud Al-Hayla (1999:64) stated, "When curricula are implemented effectively, students' overall performance improves significantly, and they can acquire additional benefits, including developing new ways of learning skills." Furthermore, the primary goal of these instructional exercises is to enhance performance through practice, repetition, and training. The nature of the teaching method and the procedures used has a clear impact on skill development; the longer the period dedicated to skill performance and the greater the number of targeted exercises, the higher the learning rate for the specific skill. This supports the conclusion that well-structured and repeated instructional exercises contribute significantly to improving students' performance levels.

From Table (4), it is evident that there are statistically significant differences between the post-test results of the experimental and control groups, favoring the experimental group in all measured tests. The researcher attributes the experimental group's superior performance to the more effective design of the educational units compared to those of the control group. These units allowed the teacher to explain the material in greater detail and accuracy while linking it to students' prior knowledge and experiences. The teacher's role in these units was that of a guide, mentor, and leader of the learning process, and the positive environment created through the four stages of the Appleton model made lessons more engaging and dynamic. Practical exercises were applied in diverse and novel ways, which enhanced skill acquisition and provided continuous, immediate feedback to correct errors, as noted by Mahmoud Al-Rubaie and Saeed Amin (2010:303), who emphasized that such practices ensure the achievement of learning objectives and refine performance.

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The Appleton-based units were more effective than traditional methods because they followed a logical sequence, included activities aligned with track and field skills, and organized content in a way that matched students' comprehension levels. The positive learning environment and novel instructional methods encouraged greater student engagement, motivation, and readiness to absorb information. As Qasim Lzaam et al. (2005:60) noted, variety and innovation in exercises and teaching methods generate excitement, enjoyment, and rapid acquisition of motor skills. The experimental group also benefited from supportive instructional tools such as data projectors, visual aids, and educational booklets, which helped students form accurate mental images of skills, connect prior knowledge with new information, and enhance interactive thinking (Al-Khazraji, 2020:43). Using these aids in the practical component of the main lesson increased students' attention, reduced monotony, and prevented distraction, thereby improving understanding. Proper use of instructional tools facilitated precise execution of the approach run, take-off, and landing phases, while promoting interactive thinking required for skill performance. Combined within the Appleton model, these tools made the lessons engaging and enjoyable, minimized boredom, and strengthened motivation, which is essential for effective learning. As Ban Adnan (2007:141) highlighted, organizing and varying skill exercises while using supportive tools stimulates learners' enthusiasm and encourages repeated practice without inducing fatigue or boredom.

Conclusions

Based on the results, analysis, and discussion, the researcher reached the following conclusions:

1. The use of the Appleton model has an effective impact on learning the long jump skill among the research sample.
2. The excitement, stimulation, and competition resulting from using the Appleton model increased students' motivation to perform and facilitated the learning of the long jump skill.
3. The Appleton model enhanced interactive thinking among first-stage students in the Department of Physical Education, College of Basic Education, Al-Mustansiriya University, as it provided students with the opportunity to engage in mental processes more effectively than traditional rote-based methods, following its four-step approach.

Recommendations

1. Adopt the Appleton learning model in teaching the long jump skill.
2. Utilize the Appleton learning model as it facilitates the teacher's process of applying and achieving the set educational objectives.
3. Conduct similar studies on other sports skills and across different age groups and educational levels.

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A survey Study to Measure the level of Motivation a Squash lesson for junior students in the College of Physical Education and Sports Sciences

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Abstract

Human behavior is one of the topics that has captured the attention of researchers throughout the ages, and motivation is one of the manifestations of this behavior, which indicates the extent of interest in a particular topic and their unwillingness to rush towards a particular topic. The topic of motivation is one of the important topics of interest to the teacher and coach in the field of sports. The aim of this research was identifying the level of motivation for junior students, and the differences in the dimensions of motivation for junior students in squash lessons. We used the descriptive survey method, and the research sample was chosen randomly. Only male of the junior students in the College of Physical Education and Sports Sciences at the University of Baghdad, where the research sample represents 15 % of the research community. We used the scale distributed in the form for measuring the motivation, and the results showed there are differences in the level of motivation among junior students in motivation scale, and there are not significant between the five dimensions for motivation scale. And recommend to Focus on the psychological aspects of squash students and develop their self-confidence to enable them to control their emotions. Finally, we must engage the junior students in training and refereeing courses, in cooperation with the Federation.

Keywords: Motivation, Squash lesson, junior students.

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Introduction

Human behavior is one of the topics that has captured the attention of researchers throughout the ages, and motivation is one of the manifestations of this behavior, which indicates the extent of interest in a particular topic and their unwillingness to rush towards a particular topic. The topic of motivation is one of the important topics of interest to the teacher and coach in the field of sports. He always searches for the reasons that push a certain group to be interested in playing basketball, for example, while others want to play squash, regardless of the different reasons and levels of this activity. In squash, some play professionally, others as a hobby, and so on from one individual to another.

(Hatamleh, et al. 2021) believes that those interested in studying sports behavior have strived to use psychology in increasing the level of motivation towards achieving the best achievement by taking into account the needs and desires of athletes to achieve the greatest achievements. Therefore, it turns out that those interested in sports behavior, are still studying important topics in sports psychology such as personality, motivation, psychological stress, burnout, sports violence, sports aggression, sports frustration, and understanding the thoughts and feelings of athletes.

The importance of research on the topic of motivation clarifies the way for coaches and teachers about the possibility of developing levels of technical performance and achievement. Creativity in sporting events depends on psychological factors, which in their entirety determine human behavior. The importance of the research lies in studying the level of motivation among junior students during squash lessons and working on developing its aspects and ranges among members of the research sample. The Iraqi environment lacks studies of psychological aspects in general and motivation in particular. Researchers have chosen the topic of motivation to identify the most important motivational characteristics of students and their levels in the various dimensions.

The adoption and implementation of a new curricular concept in educational institutions after (2003), the Iraqi Ministry of Higher Education and Scientific Research (2007) officially launched the Course Standard of Educational Institution and Health, which outlines the general direction. and aim for educational institution reform in the next decade, suggests that educational institution focus must shift from sport skill-related goals to health, fitness, cognitive, and social goals. In this new concept, the advanced curriculum intends to develop motor competencies as well as sports participation, promote healthy and safe lifestyles, and social adaptability of students (The Iraqi Ministry of Higher Education and Scientific Research, 2007).

Motivation is an internal energy force that determines all aspects of our behavior; it also affects how we think, feel and interact with others. In sport, high motivation is widely accepted as an essential prerequisite in getting athletes to fulfil their potential. However, given its inherently abstract nature, a force is often difficult to exploit fully.

Physical education plays a vital role in the all-round development of college students. Empirical studies also show that learning engagement has a significant positive promoting effect on students' intrinsic motivation development. In recent years, researchers have begun to explore the impact and predictive role of different types of engagement on intrinsic motivation from different dimensions of learning engagement. Among them, emotionally en-gaged students are more interested and curious about classroom tasks, stimulating their desire to acquire knowledge and thereby improving intrinsic motivation for learning (Karimi & Sotoodeh, 2019).

Many studies have shown that when students have lasting intrinsic motivation for physical education learning, they are more likely to achieve long-term learning results, make academic progress, and benefit significantly in physical health and social aspects (Shang et al., 2023). Behaviorally engaged students actively participate in learning activities, develop personal interests and abilities, and improve their intrinsic motivation. Cognitively engaged students pay more attention to the understanding of learning content, showing an intense curiosity and a thirst for knowledge, which also promotes the development of intrinsic motivation to a certain extent. In addition, behavioral and emotional engagement can also predict intrinsic motivation at the next time point (Yaming et al., 2025).

Ryan and Deci describe intrinsic motivation as the inherent desire to seek challenging tasks through exploring and learning. Extrinsic motivation is considered motivation that originates from external factors outside of the internal satisfaction and pleasure obtained from participating in a task. (Ryan et al., 2020).

Through the development of this study, we expect to gain a deeper understanding of the dimensions of motivation between college students. Interaction intrinsic of the dimensions of motivation, and they are five dimensions (Required to Achievement, Self-confidence, Determination, Self-control and Training) in physical education, provide a more comprehensive and in-depth under-standing of physical education and student development, and provide a more comprehensive and in-depth understanding of physical education and student development. Provide a scientific basis for practical education managers and teachers to optimize the physical education environment further and promote the all-round development of students.

The aim of this study: 1. Identifying the level of motivation for junior students in squash lessons. 2. Identifying the differences in the dimensions of motivation for junior students in squash lessons.

Methodology

Participants

The descriptive survey method was used to suit the problem and to achieve the research objectives. The research sample was chosen randomly. Only male students of the junior students in the College of Physical Education and Sports Sciences at the University of Baghdad were selected, and the research sample was 60 students out of 328 students, where the research sample represents 18 % of the research community.

Procedures

Exploratory experiment

The exploratory experiment was conducted on 13/10/2024 in the College of Physical Education and Sports Sciences, where the motivation scale form was distributed to (10) male students from the junior students who within the research sample. The goal was to review the scale and how to deal with the results and determine, the time it takes to distribute the form to the students and receive it.

Main experiment

The main experiment was conducted on 20/10/2024 in the College of Physical Education and Sports Sciences, University of Baghdad. The motivation scale were distributed to the research sample (50) of junior students. Moreover (10) students who participated in the Exploratory experiment were excluded. Where the research sample represents 15 % of the research community. The scale was distributed in the form of a questionnaire representing a form for measuring the characteristics of motivation among students. It contained five dimensions, which are (Required to Achievement, Self-confidence, determination, Self-control and Training).

Motivation scale

The scale includes five dimensions, (Required to Achievement, Self-confidence, determination, Self-control and Training), with (40) questions. Each dimension is included (8) questions. All questions in each dimensions use Likert 3-point scoring, it contains three statements, which are (Yes, Not sure and No), where yes represents (3 degree) Not sure represents (2 degree) and No represents (1 degree).

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Results

Table 1. *Means, standard deviations, and results of the ((T)) test for the required to Achievement*

N	Questions	Mean	Std. Deviation	Percentage	Sample orientation	T-test
1	I train hard to become the best player in my sport.	48.6	82.5	97%	Yes	1.02
2	I feel a lack of confidence in my ability, especially when facing a high-level competitor.	28.3	8.3	57%	Not sure	*5.85
3	I compete as hard as I do, whether I am winning or losing by a large margin.	47	76.2	94%	Yes	1.06
4	Some of my teammates think I am a very emotional player.	33	15.1	66%	Not sure	*3.77
5	I carry out very accurately everything the coach asks of me.	43.6	63.5	87%	Yes	1.19
6	I train hard just so I do not lose in competition.	46	64.4	92%	Yes	1.23
7	My abilities and skills are high compared to my colleagues.	39.3	33	79%	Yes	*2.06
8	There are some motor skills that I find difficult to implement.	42.3	47.6	85%	Yes	1.53

Note. (df 50-1=49) (T-value =1.679) *Significant at ($p \geq 1.679$).

Table 2. *Means, standard deviations, and results of the ((T)) test for the Self-confidence*

N	Questions	Mean	Std. Deviation	Percentage	Sample orientation	T-test
1	During competition, when I get emotional because of something, I can calm down quickly.	39.3	34.1	79%	Yes	*1.99
2	Coaches are often biased toward certain players.	40.3	48.2	81%	Yes	1.44
3	My performance is better in tough competitions than in easy competitions.	39	46.8	78%	Yes	1.44
4	My confidence in myself as an athlete is not very high.	35.3	26.8	71%	Not sure	*2.27
5	In sports competition, I try to give my maximum effort regardless of the outcome of the competition.	45.6	64.6	91%	Yes	1.22
6	The anxiety and stress I might feel before a competition bothers me.	40.6	48	81%	Yes	1.46

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7	The player's decline is the result of the player's mistakes and not the coach's mistakes.	38.6	30.1	77%	Not sure	*2.22
8	Sometimes it seems like I am not doing my best in competition.	41.3	47.7	83%	Yes	1.50

Note. (df 50-1=49) (T-value =1.679) *Significant at (p ≥ 1.679).

Table 3. *Means, standard deviations, and results of the ((T)) test for the Determination*

N	Questions	Mean	Std. Deviation	Percentage	Sample orientation	T-test
1	I can react well in unexpected situations during competition.	42	49.7	84%	Yes	1.46
2	I am the type of person who can easily give up in competition when defeated by a large margin.	33.6	16.9	67%	Not sure	*3.44
3	When things go wrong in competition, I can control my emotions largely.	41.3	41.7	83%	Yes	*1.71
4	I feel like my coach doesn't understand me well	36	23	72%	Not sure	*2.70
5	I do my best to reach the highest levels of sports.	40.6	53.1	81%	Yes	1.32
6	Sometimes I refrain from expressing my opinion to my coach for fear that he will criticize me.	35	28.9	72%	Not sure	*2.15
7	I train on my own in addition to my regular training times.	40.3	48.2	81%	Yes	1.44
8	I find it difficult trying to control my emotions during competition.	38.3	31.7	77%	Not sure	*2.09

Note. (df 50-1=49) (T-value =1.679) *Significant at (p ≥ 1.679).

Table 4. *Means, standard deviations, and results of the ((T)) test for the Self-control*

N	Questions	Mean	Std. Deviation	Percentage	Sample orientation	T-test
1	I respected every coach who trained me.	44.3	65.5	89%	Yes	1.17
2	It is not in my nature to face the challenge of a competitor.	31.6	15	63%	Not sure	*3.64
3	Most of my teammates think that I am a very confident player.	41.3	40.2	83%	Yes	*1.77
4	If asked me to undergo a rigorous training schedule after the end of the sports season, I get upset.	35.6	29	71%	Not sure	*2.12
5	When I make some mistakes at the beginning of the competition, this does not clearly affect my performance.	39.6	39.3	79%	Yes	*1.74

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6	I feel like my coach criticizes me unfairly.	28.3	8.3	57%	Not sure	*5.85
7	Hard training for long periods is the path to athletic excellence.	41.4	47.7	83%	Yes	1.50
8	Sometimes my ability to make decisions causes a decline in my performance in competition.	32	21.9	64%	Not sure	*2.52

Note. (df 50-1=49) (T-value =1.679) *Significant at (p ≥ 1.679).

Table 5. *Means, standard deviations, and results of the ((T)) test for the Training*

N	Questions	Mean	Std. Deviation	Percentage	Sample orientation	T-test
1	When I learn a new skill, I practice it until I mastered it completely.	42.6	51.8	85%	Yes	1.42
2	I cannot keep my calm when an opponent harasses me.	33.6	21.5	67%	Not sure	*2.70
3	I always consult my coach when I face some problems.	41	50.2	82%	Yes	1.41
4	In some competitions it seems that I am not competing seriously	30.6	12	61%	Not sure	*4.27
5	I can express my point of view without hesitation, even if it is different from the coach's opinion	44.6	60.3	89%	Yes	1.28
6	I hardly continue training beyond the end of my normal training period.	34.6	22.7	69%	Not sure	*2.64
7	I rarely lose my temper during competition	37.6	31.2	75%	Not sure	*2.09
8	If the coach does not include me as a starter in the competition, I almost think he is taking a position on me	35	29.4	70%	Not sure	*2.05

Note. (df 50-1=49) (T-value =1.679) *Significant at (p ≥ 1.679).

Table 6. *F-test one-way anova for five dimensions for Motivation scale*

Source of variance	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	889.6	4	222.4	0.990	0.426
Within Groups	7865.5	35	224.7		
Total	8755.1	39			

Note. Significant at (α ≤ 0.05)

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Discussion

The statistical results presented in Table (1) above showed that the results of Means, Standard Deviation, Percentage, Sample orientation, and (T-test) value for the first dimension (Required to Achievement). The results of the first question appeared the M (48.6), S.D (82.5), the Sample orientation was (yes) because of the (97%) of Students chosen to answer to this question (yes). While the T-test value was (1.02), it less than T-table value (1.679), that is means there are not significant. The results of the Second question appeared the M (28.3), S.D (8.3), the Sample orientation was (Not sure) because of the (57%) of Students chosen to answer to this question (Not sure). While the T-test value was (5.85), it more than T-table value (1.679), that is means there are significant. The results of the Third question appeared the M (47), S.D (76.2), the Sample orientation was (Yes) because of the (94%) of Students chosen to answer to this question (Yes). While the T-test value was (1.06), it less than T-table value (1.679), that is means there are not significant. The results of the Fourth question appeared the M (33), S.D (15.1), the Sample orientation was (Not sure) because of the (66%) of Students chosen to answer to this question (Not sure). While the T-test value was (3.77), it more than T-table value (1.679), that is means there are significant. The results of the Fifth question appeared the M (43.6), S.D (63.5), the Sample orientation was (yes) because of the (87%) of Students chosen to answer to this question (yes). While the T-test value was (1.19), it less than T-table value (1.679), that is means there are not significant. The results of the Sixth question appeared the M (46), S.D (64.4), the Sample orientation was (yes) because of the (92%) of Students chosen to answer to this question (yes). While the T-test value was (1.23), it less than T-table value (1.679), that is means there are not significant. The results of the Seventh question appeared the M (39.3), S.D (33), the Sample orientation was (yes) because of the (79%) of Students chosen to answer to this question (yes). While the T-test value was (2.06), it more than T-table value (1.679), that is means there are significant, because there are a different between the Students in a skill and abilities. (Hussein, Y. N. 2015). The results of the Eighth question appeared the M (42.3), S.D (47.6), the Sample orientation was (yes) because of the (85%) of Students chosen to answer to this question (yes). While the T-test value was (1.53), it less than T-table value (1.679), that is means there are not significant. At least.

The statistical results presented in Table (2) above showed that the results of Means, Standard Deviation, Percentage, Sample orientation, and (T-test) value for the Second dimension (Self-confidence). The results of the first question appeared the M (39.3), S.D (34.1), the Sample orientation was (yes) because of the (79%) of Students chosen to answer to this question (yes). While the T-test value was (1.99), it more than T-table value (1.679), that is means there are significant. The results of the Second question appeared the M (40.3), S.D (48.2), the Sample

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orientation was (Yes) because of the (81%) of Students chosen to answer to this question (Yes). While the T-test value was (1.44), it less than T-table value (1.679), that is means there are not significant. The results of the Third question appeared the M (39), S.D (46.8), the Sample orientation was (Yes) because of the (78%) of Students chosen to answer to this question (Yes). While the T-test value was (1.44), it less than T-table value (1.679), that is means there are not significant. The results of the Fourth question appeared the M (35.3), S.D (6.8), the Sample orientation was (Not sure) because of the (71%) of Students chosen to answer to this question (Not sure). While the T-test value was (2.27), it more than T-table value (1.679), that is means there are significant. The reason for the existence of significant differences in students' answers is due to differences in students' confidence in athletic performance. (Kamel, M.et al., 2024). The results of the Fifth question appeared the M (45.6), S.D (64.4), the Sample orientation was (yes) because of the (91%) of Students chosen to answer to this question (yes). While the T-test value was (1.22), it less than T-table value (1.679), that is means there are not significant. The results of the Sixth question appeared the M (40.6), S.D (48), the Sample orientation was (yes) because of the (81%) of Students chosen to answer to this question (yes). While the T-test value was (1.46), it less than T-table value (1.679), that is means there are not significant. The results of the Seventh question appeared the M (38.6), S.D (30.1), the Sample orientation was (Not sure) because of the (77%) of Students chosen to answer to this question (Not sure). While the T-test value was (2.22), it more than T-table value (1.679), that is means there are significant. The results of the Eighth question appeared the M (41.3), S.D (47.7), the Sample orientation was (yes) because of the (83%) of Students chosen to answer to this question (yes). While the T-test value was (1.50), it less than T-table value (1.679), that is means there are not significant.

The statistical results presented in Table (3) above showed that the results of Means, Standard Deviation, Percentage, Sample orientation, and (T-test) value for the Third dimension (Determination). The results of the first question appeared the M (42), S.D (49.7), the Sample orientation was (yes) because of the (84%) of Students chosen to answer to this question (yes). While the T-test value was (1.46), it less than T-table value (1.679), that is means there are not significant. The results of the Second question appeared the M (33.6), S.D (16.9), the Sample orientation was (Not sure) because of the (67%) of Students chosen to answer to this question (Not sure). While the T-test value was (3.44), it more than T-table value (1.679), that is means there are significant. The results of the Third question appeared the M (41.3), S.D (41.7), the Sample orientation was (Yes) because of the (83%) of Students chosen to answer to this question (Yes). While the T-test value was (1.71), it more than T-table value (1.679) that is means there are significant, this difference is due to the difference in students' reactions to controlling emotions. The results of the Fourth question appeared the M (36), S.D (23), the Sample orientation was (Not sure) because of the (72%) of Students chosen to answer to this question (Not sure). While the T-test value was (2.70), it more than T-table value (1.679), that is means there are significant. The results of the Fifth question appeared the M (40.6), S.D (53.1), the Sample orientation was (yes) because of the (81%) of Students chosen to answer to this question (yes). While the T-test value was (1.32), it less than T-table value (1.679), that is means there are not significant. The results of the Sixth question appeared the M (35), S.D (28.9), the Sample orientation was (Not sure) because of the (72%) of Students chosen to answer to this question (Not sure). While the T-test value was (2.15), it more than T-table value (1.679), that is means there are significant. The results of the Seventh question appeared the M (40.3), S.D (48.2), the Sample orientation was (Yes) because of the (81%) of Students chosen to answer to this question (Yes). While the T-test value was (1.44), it less than T-table value (1.679), that is means there are not significant. The results of the Eighth question appeared the M (38.3), S.D (31.7), the Sample orientation was (Not sure) because of the (77%) of Students chosen to answer to this question (Not sure). While the T-test value was (2.09), it more than T-table value (1.679), that is means there are significant.

The statistical results presented in Table (4) above showed that the results of Means, Standard Deviation, Percentage, Sample orientation, and (T-test) value for the Third dimension (Self-control). The results of the first question appeared the M (44.3), S.D (65.6), the Sample orientation was (yes) because of the (89%) of Students chosen to answer to this question (yes). While the T-test value was (1.17), it less than T-table value (1.679), that is means there are not significant. The results of the Second question appeared the M (31.6), S.D (15), the Sample orientation was (Not sure) because of the (63%) of Students chosen to answer to this question (Not sure). While the T-test value was (3.64), it more than T-table value (1.679), that is means there are significant. The results of the Third question appeared the M (41.3), S.D (40.2), the Sample orientation was (Yes) because of the (83%) of Students chosen to answer to this question (Yes). While the T-test value was (1.77), it more than T-table value (1.679) that is means there are significant. The results of the Fourth question appeared the M (35.6), S.D (29), the Sample orientation was (Not sure) because of the (71%) of Students chosen to answer to this question (Not sure). While the T-test value was (2.12), it more than T-table value (1.679), that is means there are significant. The results of the Fifth question appeared the M (39.6), S.D (39.3), the Sample orientation was (yes) because of the (79%) of Students chosen to answer to this question (yes). While the T-test value was (1.74), it more than T-table value (1.679), that is means there are significant. The results of the Sixth question appeared the M (28.3), S.D (8.3), the Sample orientation was (Not sure) because of the (57%) of Students chosen to answer to this question (Not sure). While the T-test value was (5.85), it more than T-table value (1.679), that is means there are significant. The results of the Seventh question appeared the M (41.4), S.D (47.7), the Sample orientation was (Yes) because of the (83%) of Students chosen to answer to this question (Yes). While the T-test value was (1.50), it less than T-table value (1.679), that is means there are not

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significant. The results of the Eighth question appeared the M (32), S.D (21.9), the Sample orientation was (Not sure) because of the (64%) of Students chosen to answer to this question (Not sure). While the T-test value was (2.52), it more than T-table value (1.679), that is means there are significant.

The statistical results presented in Table (5) above showed that the results of Means, Standard Deviation, Percentage, Sample orientation, and (T-test) value for the Third dimension (Training). The results of the first question appeared the M (42.6), S.D (51.8), the Sample orientation was (yes) because of the (85%) of Students chosen to answer to this question (yes). While the T-test value was (1.42), it less than T-table value (1.679), that is means there are not significant. The results of the Second question appeared the M (33.6), S.D (21.5), the Sample orientation was (Not sure) because of the (67%) of Students chosen to answer to this question (Not sure). While the T-test value was (2.70), it more than T-table value (1.679), that is means there are significant. The results of the Third question appeared the M (41), S.D (50.2), the Sample orientation was (Yes) because of the (82%) of Students chosen to answer to this question (Yes). While the T-test value was (1.41), it less than T-table value (1.679) that is means there are not significant. The results of the Fourth question appeared the M (30.6), S.D (12), the Sample orientation was (Not sure) because of the (61%) of Students chosen to answer to this question (Not sure). While the T-test value was (4.27), it more than T-table value (1.679), that is means there are significant. The results of the Fifth question appeared the M (44.6), S.D (60.3), the Sample orientation was (yes) because of the (89%) of Students chosen to answer to this question (yes). While the T-test value was (1.28), it less than T-table value (1.679), that is means there are not significant. The results of the Sixth question appeared the M (34.6), S.D (22.7), the Sample orientation was (Not sure) because of the (69%) of Students chosen to answer to this question (Not sure). While the T-test value was (2.64), it more than T-table value (1.679), that is means there are significant. The results of the Seventh question appeared the M (37.6), S.D (31.2), the Sample orientation was (Not sure) because of the (75%) of Students chosen to answer to this question (Not sure). While the T-test value was (2.09), it more than T-table value (1.679), that is means there are significant. The results of the Eighth question appeared the M (35), S.D (29.4), the Sample orientation was (Not sure) because of the (70%) of Students chosen to answer to this question (Not sure). While the T-test value was (2.05), it more than T-table value (1.679), that is means there are significant.

The statistical results presented in Table (6) above showed that the results of F-test (one-way) anova for five dimensions to Motivation scale, the sum of square between groups (889.6), while the sum of square within groups (7865.5), the degree of freedom for five dimensions (4), while the mean square for between groups (222.4), while the mean square within groups (224.7).

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The (Sig = 0.426), it is more than (0.05), that is mean there are not significant between the five dimensions for Motivation, because of There are no major differences between the selected sample because they are in the same educational stage and in the same college and their educational conditions are almost similar. In addition, this type of questionnaire requires a larger sample and must include all educational stages for college of Physical Education and Sport Science.

Conclusions

Based on the results of this research it is essential to instruct teachers and coaches not to ignore the importance of motivation among students or players, as it can have negative effects on the entire educational process. Through the results of this research, it was show there are differences in the level of motivation among junior students, and the five dimensions of the motivation scale, as there were three questions from the first dimension (Required to Achievement) was significant, the second dimension (Self-confidence) there were three questions was significant. The third dimension (determination) there were five questions was significant, the fourth dimension (Self-control) there were six questions was significant and the fifth dimension (Training) there were five questions was significant. The differences in the dimensions of motivation were not significant.

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The effect of static and dynamic balance exercises on developing some artistic gymnastic skills for female students of the College of Physical Education and Sports Sciences

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Abstract

The aim of the research is to identify the effect of using static and dynamic balance exercises in developing some technical gymnastics skills for female students of the Faculty of Physical Education and Sports Sciences. The research community consisted of second-year female students, while the research sample was chosen intentionally, and they are Section (B), numbering 20, female students, who were distributed into two groups (experimental - control), with 10 female students for each group. The researcher used the experimental method with a design of the experimental and control groups with pre- and post-tests, after applying the exercise components in the main experiment with 20 training units that lasted for 10 weeks. The results showed that there were significant differences in favor of the training group that used static and dynamic balance exercises.

Keywords: static balance, dynamic balance, artistic gymnastics, gymnastics skills.

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Introduction

In the past few decades, the sports sector has witnessed great progress in various fields and trends. This progress has been reflected in the development of athletes, administrators, sports facilities and all those working in them. This is what made sports reach what it has reached today. Gymnastics is one of these Olympic games that has developed like other games. This also included attention to the characteristics that included sports development, which is the training process or how to train players to reach their abilities to a higher and better level than before. Training includes all physical, motor, mental and respiratory aspects such as strength, speed, endurance, compatibility, abilities, etc.

Training physical and motor abilities and upgrading the skill and planning level of players is important. We often see in competitions athletes performing movements and sports skills that are almost free of errors, and have amazing and elaborate movement paths and at high speeds that the viewer can not follow. Sometimes we cannot determine how the movement was made, and this raises several questions about how this athlete performs these movements and skills in this way, which results in this elaborate movement sequence.

Motor skills are one of the most important abilities that must be developed for young players. One of these abilities is balance, which is the basic building block of mathematics, with its importance in achieving compatibility between the central nervous system and muscles, and ensuring (S. Ibrahim, Asleawa, and Farhan 2024) Dynamic equilibrium occurs when the sum of vertical forces, the sum of horizontal forces, and the sum of moments are equal to zero.

There are two main types of balance: static and dynamic balance. Static balance is defined as maintaining the postural balance while the body is in a static position, and dynamic balance is maintaining the postural balance while the body is moving(Jasim, Abed, and Ibrahim 2023) It is worth noting that balance is a skill that athletes need, as it is the basis for stability, movement, and even during training (coughlan G, Others, 2012) It is the basis of control for the human body, and the kinetic balance is the ability to maintain a certain position of the body during stability or movement. Balance is also the ability of a person to keep his body or its various parts in a certain position as a result of the complex, harmonious activity of a group of devices and vital systems directed to work against the effects of the forces of gravity (Asliwa & Ibraheem, 2024).

Several mechanical factors affect balance, which are (center of gravity, body weight, gravity line, friction, base of support, in addition to the level and type of resistance, and this is what trainers should pay attention to and work to develop. Athletes who have a very high level of skill performance, which is shown through the full control of the nervous system on all muscle groups involved in physical performance, and the adequacy of mental processes by sending accurate and fast signals to these muscle groups at studied times, which resulted in rapid and accurate motor responses that helped to show this wonderful picture of movement and skills, are athletes of a high level(Ali, Hameed, and Ibrahim 2020)

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Gymnastics skills require in their performance method speed, strength, muscle power and balance in a sudden and sudden manner that is launched all at once with maximum effort in a short period of time, in addition to other physical and motor skills, as the smallest distance between players and the difficulty of the motor skills of the game(S. S. Ibrahim 2021) from here the problem of the research became clear to the researcher as a specialist in this field and through answering the following question: Do female students get a sufficient amount of static and dynamic balance training during the study units, considering that balance training is a basic requirement to achieve learning the basic skills and mastery of them for female students, as giving balance exercises that allow mastery of them is a very necessary requirement for training (Jasim, Hussein, and Ibrahim 2021) To know this, the researcher decided to give exercises specific to static and dynamic balance on a sample of female students from the College of Physical Education and Sports Sciences - University of Baghdad, and conducting this research helps us in reaching accurate answers that lead to following the best way to invest the time allocated for training and reach high levels of technical skills. The importance of the research comes from using balance exercises of both static and dynamic types for the purpose of developing some technical gymnastic skills for female students.

Method and tools

The researcher used the experimental method by designing two equivalent groups with a pre-test and a post-test, to suit the nature of the research and the problem to be solved, as the sample is the part that represents the original community or model on which the researcher conducts the entirety and focus of his work (Talib Jasim, Hayder Hussein, and Saad Ibrahim 2022)

The research community was determined as the second-year female students of the College of Physical Education and Sports Sciences - University of Baghdad for the academic year 2024-2025, numbering 152. The research sample was chosen intentionally, which is the second-year female students, Section (B), numbering 20 students. They were distributed into two groups (experimental - control), with 10 students for each group, after extracting the exploratory experiment sample and also excluding some students for not committing to the lesson, and they represent a percentage of 13.15%. The researcher used a number of means of collecting information, such as Arab and foreign sources, observation, courses, devices and tests through which the researcher measured the research variables. The homogeneity process was not carried out because the samples are from one age group, one academic stage and the same gender, and therefore the sample is considered homogeneous. Equivalence was carried out between the two groups in the skills selected for the research, as shown in Table 1.

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Table 1. *It shows the equivalence of the two research groups in the pre-tests of the skills under study*

No	Tests	Experimental		control		t-value	sig
		mean	SD	mean	SD		
1	Bar Step	1.200	0.455	1.400	0.387	1.296	0.206
2	Back Roll	0.933	0.372	1.100	0.338	1.285	0.209
3	Balance Step	1.111	0.432	1.033	0.352	0.868	0.643

Note. Positive under 0.05

By observing Table (1) above, the significance value (Sig) for all tests is greater than the significance level (0.05%), which indicates that the differences are not significant between the two groups, which means the equivalence of the experimental and control groups. The researcher used the performance evaluation process of (10) points by the subject teachers in their semester exams. The pre-tests were conducted on Monday, November 4, 2024, while the main experiment began on Thursday, November 7, 2024, which included fixed and dynamic balance exercises twice a week, with 20 training sessions, i.e., for a period of 10 weeks. The post-tests were conducted on January 20, 2025. The researcher took into account all the conditions and considerations related to the test so that the conditions would be similar between the pre- and post-tests. The researcher used the necessary statistical methods through the statistical package (SPSS), in addition to using Microsoft Excel, to collect and tabulate data and process it statistically to extract the results. All search procedures are extended for the period from 11/1/2024 to 2/1/2025.

Results

The researcher presents the results in the form of tables.

Table 2. *It shows the arithmetic means, standard deviations, and the calculated T value between the pre- and post-tests of the skills under study for the two research groups*

Tests	groups	pre-test		post-test		F	Std. Error Difference	T	Sig
		mean	SD	mean	SD				
Bar Step	Experimental sample	1.200	0.455	7.903	0.568	6.703	0.094	70.803	0.000
	control sample	1.400	0.387	6.067	0.678	4.666	0.105	44.272	0.000
Back Roll	Experimental sample	0.933	0.372	7.800	0.455	6.866	0.090	75.581	0.000
	control sample	1.100	0.338	5.967	0.481	4.866	0.114	42.657	0.000

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Balance Step	Experimental sample	1.101	0.432	7.867	0.399	6.766	0.082	81.742	0.000
	control sample	1.033	0.352	5.900	0.073	4.866	0.157	30.828	0.000

Table 3. *Shows the arithmetic means, standard deviations, and T-value calculated in the post-tests between the two groups*

Tests	Experimental		control		t	sig
	mean	SD	mean	SD		
Bar Step	7.903	0.568	6.067	0.678	8.045	0.000
Back Roll	7.800	0.455	5.967	0.481	10.728	0.000
Balance Step	7.867	0.399	5.900	0.573	10.902	0.000

Discussion

We note by viewing Table (2), which shows the sum of the arithmetic means, standard deviations and differences between the pre- and post-tests of the two groups (experimental and control), which shows that there are significant differences in all three tests, which are (climbing onto the crossbar, back roll and climbing onto the parallel bars). The results show that there is development for the experimental and control groups in all tests and for both groups, meaning that the exercises used in the main experiment for the second-stage students made a difference in developing these skills.

We see in Table (3), which shows the difference in the post-tests of the experimental and control groups, as it was shown that all the differences are significant, as the level of significance is less than the level of 0.05%. By comparing the arithmetic means of the tests mentioned in the table, we notice that in the test of climbing the crossbar that the value of the arithmetic mean of the experimental group is greater than the arithmetic mean of the control group, and this confirms the effectiveness of the exercises used in the research.

In this case (T. S. S. Ibrahim 2022)confirm that the compound exercises have an effect in different directions, and concerning the back roll and parallel climb tests, the significance of the differences is also in favour of the experimental group, by comparing the arithmetic averages, which show that the experimental group is better than the control group in the post-tests. The researcher explains this by saying that the various exercises that the researcher developed, which target static balance and dynamic balance, led to an increase in the students' ability to control parts of the body and motor control over the entire body.

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Appendix(1)

Models for static and dynamic balance exercises

no	Section	Excercise	Time	rest	Groups
1-	Warmup		4x30		**30 Sec**
2-	Main Training Session		4x30		**30 Sec**
3-	Main Training Session		4 x ثا 20		**Sec 30**
4-	Warmup		4 x ثا 20		**Sec 30**

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5-	Main Training Session	4x30		**Sec 30**
6-	Main Training Session	4 x ثا 20		**Sec 30**
7-	Warmup	4x30		**Sec 30**
8-	Warmup	4x30		**Sec 30**

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Professional Challenges Faced by Physical Education Teachers in Completing Their Daily Lessons from Other Academic Subjects

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Abstract

This study aims to identify the professional challenges faced by physical education teachers in completing their teaching assignments (sports education lessons) due to the inclusion of other academic subjects in schools affiliated with the General Directorate of Education in Nineveh. The researchers adopted a descriptive methodology, covering a research sample of 317 male and female physical education teachers in Nineveh's schools. Appropriate scientific procedures and statistical methods were employed. The findings indicate that physical education teachers are highly aware of the significance of the professional challenges they face, showing closely related arithmetic averages. The professional challenges identified by the researchers are equally significant for male and female teachers.

Keywords: Professional challenges, daily lessons, other academic subjects.

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Introduction

Sports are fundamental pillars in the comprehensive advancement of civilized societies, representing individuals' behaviors and interactions through a set of laws, principles, and regulations that directly influence relationships among athletes. Sports foster competition, recreation, and collaboration.

School sports, in particular, are among the most effective and influential means of preparing youth, fostering holistic development, and contributing to genuine societal growth. School sports activities positively impact students' personalities and enhance their ability to participate meaningfully in society (Abdul Hamid, 1996, p. 41).

Many theorists in physical education and sports sciences analyze the challenges faced by physical education teachers based on their roles, responsibilities, and interactions in the classroom. The professional challenge refers to the obstacles a specialized teacher encounters in their work. Since a physical education teacher is specialized in school sports, they face distinct challenges in practicing their field, despite being academically, scientifically, and athletically qualified (Layla & Zahran, 2002, p. 23).

The success of a physical education lesson largely depends on the effectiveness of the teacher’s performance and their ability to fulfill their assigned duties. This aligns with the findings of Ali Ibrahim Radho’s study (2025), which highlights that the most significant difficulties faced by physical education teachers are administrative and technical challenges, as well as leadership responsibilities that significantly impact their job satisfaction and effectiveness. Additional tasks assigned to teachers pose obstacles to their professional development and hinder the quality of education provided in schools (Al-Badri, 2001, p. 40).

Moreover, physical education teachers are responsible for internal and external school activities, such as sports competitions, meetings, training workshops, and coaching school sports teams, which often interfere with their primary teaching responsibilities.

Based on the researchers' expertise in physical education and sports sciences, the current study aims to analyze professional challenges faced by physical education teachers in completing their daily teaching assignments due to other academic subject obligations.

School sports remain an essential component of youth education, overseen by professional teams according to structured curricula and official regulations. Despite efforts from educational authorities, professional challenges have obstructed the realization of educational objectives in physical education programs.

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This was affirmed by Bakil Al-Sufi and Najeeb Ja'eem's study (2022), which found that school administrations do not adequately support sports activities inside or outside school premises.

Thus, this research seeks to analyze the organizational challenges physical education teachers face in completing their daily lessons due to other academic subjects, aiming to diagnose the situation, understand its mechanisms, and propose solutions.

Identifying challenges in school sports, particularly those affecting physical education teachers, is a crucial step in developing strategies to address these difficulties. This will enable teachers to perform their roles effectively without being burdened by additional academic subjects that diminish their productivity and creativity. This is what prompted the researchers to undertake this study in order to examine the challenges faced by physical education teachers, including the completion of teaching quotas and the assignment of other academic subjects. (Abu Al-Ainain, 1990, p. 46)

As the two researchers work as an educational supervisor specializing in physical education and as a physical education teacher, and based on their experience in the field, as well as their review of literature, books, and scientific references, the researchers found that there are professional challenges affecting physical education teachers in teaching their specialization. These challenges may lead to a decline in the quality of field performance and vary in size and type from one school to another. Among these challenges is the imposition and assignment of other academic subjects to physical education teachers to complete their required teaching hours or to fill vacancies caused by a shortage of teachers. This observation led the researchers to conduct this study to identify the professional challenges faced by physical education teachers in schools in the city of Mosul.

This study aims to Identify the professional challenges faced by physical education teachers in completing their daily lessons due to other academic subjects in Mosul's schools. Determine differences in the challenges faced by male and female physical education teachers.

H1: There are no statistically significant differences in professional challenges among physical education teachers based on gender.

Research Scope:

- **Population:** Physical education teachers in schools affiliated with the General Directorate of Education in Nineveh.
- **Time Frame**: From October 1, 2023, to April 20, 2024.

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- **Location:** Primary schools under the General Directorate of Education in Ninawa.

Methodology

The researchers used the descriptive approach in the survey method, due to its suitability to the nature of the research.

Research community

The research community included physical education teachers in primary schools affiliated to the city of Mosul and affiliated to the General Directorate of Nineveh Education (males and females) specializing in physical education, and their number is (317) teachers in schools of education in Nineveh Governorate, and according to the gender variable and by (277) physical education teachers, and (40) physical education teachers, and table (1) shows that.

Table (1): Shows the distribution of the research population by sex (male and female)

Research Community Characterization	Total of Community	Sex	
Physical Education Teachers	317	Male Teachers	277
Physical Education Teachers		Female teacher	40
Total	317	317	

Research samples

As for the research samples, they included a sample of the exploratory experiment by (10) teachers, as well as a sample of stability and by (20) teachers, and finally the final application sample, which amounted to (45) teachers in the field of physical education, and in different percentages in order to ensure the objectivity of the research results and table (2) shows that.

Table (2): Percentages of research population samples

Sample	Sample Exploratory Experiment	Sample Stability	Sample Application	Total

Number	10	20	45	75
Ratio	9.09 %	18.18%	72,72%	100%

Research Tool

(questionnaire of professional problems facing physical education teachers in completing their daily lessons of other subjects):

In order to find professional problems and find solutions to the research sample, the researcher followed the following:

Analysis of documents : (books and scientific references).

By reviewing research and theoretical frameworks and reviewing books and scientific sources for research such as (Abu Salem, 2017) and (Al-Saffar, 2009) for the purpose of limiting the appropriate paragraphs to questionnaire the professional problems of the research sample, the researchers presented the axes of the research problem to a group of experts and specialists.

Formulation of questionnaire paragraphs

After analyzing the content of scientific sources, as well as personal interviews and the results of these procedures, the researchers prepared a questionnaire form for the professional problems facing physical education teachers in terms of completing their quorum of other subjects, as the researchers formulated a number of phrases and in line with the nature of the tasks and work of the research community, and guided by the foundations contained in the relevant scientific research and studies, and presented to experts and specialists, meaning that the questionnaire in its initial form contained (28) items, as was determined The proposed alternatives according to the Likert triple scale are (agree, to some extent, disagree)

- Key aspects have been taken into account in the drafting of the paragraphs, including:
- Not to be long leads to boredom.
- Be measurable for a single variable.

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The phrase should measure one of the themes of the questionnaire affiliated with him and related to him (Al-Taweel, 2009, 52).

It was presented to a number of experts and specialists, starting from (15/10/2023) until (26/10/2023), and after collecting and unloading them, this process resulted in the approval of the experts on the axes of professional problems, including their phrases related to physical education teachers, and some phrases were deleted that the opinion settled on deleting, and the approval rate was adopted (75%) or more, as indicated by (Bloom et al., 1983: 69), and Table (3), shows the percentages of agreement of experts on professional problems.

Table (3): Shows the themes and paragraphs of the questionnaire and the conformity and consensus of the experts' opinions on them

Section	Paragraph sequence	**Refusers**	**Approvers**	Procedure	Percentage
teacher Professional problems	1-2-3	**—**	**5**	Keep	100%
	4-5	**1**	**4**	Keep	80%
	6	**3**	**2**	delete	40%
learner Professional problems	1-2-4	**—**	**5**	Keep	100%
	3 – 5 – 6	**1**	**4**	Keep	80%
	7	**2**	**3**	delete	60%
Professional curriculum problems	1-2-3	**—**	**5**	Keep	100%
	4-5-6-7	**1**	**4**	Keep	80%
school environment problems	1-2-3-7	**—**	**5**	Keep	100%
	4-5 -7	**1**	**4**	Keep	80%

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	8	**2**	**3**	delete	60%

Exploratory Experiment

To identify potential questions that might arise in the questionnaire from respondents, an exploratory experiment was conducted on a sample consisting of 10 physical education teachers in the Nineveh Directorate of Education—7 males and 3 females. The questionnaire was administered on Sunday, November 3, 2023, in schools within Mosul city, affiliated with the Nineveh Directorate of Education. The experiment aimed to assess the clarity and suitability of the statements, the validity of the research tool, the relevance of the alternatives, and its applicability to the research sample.

Scientific Validation of the Questionnaire

Face Validity

This procedure ensures the accuracy of the questionnaire. To determine its validity, the researchers used face validity, analyzing the tool based on its content. It was evaluated by 5 experts, who assessed the clarity, wording, precision, and objectivity of its items. All evaluators approved the statements presented to them.

Questionnaire Reliability

Test-Retest Method

A sample of 20 teachers (13 males, 7 females) was selected to examine the reliability of the questionnaire using the test-retest method. The questionnaire was administered on Wednesday, December 5, 2023, and then reapplied 14 days later under the same conditions. The correlation coefficient between the two applications was 0.88, indicating high reliability.

Cronbach's Alpha Method

Cronbach's Alpha measures the reliability and accuracy of a test, evaluating how well the research tool measures the intended construct. The reliability coefficient for Cronbach's Alpha was 0.82, indicating a high level of consistency.

Final Application

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The final application targeted 45 physical education teachers (both male and female). The questionnaire was distributed to the specified sample, representing 12.98% of the total research population. The data collection took place between March 20, 2024, and April 3, 2024.

Statistical Analysis

The collected data was analyzed using SPSS statistical software, with the following methods:

1. Percentage Calculation
2. Arithmetic Mean
3. Standard Deviation
4. T-test for independent samples
5. Cronbach's Alpha Coefficient
6. Pearson Correlation Coefficient

Results

Table 4: Demonstrates the number of questionnaire items, arithmetic mean, percentage, and evaluation level of professional challenges.

Section	Number of Items	Arithmetic Mean	Percentage	Evaluation Level
First Section	7	18	85%	Very Good
Second Section	6	14	77.7%	Good
Third Section	5	10	66%	Medium
Fourth Section	7	16	76%	Good
Total	25	58	76.17%	Good

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Table 5: Illustrates the T-value, arithmetic mean, standard deviation, and probability value (Sig) for professional challenges based on gender.

Gender	Arithmetic Mean	Standard Deviation	T-value	Sig (Significance Level)
Male	55.90	11.62	1.741	0.09
Female	61.40	8.02		

Discussion

The data in (Table 4) shows that the overall percentage of professional challenges faced by physical education teachers in fulfilling their academic duties reached 76.17%, with an evaluation level of "Good." The highest percentage was recorded in the first section (85%), indicating that this area contains the most significant obstacles. Based on this table, the first research objective was achieved.

The results in Table 5 show that the independent T-value for gender was 1.741, and the probability value (Sig) was 0.09—greater than the significance level of 0.05. This indicates no statistically significant differences between male and female teachers regarding professional challenges.

The researchers attribute this result to the fact that the issue persists across elementary schools, affecting both male and female teachers. This uniformity in professional challenges is further reinforced by the varying resources available in different schools and the differing attitudes of school administrators toward physical education activities. Despite individual differences in performance and engagement in school sports, both genders agreed on the same professional issues.

This finding contrasts with the study by Mohammad, Atef, and Taha (2016), which found statistically significant gender differences favoring male teachers. However, it aligns with the results of Nashwan Mahmoud Al-Saffar (2009) and Qandil et al. (2006), who found no significant gender differences in professional challenges among teachers.

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Conclusions

Based on the results, discussions, and methodology used, the researchers concluded the following:

1. Both male and female physical education teachers acknowledged the professional challenges affecting their ability to conduct lessons effectively.
2. Research participants demonstrated an awareness of these issues, with varying degrees of concern.
3. Teachers perceived curriculum-related challenges as more significant than other professional issues.
4. High agreement among physical education teachers regarding the importance of these challenges.
5. The issue of assigning other subjects to physical education teachers affects males and females equally.

Recommendations

In light of these conclusions, the researchers suggest the following actions:

1. The Ministry of Education should prohibit assigning non-specialized subjects to physical education teachers.
2. Educational programs and training courses should be developed to increase school administrators' awareness of the importance of physical education.
3. Educational leadership should enhance the effectiveness of physical education classes through:
   a. Providing educational supervisors with updated research to improve sports education.
   b. Reducing administrative burdens on physical education teachers to help them focus on their primary role.

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The most important quantitative determinants affecting the transfer market of professional football players in Iraq

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Abstract

The research aimed to streamline the process for sports clubs in identifying and contracting professional players, focusing on the key quantitative determinants in the players' transfer market to assess their technical and commercial value. Additionally, it sought to achieve financial returns for the National Federation through the management of market access and the imposition of participation fees. The researchers employed a descriptive-analytical approach with correlational analysis to examine real-world data and identify relationships among variables, addressing the research objectives and questions. The study population comprised employees of the Iraqi Football Association involved in managing the Iraqi Stars League for the 2024-2025 season. The initial measure of quantitative determinants included 61 items, which was refined to 42 after establishing its scientific foundations. Key findings highlighted the Iraqi Football Federation's interest in establishing a professional players' transfer market in Iraq and its intention to assist clubs in reducing the time and effort required for contracting players. Based on these results, the researchers recommended creating a "virtual sports market" for player transfers in Iraq, incorporating quantitative determinants overseen by the Technical, Competitions, and Legal Committees. Furthermore, the management of this market should be conducted by the LALIQA Association under the direct supervision of the Executive Office of the Iraqi Football Federation, ensuring effective organization, transparency, and enhanced operational efficiency.

Keywords: Players Exchange, Financial Fair Play, Financial Licensing and Club Sustainability.

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Introduction

Professional sports clubs actively compete to contract athletes, including players and coaches, to win local and international championships. Achieving success in this competitive environment requires sufficient financial resources and timely communication with professional athletes, either through registered agents affiliated with national and international federations or via the player transfer market. Consequently, the establishment of a comprehensive database of professional players, both local and international, is crucial for managing contracts, particularly for those previously active in the Iraqi Stars League, and for facilitating renewals or transfers abroad. Such a database enables clubs to efficiently manage contracts, determine players' technical and marketing value, and optimize the allocation of financial and human resources while mitigating risks associated with unlicensed agents and intermediaries.

The technical and market value of a player is influenced by multiple factors, including chronological age, training age, performance level, and their contributions to the team. Club management and market dynamics, particularly supply and demand, also affect player valuation, emphasizing the necessity for federations to maintain accurate and comprehensive records. The absence of such a database in Iraq, combined with the lack of clearly defined quantitative determinants in the transfer market, delays contracting processes and increases financial and contractual risks. Therefore, the research problem focused on addressing these deficiencies, with two research questions: (1) Is there a virtual market (exchange) for professional players in Iraq? and (2) What quantitative determinants are necessary to evaluate players' technical and marketing value effectively?

The study aimed to reduce the time and effort required for clubs to identify and contract players, define the most influential quantitative determinants in the transfer market, and achieve financial returns for the National Federation by establishing and managing market access. The researchers reviewed previous studies, designed a quantitative scale to assess determinants, and developed recommendations for the creation of a virtual transfer market supervised by the Iraqi Football Federation's Professionals Committee.

Margareta & Malinda (2022) provided empirical evidence that performance, age, transfer fees, and salary significantly influence football players' market value. Their study utilized data from 400 players across 40 European clubs, analyzed via multiple regression, confirming the positive impact of these factors on valuation. Similarly, Raffaele, Roger, & Loïc (2021) developed an econometric model revealing the primary determinants of transfer fees, emphasizing contract duration as a critical yet often overlooked factor explaining over 80% of fee variations. The study

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concluded that effective transfer negotiations involve multiple elements, including contractual terms, negotiations, legal considerations, financial planning, and communications between clubs and agents.

In the context of Iraq, the absence of a formalized database for professional players and clear quantitative indicators in the transfer market presents a significant barrier to efficient player management. Establishing a virtual market for player transfers, overseen by the Professionals Committee of the Iraqi Football Federation, would enable clubs to evaluate the technical and marketing value of players objectively, streamline contract negotiations, and ensure financial integrity. This market would include all professional players active in the Iraqi Stars League and those previously involved in domestic leagues, promoting mobility, transparency, and fairness in player transactions.

Methodology

The researchers used the descriptive analytical approach and correlational relationships, which is concerned with analyzing the realistic data obtained and finding correlations for the variables of the scale used to obtain the required results related to the research objectives and answering the two research questions. The research community was represented and appointed (employees in the management of the Iraqi Stars League for the sports season 2024-2025) by the Iraqi Football Association and as shown in Table (1).

Table (1) shows *the description of the research community and its sample*

"No."	Department Name	Nr_members	Reconnaissance	Construction Sample	Application Sample	Excluded
.1	Executive Office and Technical Committee	19	-	5	14	1
.2	Asian and International Lecturers	10	1	5	4	1
.3	the Competitions Committee	7	1	4	2	-
.4	Legal Commission	6	2	3	1	1
.5	The ACRSD	4	1	2	1	-
.6	GUIDEBOOK	3	-	1	2	-

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.7	International Players Committee	4	1	2	1	1
.8	LALIQAAssociation	7	-	4	3	-
.9	Media Committee	5	1	2	2	-
.10	Licensing Committee	3	-	1	2	1
.11	The disciplinary committee...	4	-	2	2	1
		72	Desorb (v.) (Chem.)	Desorb (v.) (Chem.)	Desorb (v.) (Chem.)	Desorb (v.) (Chem.)
					Application Sample Mug = (28)	

After completing the selection and description of the research community and its sample, the researchers used a set of means and tools in order to identify the most important metrics that contribute to obtaining and discussing the data and results related to the research topic. Therefore, the researchers conducted a field survey of many scientific libraries in Iraqi universities and Arab and international digital libraries to identify the most important metrics related to the research topic. The researchers did not find any of the scientific metrics related to the research objectives and to achieve a convincing answer to the proposed research questions. When drafting the phrases, the researchers took into account that the phrase should not be accepted more than one interpretation and have one meaning, that is, the phrases should be clear in meaning and understandable **(Eyad & Dawood, 2022)**. Therefore, the two researchers built (the scale of quantitative determinants of the transfer of professional football players in Iraq) and the researchers used a group of Arab and foreign sources to formulate phrases in line with the Iraqi environment of the Iraqi Stars League. The researchers followed the scientific steps to build scientific scales, including determining the idea and purpose of the scale, formulating appropriate and understandable phrases and presenting them to a group of experts in the field of (sports management, testing and measurement, working coaches with master's and doctoral degrees, working referees with master's and doctoral degrees), which numbered (**23**) experts. The researchers relied on the Likert scale triple (agreeing three degrees), (possible two degrees), (disagree one degree) and the researchers obtained the value of the apparent validity coefficient to know the validity of the scale phrases and as shown in Table (**2**).

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Table (2) *shows the validity of the statements of the scale (apparent validity)*

"No."	Approvers	Disagree	Chi square	Sig	Result	Statement number	Approvers	Disagree	Chi square	Sig	Result
1.	23	0	23	0.00	Acceptable	2.	21	2	15.69	0.00	Acceptable
3.	22	1	19.17	0.00	Acceptable	4.	21	2	15.69	0.00	Acceptable
5.	21	2	15.69	0.00	Acceptable	6.	20	3	12.56	0.00	Acceptable
7.	21	2	15.69	0.00	Acceptable	8.	19	4	9.78	0.00	Acceptable
9.	18	5	7.38	0.00	Acceptable	10.	15	8	2.13	0.14	Rejected
11.	22	1	19.17	0.00	Acceptable	12.	22	1	19.17	0.00	Acceptable
13.	21	2	15.69	0.00	Acceptable	14.	19	4	9.78	0.00	Acceptable
15.	18	5	7.38	0.00	Acceptable	16.	18	5	7.38	0.00	Acceptable
17.	18	5	7.38	0.00	Acceptable	18.	18	5	7.38	0.00	Acceptable
19.	18	5	7.38	0.00	Acceptable	20.	14	9	1.08	0.29	Rejected
21.	16	7	3.52	0.61	Rejected	22.	19	4	9.78	0.00	Acceptable
23.	17	6	5.26	0.02	Acceptable	24.	19	4	9.78	0.00	Acceptable
25.	19	4	9.78	0.00	Acceptable	26.	20	3	12.56	0.00	Acceptable
27.	20	3	12.56	0.00	Acceptable	28.	20	3	12.56	0.00	Acceptable
29.	22	1	19.17	0.00	Acceptable	30.	18	5	7.38	0.00	Acceptable
31.	19	4	9.78	0.00	Acceptable	32.	21	2	15.69	0.00	Acceptable
33.	20	3	12.56	0.00	Acceptable	34.	20	3	12.56	0.00	Acceptable
35.	21	2	15.69	0.00	Acceptable	36.	22	1	19.17	0.00	Acceptable
37.	20	3	12.56	0.00	Acceptable	38.	18	5	7.38	0.00	Acceptable
39.	21	2	15.69	0.00	Acceptable	40.	17	6	5.26	0.02	Acceptable
41.	17	6	5.26	0.02	Acceptable	42.	19	4	9.78	0.00	Acceptable

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43.	17	6	5.26	0.02	Acceptable	44.	20	3	12.56	0.00	Acceptable
45.	21	2	15.69	0.00	Acceptable	46.	23	0	23	0.00	Acceptable
47.	19	4	9.78	0.00	Acceptable	48.	21	2	15.69	0.00	Acceptable
49.	22	1	19.17	0.00	Acceptable	50.	22	1	19.17	0.00	Acceptable
51.	22	1	19.17	0.00	Acceptable	52.	18	5	7.38	0.00	Acceptable
53.	17	6	5.26	0.02	Acceptable	54.	19	4	9.78	0.00	Acceptable
55.	18	5	7.38	0.00	Acceptable	56.	20	3	12.56	0.00	Acceptable
57.	22	1	19.17	0.00	Acceptable	58.	20	3	12.56	0.00	Acceptable
59.	20	3	12.56	0.00	Acceptable	60.	20	3	12.56	0.00	Acceptable
61.	19	4	9.78	0.00	Acceptable	62.	20	3	12.56	0.00	Acceptable
63.	18	5	7.38	0.00	Acceptable	64.	22	1	19.17	0.00	Acceptable

After the researchers presented the scale to the building sample, the raw grades were divided in descending order from the highest grade to the lowest grade, and a percentage of (**29%**) was adopted, equal to (**9** members) of the building sample grades, which represent the lowest grades, and a percentage of (**29%**), equal to (**9** members) of the building sample grades, which represent the highest grades, thus the total number of the two end groups reached (**18**) members, and the results were extracted from the application of the equation (**t.test**) for independent samples and using the statistical bag (**spss**), and it was found that all the phrases were significant except for (**20** phrases) were non-significant and sequentially (**9, 10, 12, 14, 16, 18, 19, 20, 27, 33, 34, 35, 36, 38, 40, 42, 43, 45, 56, 57**). As shown in table (**3**).

Table (3) *shows the discriminating ability of the scale phrases*

"No."	Upper Group		Lower Group		Calculated t value	Sig
	You will	Pr	You will	Pr		
1.	3	0.00	1.44	0.88	5.29	0.00
2.	3	0.00	1.44	0.88	5.29	0.00
3.	3	0.00	1.44	0.88	5.29	0.00
4.	3	0.00	1.44	0.88	5.29	0.00
5.	3	0.00	1.44	0.88	5.29	0.00
6.	3	0.00	1.44	0.88	5.29	0.00
7.	3	0.00	1.44	0.88	5.29	0.00
8.	3	0.00	1.44	0.88	5.29	0.00
9.	11.2	0.92	2.44	0.88	0.78	0.44
10.	2.66	0.50	2.22	0.97	1.22	0.24

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11.	3	0.00	1.44	0.88	5.29	0.00
12.	11.2	0.92	2.44	0.88	0.78	0.44
13.	3	0.00	1.44	0.88	5.29	0.00
14.	2.66	0.50	2.22	0.97	1.22	0.24
15.	3	0.00	1.44	0.88	5.29	0.00
16.	11.2	0.92	2.44	0.88	0.78	0.44
17.	3	0.00	1.44	0.88	5.29	0.00
18.	2.66	0.50	2.22	0.97	1.22	0.24
19.	11.2	0.92	2.44	0.88	0.78	0.44
20.	2.66	0.50	2.22	0.97	1.22	0.24
21.	3	0.00	1.44	0.88	5.29	0.00
22.	3	0.00	1.44	0.88	5.29	0.00
23.	3	0.00	1.44	0.88	5.29	0.00
24.	3	0.00	1.55	0.88	4.91	0.00
25.	3	0.00	1.44	0.88	5.29	0.00
26.	3	0.00	1.44	0.88	5.29	0.00
27.	2.66	0.50	11.2	0.92	1.58	0.13
28.	3	0.00	1.44	0.88	5.29	0.00
29.	3	0.00	1.44	0.88	5.29	0.00
30.	3	0.00	1.44	0.88	5.29	0.00
31.	2.88	0.33	1.44	0.88	4.59	0.00
32.	3	0.00	1.44	0.88	5.29	0.00
33.	2.33	0.86	11.2	0.92	0.52	0.60
34.	2.66	0.50	2.22	0.97	1.22	0.24
35.	11.2	0.92	2.44	0.88	0.78	0.44
36.	2.33	0.86	11.2	0.92	0.52	0.60
37.	3	0.00	1.44	0.88	5.29	0.00
38.	2.66	0.50	2.22	0.97	1.22	0.24
39.	3	0.00	1.44	0.88	5.29	0.00
40.	2.33	0.86	11.2	0.92	0.52	0.60
41.	2.77	0.44	1.44	0.88	4.05	0.00
42.	2.66	0.50	2.44	0.88	0.65	0.52
43.	2.55	0.72	11.2	0.92	1.13	0.27
44.	3	0.00	1.44	0.88	5.29	0.00
45.	2.66	0.50	2.22	0.97	1.22	0.24
46.	2.88	0.33	1.66	1	3.47	0.00
47.	3	0.00	1.44	0.88	5.29	0.00
48.	3	0.00	1.44	0.88	5.29	0.00
49.	3	0.00	1.44	0.88	5.29	0.00
50.	3	0.00	1.44	0.88	5.29	0.00
51.	3	0.00	1.44	0.88	5.29	0.00
52.	3	0.00	1.44	0.88	5.29	0.00
53.	3	0.00	1.44	0.88	5.29	0.00
54.	3	0.00	1.55	0.88	4.91	0.00
55.	3	0.00	1.44	0.88	5.29	0.00
56.	2.33	0.86	2.22	0.83	0.27	0.78
57.	2.66	0.50	11.2	0.92	1.58	0.13

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58.	3	0.00	1.44	0.88	5.29	0.00
59.	3	0.00	1.44	0.88	5.29	0.00
60.	3	0.00	1.44	0.88	5.29	0.00
61.	2.88	0.33	1.88	1.05	2.71	0.01

Results

Table (4) shows *the internal consistency of the statement correlation with the total score of the scale*

"No."	Correlation coefficient (Maths.)	Sig
1.	0.99	0.00
2.	0.98	0.00
3.	0.99	0.00
4.	0.98	0.00
5.	0.98	0.00
6.	0.96	0.00
7.	0.99	0.00
8.	0.99	0.00
9.	0.92	0.00
10.	0.96	0.00
11.	0.95	0.00
12.	0.97	0.00
13.	0.99	0.00
14.	0.94	0.00
15.	0.98	0.00
16.	0.97	0.00
17.	0.99	0.00
18.	0.99	0.00
19.	0.99	0.00
20.	0.99	0.00
21.	0.93	0.00
22.	0.98	0.00
23.	0.99	0.00
24.	0.99	0.00
25.	0.99	0.00
26.	0.95	0.00
27.	0.99	0.00
28.	0.93	0.00
29.	0.98	0.00
30.	0.98	0.00
31.	0.98	0.00
32.	0.99	0.00
33.	0.98	0.00
34.	0.94	0.00
35.	0.99	0.00
36.	0.97	0.00
37.	0.97	0.00
38.	0.99	0.00

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39.	0.99	0.00
40.	0.93	0.00
41.	0.73	0.00

Table (5) *Statistical analysis of the application sample for the scale of quantitative determinants market for the transfer of professional football players*

You will	Hypothetical	Pr	median	Modulus of torsion = torsion modulus (Mech.)	The high point.	Lowest Score
109.82	82	3.59	110	.205	116	101

Table (6) *Frequencies, percentage, weighted arithmetic mean, standard deviation and relative weight of scale statements*

"No."	Significant								
	(Duplicates) & (%)	Agree	possible	Disagree	Weighted	Pr	Relative weight	Likert Response Mug	Phrase Level
1.	recurrences.	24	4	-	2.85	0.35	0.95	Agree	High
	%	85.7	14.3	-					
2.	recurrences.	25	3	-	2.89	0.31	0.96	Agree	High
	%	89.3	10.7	-					
3.	recurrences.	23	4	1	2.78	0.49	0.92	Agree	High
	%	82.1	14.3	3.6					
4.	recurrences.	25	3	-	2.89	0.31	0.96	Agree	High
	%	89.3	10.7	-					
5.	recurrences.	20	7	1	2.67	0.54	0.89	Agree	High
	%	71.4	25	3.6					
6.	recurrences.	8	17	3	2.17	0.61	0.72	possible	Medium
	%	28.6	60.7	10.7					
7.	recurrences.	7	18	3	2.14	0.59	0.71	possible	Medium
	%	25	64.3	10.7					
8.	recurrences.	21	7	-	2.75	0.44	0.91	Agree	high
	%	75	25	-					
9.	recurrences.	17	7	4	2.46	0.74	0.82	Agree	high

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	%	60.7	25	14.3					
10.	recurrences.	24	3	1	2.82	0.47	0.94	Agree	high
	%	85.7	10.7	3.6					
11.	recurrences.	25	2	1	2.85	0.44	0.95	Agree	high
	%	89.3	7.1	3.6					
12.	recurrences.	27	1	-	2.96	0.18	0.89	Agree	high
	%	96.4	3.6	-					
13.	recurrences.	10	16	2	2.28	0.59	0.76	possible	Medium
	%	35.7	57.1	7.1					
14.	recurrences.	8	16	4	2.14	0.65	0.71	possible	Medium
	%	28.6	57.1	14.3					
15.	recurrences.	20	6	2	2.64	0.62	0.88	Agree	high
	%	71.4	21.4	7.1					
16.	recurrences.	23	3	2	2.75	0.58	0.91	Agree	high
	%	82.1	10.7	7.1					
17.	recurrences.	11	13	4	2.25	0.70	0.75	possible	Medium
	%	39.3	46.4	14.3					
18.	recurrences.	28	-	-	3	0.00	100	Agree	high
	%	100	-	-					
19.	recurrences.	17	7	4	2.46	0.74	0.82	Agree	high
	%	60.7	25	14.3					
20.	recurrences.	28	-	-	3	0.00	100	Agree	high
	%	100	-	-					
21.	recurrences.	28	-	-	3	0.00	100	Agree	high
	%	100	-	-					
22.	recurrences.	24	4	-	2.85	0.35	0.95	Agree	high
	%	85.7	14.3	-					
23.	recurrences.	22	5	1	2.75	0.51	0.91	Agree	high
	%	78.6	17.9	3.6					
24.	recurrences.	11	12	5	2.21	0.73	0.73	possible	Medium
	%	39.3	42.9	17.9					
25.	recurrences.	23	5	-	2.82	0.39	0.94	Agree	high
	%	82.1	17.9	-					
26.	recurrences.	28	-	-	3	0.00	100	Agree	high
	%	100	-	-					
27.	recurrences.	19	9	-	2.67	0.47	0.89	Agree	high
	%	67.9	32.1	-					

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28.	recurrences.	24	3	1	2.82	0.47	0.94	Agree	high
	%	85.7	10.7	3.6					
29.	recurrences.	18	4	6	2.42	0.83	0.80	Agree	high
	%	64.3	14.3	21.4					
30.	recurrences.	22	6	-	2.78	0.41	0.92	Agree	high
	%	78.6	21.4	-					
31.	recurrences.	14	10	4	2.35	0.73	0.78	Agree	high
	%	50	35.7	14.3					
32.	recurrences.	21	4	3	2.64	0.67	0.88	Agree	high
	%	75	14.3	10.7					
33.	recurrences.	20	5	3	2.60	0.68	0.86	Agree	high
	%	71.4	17.9	10.7					
34.	recurrences.	28	-	-	3	0.00	100	Agree	high
	%	100	-	-					
35.	recurrences.	28	-	-	3	0.00	100	Agree	high
	%	100	-	-					
36.	recurrences.	28	-	-	3	0.00	100	Agree	high
	%	100	-	-					
37.	recurrences.	28	-	-	3	0.00	100	Agree	high
	%	100	-	-					
38.	recurrences.	19	7	2	2.60	0.62	0.86	Agree	high
	%	67.9	25	7.1					
39.	recurrences.	19	5	4	2.53	0.74	0.84	Agree	high
	%	67.9	17.9	14.3					
40.	recurrences.	18	7	3	2.53	0.69	0.84	Agree	high
	%	64.3	25	10.7					
41.	recurrences.	14	10	4	2.35	0.73	0.78	Agree	high
	%	50	35.7	14.3					
Measure of quantitative determinants of transfers of professional football players in Iraq					2.67	0.27	0.89	Agree	high

Discussion

Tables (5) and (6) indicate full acceptance of the scale, with an average weighted mean of 2.67, suggesting a high level for all scale phrases. Therefore, the committee supervising the virtual player transfer market can include all quantitative determinants. Biological and training age are critical factors affecting a player's market value, as early maturity and coaching age influence

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performance and attractiveness in the transfer market (James Parr, 2020; Jamie et al., 2022; Kevin et al., 2017).

Including current and historical marketing values allows club managers to track fluctuations, identify reasons for changes, and make informed contracting decisions. Overall performance in competitions provides objective assessments for transfer decisions, supporting clubs in forming competitive teams within budgetary constraints (Giovanni & Hvattum, 2021; Kaukab, 2022). Offensive capabilities, minutes played, goals, and contributions to team success enhance market value and inform contracting decisions (Yalçınkaya & Murat, 2024; Prayoga et al., 2023).

Player versatility, such as transitions between defense and attack, speed, endurance, and tactical compliance, as well as set-piece proficiency, significantly impacts market value. Tactical behavior in various phases of play (attack, defense, transitions) informs strengths and areas for improvement, which are critical for transfer decisions (Leander et al., 2023). Scoring efficiency, defensive contributions, and technical performance metrics, tracked via analysis programs, provide quantitative and qualitative indicators for the transfer market (Carlos, 2020).

Visual scanning, aerial duels, dribbling success, and participation indices reflect players' sensory perception, tactical awareness, and physical and technical abilities. Players' nationality, team quality, FIFA ranking, and participation in critical matches inform market evaluation (Anton et al., 2017; C. d. et al., 2022). Offensive contributions, such as goal opportunities and decisive passes, influence the transfer market and assist clubs in evaluating player performance and tactical effectiveness (Bransen et al., 2019).

Errors, penalties, and psychological stability are also considered, as repeated mistakes affect contract decisions. Proper psychological management can mitigate negative impacts, making emotional and mental indicators crucial alongside technical, tactical, and physical metrics in evaluating players for transfer (G. J. et al., 2007).

Conclusions

The Iraqi Football Association demonstrates a strong interest in establishing a market for the transfer of professional players within Iraq, aiming to assist sports clubs in reducing the time and effort required to secure appropriate contracts with these players. The high quality of the quantitative determinants developed by the researchers supports their adoption within the Iraqi professional players' transfer market. Furthermore, effective management of this market by the Iraqi Football Federation enhances its budgetary resources through the imposition of participation and access fees in the digital virtual platform for player contracting.

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Recommendations

The establishment of a virtual sports market for player transfers in Iraq, incorporating quantitative determinants provided by the Technical, Competitions, and Legal Committees, is proposed by the researchers. Management of this transfer market should be overseen by LALIQA under the direct supervision of the Executive Office of the Iraqi Football Association. Participation fees would be imposed on sports clubs through dedicated electronic accounts for the Sports Contracting Committee, enabling clubs to recruit or sell players. Additionally, professional player agents wishing to register and offer services in the transfer market would be charged fees, as would individuals interested solely in browsing within the professional player transfer market.

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Impact of an Assistive Device on Arm Movement Coordination in Freestyle Swimming Among Female Physical Education Students at Baghdad University

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Abstract

The arm plays a crucial role in the freestyle swimming stroke, especially during the propulsion phase, contributing significantly to efficient movement and limb coordination. However, many learners, particularly female students at the College of Physical Education and Sport Science at Baghdad University, face difficulties mastering this skill. Traditional training methods lack immediate feedback on arm force balance and quality, limiting opportunities for simultaneous motor learning and technical improvement. To address this, a new swimming aid was developed to quantitatively measure palm pressure during swimming movements. The device includes sensors on both hands, a data processing unit, and a real-time force coordination display that provides instant biomechanical feedback. A three-month pilot study was conducted where an experimental group trained with the device, while a control group followed conventional exercises. The study aimed to evaluate the device's effectiveness in enhancing motor coordination and propulsion force balance. Results showed a statistically significant improvement, with the experimental group's average freestyle distance increasing from 14.125 to 20.687 meters, whereas the control group showed minimal change. The t-test confirmed the significance of these differences at $p < 0.05$. These findings highlight the added value of biomechanical feedback in physical education for improving motor skill performance and learning. The study provides strong evidence that this assistive device can effectively enhance swimming training techniques.

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Keywords: Biomechanical Feedback, Motor Coordination, Swimming Performance, Sensor-Based Training, Hand Propulsion Dynamics.

Introduction

These days, tools and devices have a significant part in enabling us to learn new skills. They can accelerate the acquisition of skills and offer a flexible and integrated learning environment by providing individuals with diverse technology resources (computers, and smartphones, and educational software) (Sripavithra et al., 2022). These are assisting to bring educational content in interactive and fun way that motivates the learners and promotes learning new concept and applying them better (Ahnaf Istiqlal Berutu et al., 2024).

Apart from this, the smart devices provide visualized lessons and simulated tools, the learner can learn practical and some advanced skills effectively (Prasad & Paras, 2024). Moreover, the technology enables to tailor and adjust the process of learning towards the personal needs of the learner, which increases the probability of success and the deepness and speed of mastery of skills (Amer et al., 2024; Putra et al., 2024).

Assistive devices and tools are employed in the cultivation and instruction of fundamental skills within the educational framework. Their efficacy and significance have been substantiated, particularly in enhancing the performance of athletes in physical, motor, and skill-related domains. These tools facilitate the development of sensory capabilities and motor perception, while also generating enthusiasm in learners as they engage with the equipment or navigate their environment, ultimately showcasing their competencies (BULZ et al., 2024).

Swimming is one of the oldest and most important sports activities practiced by humans, as it is considered a comprehensive sport that combines physical fitness and physical and mental endurance (Lian & Atiyah, 2024; Lin, 2024). It is also an effective way to improve overall health and stamina, as it contributes to strengthening all the muscles of the body and increasing joint flexibility (Adnan et al., 2024; Moffatt, 2017).

Arm movement is an essential element of swimming, as it plays an important role in propelling the body forward and increasing speed and efficiency. The stronger and more precise the arm movement, the more efficient the swimmer will be, allowing the learner to maintain balance in the water and increase their speed. Swimming speed depends on a periodic accelerated movement and the net balance between pushing and pulling forces and arm movement also enhances body coordination and helps reduce the resistance faced by the learner while moving through the water, improving overall swimming performance (McLeod, 2009).

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Biomechanics, with its different kinematic and kinetic rules, has contributed to giving a distinct amount and type of reliable information that ultimately serves motor learning and other sciences, and this is done through mechanical analysis in its two qualitative ways, which depends on personal experience and observation, and quantitative, which is the most accurate, which looks into the details of the motor performance in terms of description and external form of movement as well as the causative and productive forces and thus obtaining accurate digital values, and this requires us to design and manufacture advanced technical devices and tools according to specialized scientific visions according to the type of effectiveness and performance requirements (Abdulkareem et al., 2024; Winter, 2009).

Since the arms movement is more difficult to learn because it contains three main movements (pulling, pushing and covering) and that many learners have errors in the performance of these movements, especially the water pushing movement, some learners do not perform the pushing movement correctly, that is, the push may be only with the palm without the participation of the forearm, which is achieved by the angle of the elbow joint 90 degrees(Gomes et al., 2014), This achieves a larger area to push the water or the palm is tilted so that the learner does not perform the correct push movement (Barnamehei et al., 2022), which raised the researcher's interest in this aspect due to its importance in learning freestyle swimming because without pushing there is no forward movement until a very small percentage (as contained in Newton's third law, every action has an equal and opposite reaction in the direction).

Since the main means of transportation of the swimmer in the aquatic environment represents the arms greatly and most of the female learners do not perform the movement of the arms on the correct path as explained by this research for female freestyle learners, especially for the movement of the arms (pushing force for each arm) what is the amount of that force they exert for both arms and to minimize the difference between the two forces and make them closer to the ideal to reach the best possible technical performance for all learners who will compare the skill variables, and evaluate performance before and after applying educational exercises by using the device by the researcher in learning freestyle swimming for female students (Maqableh et al., 2023).

The aim of the research is to design a device to measure the pressure force on the palm of the hand during freestyle swimming for female students of the Faculty of Physical Education and Sports Sciences and to identify the effect of the device on the balance of the pushing force of the movement of the arms of female students and to compare the performance of female students after using the device with the control sample to measure the usefulness of the device in achieving the Motor Coordination of the arms

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The primary hypotheses of the research assert that there are no statistically significant differences between the pre-test and post-test results of the experimental and control groups regarding the attainment of motor balance in the arms during freestyle swimming among female students, and that there are no statistically significant differences in the post-test results of the experimental and control groups concerning the achievement of motor coordination in the arms during freestyle swimming for female students.

Methodology

Research Design

This study employed an experimental design including both an experimental group and a control group. The experimental group underwent a training program utilizing the designed assistive device, whereas the control group did not receive any intervention. Performance comparisons between the two groups were conducted exclusively through post-test measurements to evaluate the effect of the assistive device on enhancing arm motor balance during freestyle swimming among female students.

Research participants

The research population represents the female students of Baghdad University, Faculty of Physical Education and Sport Sciences, Jadiriya, second stage for the academic year 2024-2025.

Research sample

The study sample of (32) female students was randomly selected according to the availability of information to ensure that all target groups in terms of age and skill level are available.

The sample was divided into: Experimental group: (n=16) Students who receive the intervention using the palm pressure force measurement and the control group: (n=16) those who follow the traditional method of learning arm movement without using the device.

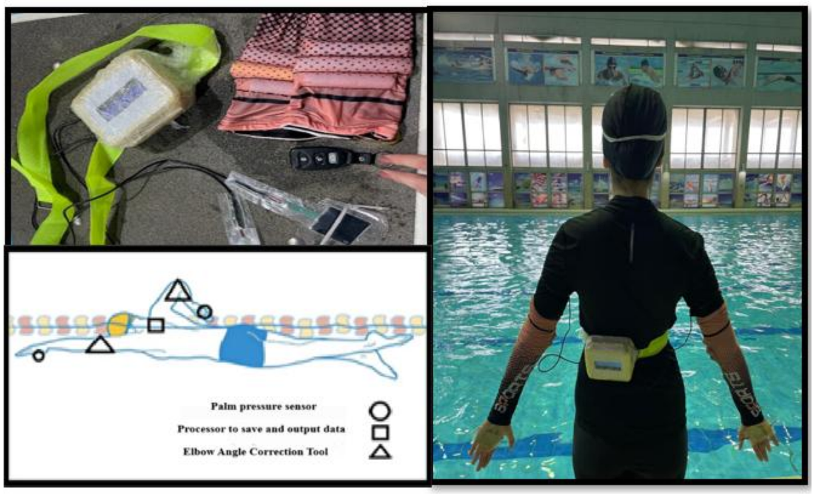
Components of the device

1. Two sensors are installed on the palms of the arms that read the force of the pressure applied to the learner's palm.

2. A processor to calculate the sensor reading simultaneously with each arm stroke and compare the force between the two arms.

3. A tool to determine and correct the angle of the elbows while pushing the arms.

A screen to show the results of the sensor reading that will give the average pressure force applied to each arm, the highest reading of the pressure rate and the difference between the right



and left arm (force symmetry = weak arm/strong arm)

Figure 1. *Shows the shape and location of the device on the learner's body*

Procedure

Thursday, 10/17/2024 was the first day of the researcher's exploratory experiment inside a small basin. The purpose of the experiment was to test the sensor's efficiency for the pressure force inside the water, determine the success of isolating the water from the sensor, and determine the extent to which the method he adopted in isolation was effective. In addition, the pushing process yielded accurate and legible readings, which were double-checked and compared to the company's recommendations. The medical palm, which was supposed to hold the sensor, was dispensed with, and the water isolator's plastic casing was adopted.

On Wednesday, June 11, 2024, in the swimming pool of the Faculty of Physical Education and Sports Sciences, the researcher ran a second exploratory experiment with a group of female students (three of whom were not part of the research sample) to determine the average number of strokes per arm over a 25-meter distance. The results showed that the average number of strokes per arm ranged from eight to fourteen. For the purpose of learning, the gadget was designed to measure the pressure force delivered to each arm (the palm sensor) using ten strokes. The student may then compare the findings from their right and left arms, to determine any differences "as described in Table 1".

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Table 1. *Show Stroke count in freestyle with the distance of the second exploratory experiment*

No.	Stroke count in freestyle	Distance
1	10	20M
2	5	7M
3	14	25M

The test was performed for the experimental and control samples and the test was to swim freestyle for the farthest distance (Yang et al., 2025).

Purpose of the test: To measure the distance traveled by the tester when performing freestyle swimming. Instruments: Swimming pool, tape measure, stopwatch. **Test description**: The tester stands inside the pool with their back facing the edge of the pool, one leg straight with the foot on the ground while the other leg is bent backwards from the knee joint with the foot resting on the edge of the pool and performs freestyle swimming for as far as possible. **Scoring the test**: The test is recorded by calculating the distance traveled from the edge of the pelvis to the tester's feet.

The researcher developed an educational curriculum for 3 months with 24 educational units and an average of 8 units per month and 2 educational units per week (Sunday, Wednesday). The researcher's educational curriculum is only the main part of the educational unit for students whose time ranges between 25 and 30 minutes, and the transition of exercises from easy to difficult emphasizes performance with consistency and calm in order to adjust the correct paths of movements and ensure the repetition and use of feedback by the researcher with the help of readings extracted from the designed device that shows the difference in pressure force for both arms.

The pre-tests were conducted for the research sample, which numbered 32 learners, divided into two groups, experimental (16 female students) and control (16 female students), on (Wednesday) 11/12/2024, at the Faculty of Physical Education and Sport Sciences.

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The researcher conducted the post-tests and performance evaluation on Wednesday, 12/3/2025, after completing the application of the educational curriculum under the same conditions as the pre-tests on the female learners of the sample and on the swimming pool of the college of Physical Education and Sports Sciences at university of baghdad/Jadiriya.

Data Analysis

The researcher utilized SPSS version 26 to analyze the data. Descriptive statistics, including arithmetic means, standard deviations, and skewness coefficients, were used to characterize the sample. An independent samples T-test was conducted to verify the homogeneity between the experimental and control groups before the intervention. Furthermore, the T-test was applied to compare the post-test results between the two groups. The significance level was set at 0.05.

Results

The normal distribution of the sample was performed to ensure the homogeneity of the sample in terms of the variables of height, weight and age, and the results showed that the sample is normally distributed when looking at the skewness from within (±1) "as described in Table 2".

Table 2. *shows the normal distribution of the sample*

Variable	Means	Std. Deviation	Skewness
Age	20.468	1.343668	0.241096
Weight	57.68	7.257643	0.187054
Length	160.562	6.174545	0.291735

Equivalence and homogeneity tests were conducted for the experimental and control research samples in the variables to start with a similar starting position and the results showed non-significant and greater than (0.05) indicating the sample is equivalent "as described in Table 3"

Table 3. *shows the equivalence between the experimental and control groups in the research variables*

Variable	Experimental group		Control group		F	Sig.	T	Sig. (2-tailed)	Mean Difference	Std. Error Difference
	Means	**SD**	**Means**	**SD**	0.570	0.456	0.103	0.918	0.062	0.606

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freestyle for the farthest distance	14.125	1.707	14.187	1.721

* at a significance level of 0.05 with a degree of freedom of 30

The results of the posttest between the experimental and control groups, which showed statistically significant differences for the experimental group "as described in Table 4"

Table 4. *shows the results of the post-tests for the experimental and control groups*

Variable	Experimental group		Control group		F value	Sig.	T value	Sig. (2-tailed)	Mean Difference	Std. Error Difference
freestyle for the farthest distance	**Means**	**SD**	**Means**	**SD**	11.811	0.002	7.764	0.000	6.125	0.788
	20.687	2.821	14.562	1.412						

* at a significance level of 0.05 with a degree of freedom of 30

Discussion

The study's results demonstrated the efficacy of the device intended to measure palm pressure force during freestyle swimming in enhancing the motor performance of female students' arms, as the statistical data revealed significant differences favouring the experimental group in the farthest distance swimming test. The findings are reflected in the significant enhancement observed in the mean distance travelled, indicating that the device facilitated improved motor coordination and an equitable distribution of force between the arms, enabling students to navigate successfully and precisely in water.

The improvement benefits from the reasonable design of the device, which will returned the prompt feedback of the pressing exertion of the two arms for the users, so the users can feel and regulate the strength difference between the both arms during self-training. In particular, prompt feedback with respect to error correction may also be an important factor for improvement of near-term and better performance for the early learning process Some studies have reported that prompt feedback with respect to error correction may be a key factor to facilitate fast learning and good performance in the skills-learning task (Magill & Anderson, 2012; Schmidt & Lee, 2019; Zaher Yahya et al., 2024).

Furthermore, the hands-on use of the device in a natural teaching setting allowed students to connect the biomechanical analysis of performance to the learning process, to heightened kinesthetic sensitivity and to finer details of the arm motion. Significance of modern technology along with kinetic analysis for enhancing performance in game and sports which needs muscle coordination with high preciseness (Prasad & Paras, 2024).

The findings are compatible with the kinetic theory of force, and propulsion in swimming because of the increased palm pressure contributing to attain more effective water push and this translated in enhanced speed and kinetic efficacy (Koga et al., 2022). This finding is notable because arm motion is the largest contributor to movement through water with freestyle swimming, and correcting the kinematics of this movement produces noticeable differences in overall performance (Abdulkareem et al., 2017; Cohen et al., 2015; ITO, 2007).

Based on the aforementioned, we can highlight that the use of smart technologies, in particular smart devices for sensing analysis and motor analysis, is a favorable initiative to enhance fine motor skills and the professional learning environment in the sport context. These findings suggest the potential for the extension of the use of the device to other populations or to other similar water sports, as well as the development of further kinematic indicators like the propulsion angle or the movement time (Abdulkareem et al., 2025).

Conclusions

The results of this study underscore the practical importance of employing assistive technology in sports education, particularly in teaching and enhancing fine motor skills such as hand grip strength during freestyle swimming. The designed device demonstrated high precision in recording the exerted force during performance, which enabled the participants to identify weaknesses in their movement and work on correcting them through immediate feedback provided by the device.

The use of this device contributed significantly to the improvement of motor coordination between the arms among the participants, reflecting the effectiveness of technological intervention in enhancing the quality of motor learning. The progress achieved by the experimental group compared to the control group indicates that custom-designed devices for evaluating and monitoring detailed motor performance can play a vital role in both teaching and training settings.

These results confirm the validity of integrating biomechanical information with an applied educational design and advocate a further development of novel technological tools in the area of PE. Its application is particularly useful in novice learners, when is required a clear feedback to adequately assess the task.

Therefore, this research not only helps to develop the students' mobility skills, but also accepts teaching different ball games skills with similar devices. It also demonstrates the possibility of using local educational tools made in-house as cheap, efficient alternatives to expensive imported tools, thereby encouraging independence and inventiveness in learning institutions.

Recommendations

1. Adopting the device in educational curricula for swimming to help learners gain a better understanding of proper arm mechanics and improve pushing force symmetry.
2. Expanding the use of biomechanical measurement tools in other swimming styles and across different age groups to evaluate their effectiveness in diverse learning contexts.
3. Encouraging collaboration between sports technologists and educators to further develop assistive devices that support motor learning and technique correction.
4. Conducting follow-up studies with larger and more varied samples to validate the current findings and explore long-term performance improvements.

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The Effect of a Rehabilitation Program on Improving Knee Joint Range of Motion in Injured Basketball Players

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Abstract

The research aimed to evaluate the physical condition of the Al-Talaba Club players in (16) matches in the Iraqi Premier League for football using the (PLAYERTEKTEAM) device, which works with global positioning technology, and to find out if there is an increase or decrease in the physical condition, or the physical performance of the players in the matches. High level, medium level, or lower, at the beginning of the second stage, and at the end of the league, The researcher concluded that there are significant differences in the variables of distance, speed distance, power plays , number of acceleration, deceleration and player load in high-level matches compared to low- or medium-level matches and in favor of high-level matches. There is a decrease in The physical performance of the variables that were measured as a result of the effect of the hot weather in Iraq on the players, especially in the matches of the seventh month, and the occurrence of a decrease in physical performance in the last match of the league for the variables of the number of acceleration and maximum deceleration, and that the tactical aspect of the team affects the results of the physical variables that were measured.

Keywords: Distance, Acceleration, Deceleration, Power plays, Player load, PLAYERTEKTEAM.

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Introduction

With the rapid advancements in information technology and its wide-ranging applications in various aspects of life, it has become essential to employ such technologies in football, given its status as the most popular sport worldwide. The integration of information technology has had a significant impact on the development of the game, both in terms of match management and training units. For instance, it has been utilized to assist referees in making accurate decisions during matches, as exemplified by the Video Assistant Referee (VAR) system, which has brought about a substantial improvement in fairness and accuracy within the sport (Al-Mousawi & Al-Zubaidi, 2020).

Since football relies heavily on players' physical and performance-related capacities, the need for advanced technologies to measure and analyze physical variables has become increasingly evident. Such analyses allow for the assessment of players' physiological and physical status, which, in turn, forms the basis for tailoring training programs to achieve optimal performance improvements, thereby enhancing the chances of winning. In this context, the present study analyzed physical performance data of Al-Talaba Club players in the Iraqi Premier League, focusing on eleven variables measured using Global Positioning System (GPS) technology through the PLAYERTEKTEAM device.

This device enables coaches to assess the distances covered during position-switching drills, which are crucial for developing speed-strength abilities and improving shooting accuracy (Sada & Aboud, 2023). Furthermore, it allows for the measurement of player acceleration rates (Ibrahim, 2021) and contributes to the evaluation of speed endurance by quantifying the distances covered at various velocities (Mhana & Khalaf, 2023). Additionally, it provides the ability to monitor players' physical load during both training sessions and competitive matches, where increased training load is directly associated with higher energy expenditure (Abdulqader & Yousif, 2020).

Accordingly, the application of such technologies plays a pivotal role in regulating training units, enhancing players' physical and technical capacities, and ultimately improving overall performance levels.

Methodology

The research methodology represents a fundamental component of scientific inquiry, as it enables the selection of the most appropriate approach to achieve the study's objectives. In this study, the researchers employed the survey method due to its capacity to analyze relationships

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among different variables and to provide deeper explanations of the phenomenon under investigation. The research sample was intentionally selected and consisted of Al-Talaba Football Club players who participated in sixteen matches during the second stage of the 2022/2023 Iraqi Premier League season. This sample was chosen because of the availability of appropriate technological devices to address the research problem, in addition to the substantial cooperation provided by the club's management. A pilot experiment was conducted on April 7, 2023, at 5:00 p.m. at the University of Baghdad stadium with ten players from the same club to regulate the procedures related to the use of the PLAYERTEKTEAM device. The pilot study aimed to test the functionality, suitability, and validity of the device for the players, to ensure the supporting team's competence in operating it, to address potential challenges in data collection, to test the suitability of the garment used for carrying the device, to determine the time required for satellite connection, to confirm proper linking of the devices to the hub and data synchronization with the computer, to ensure accurate extraction and interpretation of physical performance variables, and to practice segmenting match durations (first and second halves) by excluding time not included in actual play.

Figure 1. *The hub unit for the devices*

Measurements were taken from sixteen matches of Al-Talaba Football Club in the Iraqi Premier League during the second stage of the 2022/2023 season. The main experiment was conducted in licensed football stadiums between April 9, 2023, and July 21, 2023. The procedures were divided into three stages. In the first stage, the researchers and their assistants attended each match at least one hour before kickoff to ensure proper preparation. Players were instructed to wear the tight-fitting performance shirts designed to hold the device, which was activated and placed in the back pocket of the shirt prior to the warm-up, allowing sufficient time for satellite signal acquisition. The exact timing of the first and second halves was recorded, and after the match the devices were removed, switched off, and labeled with the players' names to prevent mix-ups during synchronization. In the second stage, two applications were installed on the computer: one for synchronizing data between the devices and the computer, and another for extracting and displaying the data. A dedicated account was created for each player containing the relevant information. Devices were connected to the hub and synchronized with the computer using a special cable, after which the recorded data were uploaded into the players' accounts. The data were then processed by labeling each match, segmenting the first and second halves, and excluding the warm-up, half-time interval, and post-match periods to ensure that only match-related data were retained. The extracted variables were stored within each player's account, tagged with the match time, date, and location. Following this, the devices were cleared, recharged, and prepared for subsequent use. The third stage involved creating specific data tables for the studied variables of each match, resulting in sixteen tables—one per match—through which the physical condition of Al-Talaba players was systematically analyzed throughout the Iraqi Premier League season.

The PLAYERTEKTEAM device (Catapult Sports, 2022) is an American-made system designed to measure a variety of physical performance variables in athletes. Its use, however, requires open-field settings rather than indoor venues, as the device operates through the Global Positioning System (GPS). The system consists of a small sensor unit equipped with multiple accelerometers and detectors, a dedicated charger for each device, a cable for data transfer to the computer, and a tight-fitting vest (short jersey) in which the sensor is inserted at the back. The device functions through two specialized applications, available free of charge from the App Store for Apple Mac computers, or via a web browser (e.g., Google Chrome) on Windows systems. Following training sessions or matches, the device is connected to the computer via cable, and the data are synchronized. Coaches create secure accounts (username and password) in agreement with the manufacturer to protect data integrity. Each player's profile includes precise personal information—such as full name, date of birth, nationality, gender, body weight, minimum and maximum heart rate, type of sport, and a profile picture—which are essential for the device's internal calculations (Figure 2).

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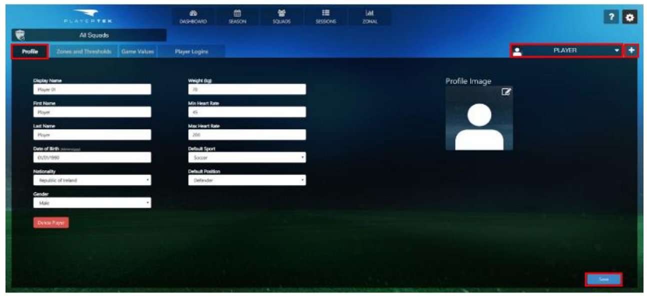

Figure 2. *Required personal information*

The PLAYERTEKTEAM system measures several key performance variables: Distance, representing the total distance covered by the player, expressed in meters, kilometers, miles, or yards, which provides a global indicator of exercise volume. Sprint Distance, defined as the total distance covered at speeds above 18 km/h, corresponding to speed zones 4 and 5. Power Plays, referring to instances of maximal power output (>20 W/kg for more than one second), including sprints, accelerations, or rotational movements. Acceleration, quantifying the number of times a player surpasses a defined acceleration threshold for at least one second. Deceleration, representing the number of times a player reduces velocity beyond a specific threshold for at least one second, reflecting the ability to transition from high-speed running to lower speeds or complete stops. Impacts, defined as collisions exceeding 5G (49 m/s²), detected across three axes while excluding normal steps or running motions (Figure 3). Sprints, measuring the frequency of high-speed runs sustained for at least two seconds within zone 4. Player Load, calculated as the composite of accelerations across three axes (forward, lateral, and vertical) using an internal algorithm, reflecting overall physical effort. Top Speed, denoting the highest running speed achieved and maintained for at least 0.5 seconds, often exceeding 8.5 m/s (30.6 km/h) for elite players. Max Deceleration and Max Acceleration, indicating the greatest reductions or increases in speed, respectively, sustained for at least one second, both expressed in meters per second squared (m/s²).

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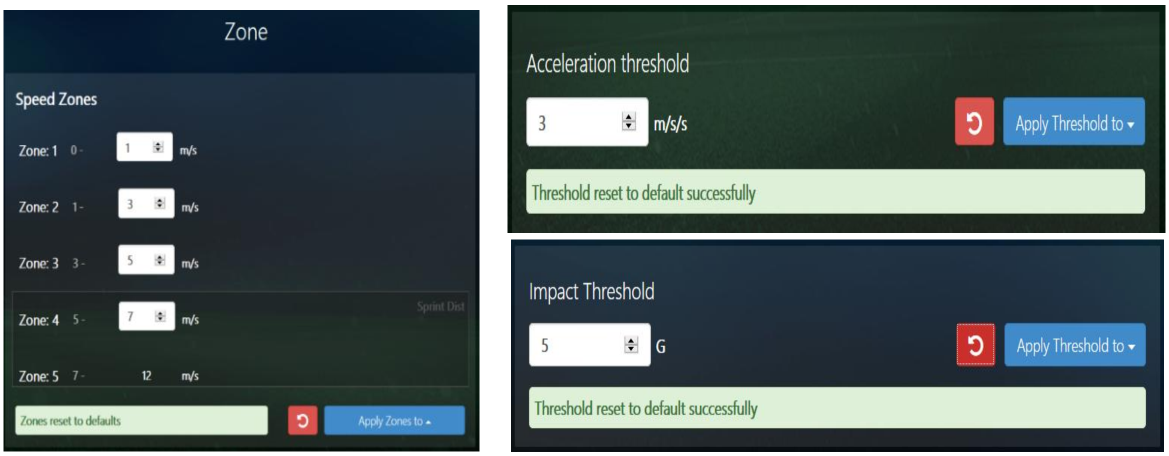

Figure 3. *Speed zones, acceleration threshold, and impact threshold in the PLAYERTEKTEAM system*

Results

Table 2. *Means, Standard Deviations, and One-Way ANOVA for Four Teams in April*

Variable	Team	N	Mean (M)	SD	Between/Within Groups	Sum of Squares	Mean Square	F	Sig
1- Distance (km)	Naft Maysan	9	8.420	1.429	Between	5.60	1.87	0.662	0.582
	Hudood	9	9.403	1.672					
	Duhok	9	9.307	1.777	Within	87.45	2.82		
	Al-Shorta	8	8.819	1.832	Total	93.05			
	Total	35	8.992	1.654					
2- Sprint Distance (m)	Naft Maysan	9	890.84	244.06	Between	483090.20	161030.07	1.558	0.219
	Hudood	9	928.55	398.55					
	Duhok	9	1191.11	331.70	Within	3203768.58	103347.37		
	Al-Shorta	8	987.81	286.94	Total	3686858.78			
	Total	35	999.91	329.30					
3- Power Plays (count)	Naft Maysan	9	60.222	10.663	Between	1389.56	463.19	1.487	0.237

	Hudood	9	67.000	24.663					
	Duhok	9	77.222	17.398	Within	9654.61	311.44		
	Al-Shorta	8	64.750	14.430	Total	11044.17			
	Total	35	67.371	18.023					
4- Accelerations (count)	Naft Maysan	9	64.111	14.692	Between	1455.19	485.06	1.537	0.225
	Hudood	9	72.111	16.420					
	Duhok	9	82.000	19.307	Within	9783.78	315.61		
	Al-Shorta	8	74.000	20.417	Total	11238.97			
	Total	35	73.029	18.181					
5- Decelerations (count)	Naft Maysan	9	72.444	17.973	Between	2126.55	708.85	1.364	0.272
	Hudood	9	89.556	27.501					
	Duhok	9	91.111	20.709	Within	16109.33	519.66		
	Al-Shorta	8	90.000	24.036	Total	18235.89			
	Total	35	85.657	23.159					
6- Impacts (count)	Naft Maysan	9	4.222	2.048	Between	2.87	0.956	0.177	0.911
	Hudood	9	4.222	2.438					
	Duhok	9	4.889	2.205	Within	167.88	5.42		
	Al-Shorta	8	4.625	2.615	Total	170.74			
	Total	35	4.486	2.241					
7- Sprints (count)	Naft Maysan	9	30.778	9.298	Between	317.01	105.67	0.920	0.443
	Hudood	9	30.778	13.764					
	Duhok	9	38.000	10.320	Within	3560.99	114.87		
	Al-Shorta	8	32.375	8.467	Total	3878.00			
	Total	35	33.000	10.680					
8- Player Load	Naft Maysan	9	347.04	63.106	Between	14707.84	4902.61	1.072	0.375
	Hudood	9	400.03	66.679					
	Duhok	9	387.58	69.179	Within	141804.55	4574.34		
	Al-Shorta	8	366.23	71.804	Total	156512.40			
	Total	35	375.48	67.848					
9- Top Speed (km/h)	Naft Maysan	9	30.204	1.992	Between	2.22	0.741	0.168	0.917
	Hudood	9	29.742	2.086					
	Duhok	9	30.430	1.915	Within	136.26	4.40		
	Al-Shorta	8	30.164	2.401	Total	138.49			
	Total	35	30.134	2.018					

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10- Max Deceleration (m/s²)	Naft Maysan	9	7.463	0.659	Between	4.63	1.54	1.346	0.278
	Hudood	9	7.236	1.062					
	Duhok	9	8.168	1.362	Within	35.57	1.15		
	Al-Shorta	8	7.374	1.085	Total	40.20			
	Total	35	7.565	1.087					
11- Max Acceleration (m/s²)	Naft Maysan	9	5.462	0.415	Between	0.912	0.304	1.231	0.315
	Hudood	9	5.821	0.551					
	Duhok	9	5.650	0.450	Within	7.65	0.247		
	Al-Shorta	8	5.876	0.564	Total	8.56			
	Total	35	5.697	0.502					

Table 3. *Means, Standard Deviations, and One-Way ANOVA for Four Teams in May*

Variable	Team	N	Mean (M)	SD	Between/Within Groups	Sum of Squares	Mean Square	F	Sig
1- Distance (km)	Diwaniya	10	9.094	1.580	Between	16.816	5.605	3.696	0.021
	Naft	8	9.179	1.226					
	Naft Wasat	10	10.408	0.776	Within	51.560	1.516		
	Erbil	10	10.513	1.209	Total	68.376			
	Total	38	9.831	1.359					
2- Sprint Distance (m)	Diwaniya	10	902.29	263.94	Between	565085.78	188361.93	2.199	0.106
	Naft	8	1090.73	227.51					
	Naft Wasat	10	837.03	306.42	Within	2912428.54	85659.66		
	Erbil	10	1122.30	346.10	Total	3477514.33			
	Total	38	982.69	306.57					
3- Power Plays (count)	Diwaniya	10	62.600	17.475	Between	1128.88	376.29	1.992	0.134
	Naft	8	67.125	8.790					
	Naft Wasat	10	66.400	14.501	Within	6423.68	188.93		
	Erbil	10	77.000	11.747	Total	7552.55			
	Total	38	68.342	14.287					

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4- Accelerations (count)	Diwaniya	10	75.200	13.839	Between	1742.28	580.76	3.269	0.033
	Naft	8	67.750	14.260					
	Naft Wasat	10	85.800	11.745	Within	6040.80	177.67		
	Erbil	10	82.700	13.549	Total	7783.08			
	Total	38	78.395	14.504					
5- Decelerations (count)	Diwaniya	10	85.500	18.549	Between	1372.17	457.39	1.864	0.154
	Naft	8	78.500	12.558					
	Naft Wasat	10	85.700	11.470	Within	8344.70	245.43		
	Erbil	10	95.700	18.136	Total	9716.87			
	Total	38	86.763	16.205					
6- Impacts (count)	Diwaniya	10	4.000	1.414	Between	21.263	7.088	0.980	0.414
	Naft	8	4.000	1.309					
	Naft Wasat	10	5.800	3.584	Within	246.000	7.235		
	Erbil	10	4.400	3.340	Total	267.263			
	Total	38	4.579	2.688					
7- Sprints (count)	Diwaniya	10	30.100	9.960	Between	357.541	119.18	1.183	0.331
	Naft	8	35.625	6.927					
	Naft Wasat	10	28.600	10.047	Within	3424.78	100.73		
	Erbil	10	35.200	11.961	Total	3782.32			
	Total	38	32.211	10.111					
8- Player Load	Diwaniya	10	375.30	64.989	Between	30855.43	10285.14	3.724	0.020
	Naft	8	388.97	57.181					
	Naft Wasat	10	439.24	30.700	Within	93901.11	2761.80		
	Erbil	10	436.00	52.195	Total	124756.54			

	Total	38	410.98	58.067					
9- Top Speed (km/h)	Diwaniya	10	30.265	1.951	Between	3.877	1.292	0.271	0.846
	Naft	8	30.728	1.632					
	Naft Wasat	10	30.389	2.687	Within	162.38	4.776		
	Erbil	10	31.067	2.223	Total	166.26			
	Total	38	30.606	2.120					
10- Max Deceleration (m/s²)	Diwaniya	10	7.208	1.089	Between	1.853	0.618	0.585	0.629
	Naft	8	7.398	1.024					
	Naft Wasat	10	6.928	0.865	Within	35.94	1.057		
	Erbil	10	7.500	1.115	Total	37.79			
	Total	38	7.251	1.011					
11- Max Acceleration (m/s²)	Diwaniya	10	6.077	0.547	Between	0.617	0.206	0.822	0.491
	Naft	8	5.713	0.495					
	Naft Wasat	10	5.853	0.487	Within	8.498	0.250		
	Erbil	10	5.879	0.466	Total	9.115			
	Total	38	5.889	0.496					

Table 5. *Mean, Standard Deviation, and One-Way ANOVA for Four Teams in June*

Variable	Team	N	Mean	SD	Between/Within Groups	Sum of Squares	Mean Square	F	Sig.
Distance (km)	Zawraa	9	10.809	0.671	Between	26.489	8.830	5.938	0.003
	Al-Jawiya	8	9.811	1.282	Within	43.123	1.487		
	Naft Al-Janoub	8	9.555	1.344	Total	69.611			

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	Al-Karkh	8	8.321	1.482	Total				
Sprint Distance (m)	Zawraa	9	1089.80	322.38	Between	311397.34	103799.11	1.398	0.263
	Al-Jawiya	8	1110.37	218.59	Within	2153553.46	74260.46		
	Naft Al-Janoub	8	988.33	247.22	Total	2464950.81			
	Al-Karkh	8	863.93	282.80	Total				
Power Plays	Zawraa	9	71.778	13.055	Between	449.437	149.812	0.644	0.593
	Al-Jawiya	8	71.625	12.282	Within	6744.81	232.580		
	Naft Al-Janoub	8	67.375	17.221	Total	7194.24			
	Al-Karkh	8	62.750	17.926	Total				
Accelerations	Zawraa	9	92.889	22.992	Between	1582.36	527.455	1.783	0.172
	Al-Jawiya	8	84.125	15.104	Within	8577.51	295.776		
	Naft Al-Janoub	8	82.625	13.742	Total	10159.88			
	Al-Karkh	8	73.625	14.292	Total				
Decelerations	Zawraa	9	95.333	13.295	Between	5027.31	1675.77	6.881	0.001
	Al-Jawiya	8	88.875	18.581	Within	7062.75	243.543		

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	Naft Al-Janoub	8	86.000	13.342	Total	12090.06			
	Al-Karkh	8	62.625	16.843	Total				
Impacts	Zawraa	9	7.000	4.359	Between	99.617	33.206	2.913	0.051
	Al-Jawiya	8	4.125	3.227	Within	330.625	11.401		
	Naft Al-Janoub	8	5.625	3.335	Total	430.242			
	Al-Karkh	8	2.375	1.996	Total				
Sprints	Zawraa	9	35.778	9.744	Between	334.164	111.388	1.456	0.247
	Al-Jawiya	8	37.125	6.446	Within	2218.81	76.511		
	Naft Al-Janoub	8	32.875	9.047	Total	2552.97			
	Al-Karkh	8	28.750	9.223	Total				
Player Load	Zawraa	9	474.81	34.379	Between	71212.16	23737.39	8.368	0.000
	Al-Jawiya	8	404.93	59.054	Within	82261.26	2836.60		
	Naft Al-Janoub	8	392.50	54.041	Total	153473.42			
	Al-Karkh	8	347.72	63.191	Total				
Top Speed (km/h)	Zawraa	9	31.124	2.239	Between	16.145	5.382	1.139	0.350

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	Al-Jawiya	8	30.965	2.648	Within	137.027	4.725		
	Naft Al-Janoub	8	31.918	1.478	Total	153.172			
	Al-Karkh	8	29.924	2.156	Total				
Max Deceleration (m/s²)	Zawraa	9	7.513	0.531	Between	1.053	0.351	0.447	0.721
	Al-Jawiya	8	7.863	0.838	Within	22.745	0.784		
	Naft Al-Janoub	8	7.871	0.957	Total	23.798			
	Al-Karkh	8	7.974	1.144	Total				
Max Acceleration (m/s²)	Zawraa	9	5.992	0.296	Between	0.616	0.205	0.779	0.515
	Al-Jawiya	8	5.853	0.597	Within	7.645	0.264		
	Naft Al-Janoub	8	5.715	0.450	Total	8.260			
	Al-Karkh	8	6.078	0.658	Total				

Table 6. *LSD Post Hoc Comparison for Four Teams in June*

Variable	Team Comparison	Mean Difference	Sig.	Significant in Favor of
Distance (km)	Zawraa – Al-Jawiya	0.998	0.103	–
	Zawraa – Naft Al-Janoub	1.254*	0.043	Zawraa
	Zawraa – Al-Karkh	2.488*	0.000	Zawraa

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	Al-Jawiya – Naft Al-Janoub	0.256	0.677	–
	Al-Jawiya – Al-Karkh	1.490*	0.021	Al-Jawiya
	Naft Al-Janoub – Al-Karkh	1.234	0.052	–
Decelerations	Zawraa – Al-Jawiya	6.458	0.401	–
	Zawraa – Naft Al-Janoub	9.333	0.228	–
	Zawraa – Al-Karkh	32.708*	0.000	Zawraa
	Al-Jawiya – Naft Al-Janoub	2.875	0.715	–
	Al-Jawiya – Al-Karkh	26.250*	0.002	Al-Jawiya
	Naft Al-Janoub – Al-Karkh	23.375*	0.006	Naft Al-Janoub
Player Load	Zawraa – Al-Jawiya	69.880*	0.011	Zawraa
	Zawraa – Naft Al-Janoub	82.309*	0.003	Zawraa
	Zawraa – Al-Karkh	127.090*	0.000	Zawraa
	Al-Jawiya – Naft Al-Janoub	12.429	0.644	–
	Al-Jawiya – Al-Karkh	57.210*	0.040	Al-Jawiya
	Naft Al-Janoub – Al-Karkh	44.781	0.103	–

Table 7. *Mean, Standard Deviation, and One-Way ANOVA for Four Teams in July*

Variable	Team	N	Mean	SD	Between/Within Groups	Sum of Squares	Mean Square	F	Sig.
Distance (km)	Al-Sinaa	10	8.979	0.815	Between	3.114	1.038	0.619	0.608
	Zakho	10	9.609	1.265	Within	55.361	1.678		
	Nowruz	8	9.731	1.386	Total	58.474			
	Al-Najaf	9	9.346	1.641	Total				
Sprint Distance (m)	Al-Sinaa	10	962.64	302.31	Between	89734.99	29911.66	0.672	0.576
	Zakho	10	921.47	193.04	Within	1469863.42	44541.32		
	Nowruz	8	926.16	118.81	Total	1559598.42			

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	Al-Najaf	9	829.26	163.23	Total				
Power Plays	Al-Sinaa	10	63.200	8.702	Between	178.844	59.615	0.516	0.674
	Zakho	10	63.800	12.035	Within	3811.589	115.503		
	Nowruz	8	64.750	11.184	Total	3990.432			
	Al-Najaf	9	58.889	10.902	Total				
Accelerations	Al-Sinaa	10	75.600	15.686	Between	1362.795	454.265	2.248	0.101
	Zakho	10	77.800	16.417	Within	6667.097	202.033		
	Nowruz	8	78.875	12.609	Total	8029.892			
	Al-Najaf	9	63.444	10.690	Total				
Decelerations	Al-Sinaa	10	81.400	6.328	Between	200.673	66.891	0.346	0.792
	Zakho	10	85.400	15.364	Within	6382.300	193.403		
	Nowruz	8	81.750	17.027	Total	6582.973			
	Al-Najaf	9	79.000	15.281	Total				
Impacts	Al-Sinaa	10	4.800	3.155	Between	11.860	3.953	0.748	0.531
	Zakho	10	3.300	2.003	Within	174.464	5.287		
	Nowruz	8	4.375	1.996	Total	186.324			
	Al-Najaf	9	4.111	1.616	Total				
Sprints	Al-Sinaa	10	32.000	10.143	Between	86.120	28.707	0.435	0.729
	Zakho	10	31.000	8.138	Within	2177.556	65.987		
	Nowruz	8	32.000	6.459	Total	2263.676			

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	Al-Najaf	9	28.222	6.741	Total				
Player Load	Al-Sinaa	10	372.40	37.459	Between	4476.842	1492.28	0.429	0.733
	Zakho	10	401.69	63.438	Within	114743.67	3477.08		
	Nowruz	8	392.43	61.421	Total	119220.51			
	Al-Najaf	9	390.41	70.257	Total				
Top Speed (km/h)	Al-Sinaa	10	31.446	2.303	Between	24.831	8.277	2.141	0.114
	Zakho	10	29.361	2.201	Within	127.589	3.866		
	Nowruz	8	30.900	0.931	Total	152.420			
	Al-Najaf	9	30.048	1.944	Total				
Max Deceleration (m/s²)	Al-Sinaa	10	7.709	0.790	Between	8.793	2.931	7.315	0.001
	Zakho	10	7.177	0.619	Within	13.222	0.401		
	Nowruz	8	7.693	0.673	Total	22.015			
	Al-Najaf	9	6.499	0.351	Total				
Max Acceleration (m/s²)	Al-Sinaa	10	5.884	0.616	Between	0.033	0.011	0.035	0.991
	Zakho	10	5.844	0.518	Within	10.338	0.313		
	Nowruz	8	5.900	0.574	Total				
	Al-Najaf	9	5.823	0.524	Total				

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Table 8. *LSD Post Hoc Comparison for Four Teams in July (Max Deceleration)*

Variable	Team Comparison	Mean Difference	Sig.	Significant in Favor of
Max Deceleration (m/s²)	Al-Sinaa – Zakho	0.532	0.069	–
	Al-Sinaa – Nowruz	0.017	0.957	–
	Al-Sinaa – Al-Najaf	1.210*	0.000	Al-Sinaa
	Zakho – Nowruz	-0.516	0.095	–
	Zakho – Al-Najaf	0.678*	0.026	Zakho
	Nowruz – Al-Najaf	1.194*	0.000	Nowruz

Discussion

It is evident from Table (3) that the significance value for the first variable (Distance) is significant. The researchers attribute this to the fact that Al-Talaba Club competes for the top positions in the league. When playing against teams in the middle or bottom of the league table, the team changes its playing style to quick transitions into open spaces of the opponent. This requires movement from the wide players, midfield anchors, continuous support from defenders, and reducing gaps between them and the attackers. This indicates the endurance capacity of Al-Talaba players and also reflects the high level of their aerobic energy system, where total energy is represented by glucose derived from glycogen stored in the liver and muscles, as well as fatty acids from fats stored in adipose cells or free fatty acids in the blood. The more efficient this system is, the more players can cover greater distances and resist fatigue for longer periods (Al-Kubaisi, Al-Yasiri, & Al-Hasani, 2021, p. 100).

It is also clear that the significance value for the fourth variable (Acceleration) is significant. The researchers attribute this to the new coaching staff focusing, after taking over, on reviewing player data from the PLAYERTEK TEAM device, evaluating the previous work of the Tunisian coach, and then focusing on developing abilities related to acceleration through exercises targeting explosive strength, speed-strength, and plyometric strength.

The significance value for the eighth variable (Player Load) is also significant because this variable is associated with the total accelerations along the forward, lateral, and vertical axes, as well as time (Catapult Sports, 2022).

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From Table (4), significant differences are observed in the first variable (Distance) between the matches of Al-Diwaniya and Naft Al-Wasat, in favor of the Naft Al-Wasat match. This is because Al-Diwaniya tends to adopt a defensive compact style, reducing spaces between players, unlike Naft Al-Wasat. The same reason explains the significant difference between Naft Al-Wasat and Naft match, in favor of Naft Al-Wasat, due to Naft adopting a similar defensive approach to Al-Diwaniya. Significant differences were also observed between Al-Diwaniya vs. Erbil and Naft vs. Erbil, favoring the Erbil match, as Erbil displayed a high level and excellent offensive style, leaving wide spaces that allowed open play.

Significant differences in (Acceleration) were noted between Naft vs. Naft Al-Wasat and Naft vs. Erbil, favoring the latter matches due to reliance on collective offensive style, which increased the number of accelerations. Significant differences in (Player Load) were also observed between Al-Diwaniya vs. Naft Al-Wasat and Al-Diwaniya vs. Erbil, favoring Naft Al-Wasat and Erbil matches, due to the high effort exerted by players in these matches, noting that this variable is related to total accelerations across all axes and time (Catapult Sports, 2022).

Conclusions

The results indicate significant differences in the variables of distance, sprint distance, playing ability, number of accelerations, decelerations, and player load in favor of high-level matches compared to low- or medium-level matches. A decline in physical performance was also observed in the measured variables due to the effect of hot weather in Iraq, especially in the matches of the seventh month, in addition to a decrease in physical performance in the last league match for the variables of number of accelerations and maximum deceleration. It is also concluded that the team’s tactical aspect has a clear impact on the outcomes of the measured physical variables.

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The effect of flexibility training using the Ki-Hara method on some specific physical abilities and performance the basic skills of the players of the Al-Karkh Second Education Directorate handball team

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Abstract

Countries around the world have directed all their resources, expertise, and sciences towards achieving advanced levels in various sports. The aim of sports training is to prepare players well and the research aims to develop flexibility exercises using the Ki-Hara method for handball players. The research aims to identify the impact of Ki-Hara flexibility training on specific physical abilities of the Al-Karkh Second Education Directorate handball team players. Identifying the impact of Ki-Hara flexibility training on the performance of basic handball skills. The researcher used the experimental method with pre-test and post-test for a single group, and the research sample included 14 players aged 14-17 years. Physical and skill tests were used to collect the research data. Among the most important findings: the exercises prepared by the researcher have a positive impact on developing the specific physical abilities of the players of the Al-Karkh Second Education Directorate handball team, and the exercises prepared by the researcher have a positive impact on developing the basic handball skills. The researcher recommends the necessity of using the training prepared by the researcher in developing basic handball skills.

Keywords: flexibility, ki-hara, physical abilities, handball.

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Introduction

Achieving good sports results at a high level has become the hallmark of our current era, and this did not come out of nowhere but rather as a result of utilizing various knowledge and sciences, modern training devices, as well as scientific research in the field of sports training. Therefore, it has become essential to follow the correct scientific methods in structuring the sports training process.

Given that handball is a team sport requiring both physical and skill-related demands from players, all scientific research has concentrated on identifying effective solutions and methods to enhance players' physical capabilities and complex skill performance by innovating new techniques and utilizing advanced equipment to achieve optimal levels and results. Physical capabilities are an important requirement for the success of the skill aspect and achieving better accomplishments.

The importance of the research lies in the necessity of using modern training methods, including flexibility exercises using the Ki-Hara method, which forces the athlete to break the usual line in developing performance skills for handball players and brings about tangible changes in the field of training. It involves using modern training methods and techniques, moving away from everything familiar, including flexibility exercises, and distancing from all that is conventional in sports training (Marzouk, & Shabib. 2023).

The research problem lies in the field experience of the researcher and his observation of the training sessions of the players of the Al-Karkh Second Education Directorate handball team, where a clear weakness in physical abilities was noted. It is essential to address these weaknesses in order to achieve better performance.

The aim of the research

-The task involves preparing flexibility exercises using the Ki-Hara method for handball players, understanding the impact of Ki-Hara flexibility exercises on certain physical abilities of the Al-Karkh Second Education Directorate handball team, and understanding the impact of Ki-Hara flexibility exercises on the performance of basic handball skills.

-Research hypothesis: There are no statistically significant differences between the pre-test and post-test of physical abilities among the players of the Al-Karkh Second Education Team.

-There are no statistically significant differences between the pre-test and post-test in the performance of basic skills among the players of the Al-Karkh Second Education Handball Team.

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Methodology

The researcher used the experimental method with pre-test and post-test for a single group due to its suitability and the nature of the research problem, as the experimental method provides real results.

Research sample

The research community was defined as the players of the Al-Karkh Education Directorate's handball team, totaling 17 players, excluding goalkeepers, aged between 14 and 16 years. The research sample consisted of 14 players, representing 82.35% of the community. To determine the homogeneity of the sample members, the researcher used height, weight, and age measurements on Thursday, January 26, 2023, to conduct the homogeneity test. The skewness coefficient value ranged between (-+3), indicating that the sample is homogeneous, as shown in Table (1). One of the crucial tasks for the researcher is to accurately select a sample that precisely represents the original community (Idan, el at.1988)

Table 1. *shows the arithmetic means, standard deviation, and skewers coefficient for the sample homogeneity*.

No	Variables	Unit of measurement	arithmetic mean	mediator	Standard deviation	Twist coefficient
1	Chronological age	year	15.87	16.00	0.80	0.42
2	Height	Centimeter	1.70	1.70	0.57	0.02
3	Weight	KG	67.25	67.50	3.56	0.21

By reviewing sources, references, and previous studies in handball and sports training, the researcher identified physical abilities and basic skill tests in handball (as they are scientific, precise, and standardized tests characterized by scientific foundations of validity, reliability, and objectivity as applied in similar research) (Morad, H., & Shbeeb. 2023). Flexibility stretching

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exercises were prepared, and the researcher conducted pre-tests on the research group on Monday, 7/2/2023, at 10:00 AM in the second Al-Karkh Sports Hall for physical abilities (explosive strength of the arms, speed strength of the arms and legs, and basic handball skills) (Darwish. 2000: Hussain. 1998: Abdul Razzaq. 2017).

The experiment was conducted on the experimental group in the main section of the training unit over a period of 8 weeks, with 3 training units per week, totaling 24 training units. After completing the training program, post-tests were conducted for the experimental group, taking into account the same spatial and temporal conditions as the pre-tests. The researcher used statistical software to analyze the data and extract the results.

Results

Table 2. *shows the results of the pre- and post-tests for physical abilities and basic skills under study*

Physical abilities	Pre-test		Post-test		F S	F A	The accountant	Error level
	S	±A	S	±A				
The explosive strength of the arms	6.53	0.18	7.62	0.74	1.08	0.53	5.80	0.00
Explosive strength of the legs	1.83	0.07	1.97	0.06	0.14	0.02	15.6	0.00
Special strength in arm speed	7.25	3.01	11.12	3.13	3.87	0.64	17.10	0.00
Special strength in leg speed	6.25	1.32	4.83	0.46	1.44	1.05	3.88	0.00

Significant at a significance level of < 0.05 and with 13 degrees of freedom.

Table 3. *shows the results of the pre- and post-tests for the range of motion of the upper limbs in the research sample*

The range of motion	Pre-test		Post-test		S-F	A F	T The Enforcer	Error level
	S-	A	S-	A				

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Range of motion for upward bending	64,00	15,162	117,00	15,65	53,00	24,899	2,760	0,002
Range of motion Back extension	29,400	1,634	42,200	1,483	17,800	11,987	3,320	0,013
The range of motion extends outward.	71,000	5,472	105,00	11,180	34,00	15,572	4,881	0,000
The approximate inward range of motion	60,800	7,463	104,00	9,617	43,200	16,769	5,761	0,001

Table 4. shows the results of the pre-test and post-test for basic handball skills.

variables	Pre-test		Post-test		F S	F A	The Enforcer	Error level
	S	±A	S	±A				
Coverage	5.500	0.925	9.500	0.925	4.000	1.6903	6.693	0.000
The interview	2.125	0.640	4.750	0.707	2.6250	0.7440	9.979	0.000
Side movements	16.25	2.815	8.875	1.125	7.3750	1.9226	10.850	0.000

*Significant at a significance level of < 0.05 with 13 degrees of freedom

Discussion

It is evident from tables (2) and (3) that there are statistically significant differences between the pre-test and post-test for the research sample in the physical abilities under study (explosive strength of the arms, explosive strength of the legs, speed-strength of the arms, speed-strength of the legs), flexibility, and basic handball skills.

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The researcher attributes these differences to the nature of the exercises that were prepared, which were characterized by variety and diversity, whether physical or skill-based, and their association with skills had a clear impact on developing physical abilities. It is a mistake to rely on the notion that the physical aspect develops in isolation from the skill aspect. Additionally, the use of Ki-Hara exercises, designed by the researcher, had a clear impact on developing physical abilities, including flexibility, which is important not only in the training aspect but also in health and functional aspects in the present time.

The specific exercises prepared by the researcher aim to develop the muscle groups involved in handball and, more importantly, to ensure the development and preparation of muscle groups with motor skills similar to those required in handball. This aligns with what Adel Abdel Basir mentioned, saying, "Those who think there is a separation between developing physical abilities and developing motor skills are mistaken." (Abdel Basir. 1999) And despite the advancement of modern technology and its integration into most aspects of life, what has increased interest is the use of modern devices and training methods that simulate the training reality and resemble the steps of the game. (Mubarak, Badawi, Abdul-Hussein. 2023). The researcher was keen on preparing exercises in multiple and varied directions because this will contribute to the player's ability to perform skills better. The prepared exercises have worked on improving the speed of motor transition by organizing the muscular work between contraction and relaxation of the working muscles, which helps in performing the movement in a regular and easy manner. This is because the requirements of handball include speed, variety, and changes in play from one skill to another, and to keep up with the developments in handball, which require the player to have a high degree of strength and speed in particular. In addition to the use of tools and equipment. Modern training methods have increased players' motivation to train and achieve their desired goals from the training process. (Badawi, 2020)

Moreover, the exercises prepared by the researcher had a clear impact on developing physical abilities and basic handball skills by incorporating variety and avoiding monotony in training. The study indicates the importance of sports training in fostering a spirit of cooperation, excitement, and thrill. This aligns with what Mohamed Sobhi Hassanien and Kamal Abdel Hamid mentioned, that "the true success of a player will be achieved by combining knowledge with practice of the activity and the necessity of being well-versed in the sports knowledge and information specific to the game they practice" (Hamid, Hassanein. 2002).

Exercises in general work on increasing muscle tension and recruiting as many motor units as possible in muscle work. Loaded stretching exercises, which cause contraction and elongation at the same time, do so by elongating a muscle group through its full range of motion during contraction. For this reason, (ki-hara) exercises are as much about strengthening muscle groups as

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they are about elongating them. (BRAD WAIKER 2011, 24) This type of training directly works on the muscle coils; it is a form of stretching with two essential elements: resistance and movement. The resistance comes from muscle tension, and the movement comes from moving the limbs or the trunk, or both together in a specific manner for each stretch. Al-Badri and Hamza indicate that the term "flexibility" is related to the functioning of joints, while the term "stretching" is related to the functioning of muscles. In Western countries, the term "flexibility" is associated with muscle function because the movement of joints is considered the same in all humans, and the difference lies in the range of motion of the joints, which is related to muscle efficiency. Flexibility is not related to joints or muscles, but to the sheaths around muscle fibers.

Conclusions

Where the researcher concluded the following:

-The prepared exercises have a positive impact on developing the researched physical abilities (explosive strength of the arms, explosive strength of the legs, speed-strength of the arms, speed-strength of the legs, and flexibility).

-The prepared exercises and the Ki-Hara training method have a significant impact on developing the basic skills of the research sample.

Recommendations

-The exercises prepared by the researcher can be adopted in other team sports, such as basketball, football, and volleyball, while taking into account the uniqueness of each sport.

-We use training methods like ki-hara exercises to help people of all ages improve their skills in different games.

-The training process requires the adoption of modern training devices and methods, while also moving away from traditional training techniques and equipment.

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The effect of anaerobic effort on the level of triiodothyronine in advanced basketball players

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Abstract

To perform any physical effort, any body needs a lot of energy sources, including carbohydrates, fats, or chemical sources that vary in rates depending on the nature of the activity performed. Therefore, hormones play an important role in regulating the body's functions during physical effort. The hormone triiodothyronine is one of the hormones that work to increase the level of activities of the necessary body systems The problem of the research lies in identifying more information about the effect of anaerobic effort on the hormone triiodothyronine in some basketball players in order to benefit from it and take it into consideration during the training planning process. The research aims to identify the effect of anaerobic effort on the hormone triiodothyronine in some advanced basketball players. The researchers used the descriptive approach to suit the nature of the problem, and the research sample was the advanced basketball players of the Popular Mobilization Club. The researchers concluded that the hormone triiodothyronine (T3) is decisive in its effect during rest or after effort, which indicates the important effect of exercise, as well as the effect of anaerobic effort on the secretion of Triiodothyronine hormone: Researchers recommended adopting triiodothyronine measurement as an indicator for selecting players as it is a clear indication of sports training adaptations.

Keywords: anaerobic effort, triiodothyronine, advanced basketball.

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Introduction

After opinions differed about the concept of physical education and its goals, which aim to achieve optimal achievement in general, researchers and those in charge of this vital activity sought to find new ways that could achieve the desired goals. Those in charge of the scientific research process left no stone unturned in their efforts to achieve a better athletic condition.

It is known that athletic achievements cannot be achieved unless they acquire a state of biological improvement, according to which athletic achievements are a reflection of what is happening in the human body. From here, most of the research in the field of physiology was launched, sometimes to understand and sometimes to standardize, and to advance the achievement as an ideal goal, since the human body cannot perform its functional duties unless the appropriate conditions are available, including energy compounds and the metabolic wastes that result from them, which may also cause an obstacle to achieving those paths.

Hence, it was necessary to conduct a comprehensive study of all biological elements in order to provide a suitable environment for practicing various sports activities.

Progress in athletic performance is nothing but functional and biological adaptations that occur in the internal systems, and consequently, the individual's functional capabilities increase, which vary in degree of impact according to the nature of each activity, the time of practice, and the performance style.

While various opinions differed on the extent to which hormones are affected during physical activities and effort, sports activity leads to physiological and chemical changes within the muscle cell to produce the energy needed for physical effort as a result of the increased activity of hormones that participate in the metabolism process. The physical and athletic level of the individual depends on the positivity of the chemical changes in order to achieve adaptation to the body’s systems and organs in order to face the effort and fatigue resulting from physical training. (Salama and Baha El-Din, 1999)

Any body needs a lot of energy sources to perform any physical effort, whether carbohydrates, fats, or chemical sources, the rates of which vary according to the nature of the activity being practiced. Therefore, hormones play an important role in regulating the body’s functions during physical effort. Triiodothyronine is one of the hormones that works to raise the level of activity of the body’s necessary systems, and physical activity.

Hence, the importance of this research in revealing the effect of anaerobic exercise on the level of triiodothyronine in some basketball players is evident, with the aim of providing scientific information, facts, and precise indicators of these effects, which could be of assistance to those working in the field of sports training.

Hence the research problem came about .The challenges facing researchers and those in charge of sports training or the lack of information are among the basic matters that prompt us to search, scrutinize and investigate information and its objectivity so that we may find solutions and answers that explain the phenomena to be studied. Given the scarcity of studies that deal with the balance of the internal environment, which is about maintaining a stable

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internal environment in the face of internal or external variables, as it is one of the indicators of the body's stability, such as the secretion and maintenance of hormones, the balance of the internal environment is a measure of the speed of the body's recovery of internal functional indicators and their return to the normal state when exposed to variables, whether external or internal.

The study of the effect of physical effort on hormones is considered one of the most important indicators of the validity of training curricula. As far as the researchers know, our Iraqi library lacks such studies, as well as the ambiguity surrounding that aspect. The researchers considered it an unmet need, and through it, this problem emerged in their quest to learn more information about the effect of anaerobic effort on the level of the hormone

triiodothyronine in some basketball players, to benefit from it and take it into consideration during the training planning process.

The aim of the research was to identify the effect of anaerobic effort on the level of the hormone triiodothyronine in some basketball players. The researchers assumed that there is...Statistically significant differences in anaerobic effort and triiodothyronine levels in basketball players.

According to the above, the researchers should review some studies that have a relationship in terms of the studied variables. Among these related studies are:

Practical sources emphasize the importance of studying and knowing the functional and physiological changes, especially the (hormonal) ones, that occur to the player during performance or during sports training (when he is exposed to a certain effort), and in view of the importance of sports physiology and the extent of its clear impact on sports levels.

This study aimed to study one of the important physiological problems that should be clear to the athlete in general and the trainer in particular, which is (studying the determination of the secretion of the hormones TSH, T3 and T4 in the blood according to the pulse index in athletes). After reviewing the yard of some scientific sources and references, I noticed that the secretion of these hormones in the blood is affected according to the pulse index.

Method and tools

The nature of the phenomenon and the objectives imposed on the researcher to choose the appropriate method. The method is defined as" the art of correctly organizing a series of many ideas, either in order to reveal a truth unknown to us, or in order to prove a truth that others do not know "(Bahi, 2013, p. 65). The researchers used the descriptive method in the survey method because it is closest to the nature of the problem and the goal to be achieved, and also suitable for the method of research procedures, as descriptive research aims to determine the conditions and relationships between reality and appearance. The descriptive survey method aims to collect data from members of society to determine the current state of society in many variables (Rateb, 1999, p. 139). The objectives that the researcher sets for his research and the procedures that he uses will determine the nature of society and the sample that he chooses).Khairy, 1986(Therefore, the research community was chosen, which is the players of the Popular Mobilization Club in basketball participating in the Iraqi Premier League for the season (2022-2023), as the members of the research sample were chosen

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randomly from this community, numbering 12 players, and to ensure the homogeneity of the sample, a skewness coefficient test was conducted for both age and training age, and the results showed a high degree of homogeneity and that they are close to the normal distribution. See Table No.(1) .

Table (1). ***Sample homogeneity in variables of age, training age and weight for the sports group***

Variables	Unit of measurement	Coefficient of torsion
the age	year	0.67
Training age	year	0.79
the weight	kg	0.72
height	right	199

The researchers used Arab and foreign scientific sources, as well as the Internet, tests and measurements, a form for recording test and measurement results, a timer, a weight and height measuring device, and a Lenovo computer.One (1) Japanese-made treadmill (TREAD MILL) type (EC-T220.CATEYE) and one (1) Chinese-made centrifuge (CENTRIFUGE) type (80-2) and laboratory devices for measuring triiodothyronine hormone, tubes for storing blood samples, a medical case for storing blood sample test tubes, a box for transporting blood serum samples, plastic syringes for drawing blood, medical and sterile cotton, and wound dressing.

The research tests were represented by the test: Anaerobic capacity test (Cunningham and Faulkins test) (Abdullah, 2008, p. 54)

Test name: Cunningham and Faulkins test

Purpose of the test: To measure lactic tolerance

Devices used:

1. Treadmill
2. stopwatch

Test specifications:

After the player completes the appropriate warm-up for a period of (5-10) minutes, the player ascends On the treadmill, the device starts to operate at the specified speed (14 km/h) and at an inclination angle of (11) degrees, (20%), noting that the device starts to

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increase the speed gradually until it reaches the specified speed. This gives the tester enough opportunity to work on the device in a compatible and harmonious manner. After reaching the specified speed, the timing clock is started by the judges and the player continues to work on the device until he reaches extreme fatigue such that he cannot run on the device. Thus, the timing clock is stopped, meaning that the recording is done from the beginning of the test (the device's speed reaches 14 km/h until it stops working.

Hormone analysis method

To conduct tests for these hormones in any government or private laboratory, the following steps must be followed carefully:

Blood withdrawal method:

We draw blood from the clearest available vein in an amount of (3) ml. The hand can be tied with a tourniquet to increase the clarity of the vein, as the drawing process must

be quick and organized to avoid the breakdown of red blood cells and their spread in the serum, which leads to errors in the results.

After drawing the blood, we place the blood in a special tube to separate the blood serum from the rest of its components. It is best for this tube to be of the type that contains gel and is called a" Gel Tube ",as this gel speeds up blood clotting and also acts as a barrier between the blood serum and the rest of the components after they are separated.

separation process:

We place the tube (Gel Tube) in the centrifuge and place the device at a speed of (3000-4000) rpm for a period ranging between (5-10) minutes to ensure good separation of the blood components from the serum.

.4After the separation process, we take the serum from the tube and use one of the available devices to measure the hormone. We place the serum in the device according to the mechanism of the available device, as the devices differ from one another in the way they work, as well as in the mechanism of their interactions and the principle of their operation, each according to its different degree of development.

5blood conservation

When storing, all samples after serum or plasma separation are kept refrigerated to delay chemical reactions and thus prevent changes in component ratios.

The pilot experiment was conducted on Tuesday, January 18, 2024, at ten o'clock in the morning in the fitness hall at the College of Physical Education and Sports Sciences at the University of Baghdad. All conditions were prepared for the success of the pilot experiment on (3) players from the research community with the help of the auxiliary work team*.This is to know the ability of the support team to complete its field duties, which are to draw blood and put it in special tubes numbered according to the sequence of players, and then transport it from the test site to the laboratories to measure it and know the suitability of the treadmill to work continuously and its efficiency and to ensure the suitability of the devices and tools used in the tests and to ensure the suitability of the test of increasing physical effort until

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fatigue for the players to the sample individuals Identify the time required to conduct the tests for individual samples and the ease of applying them.

The researchers conducted the main experiment after completing the pilot experiment to control all factors and variables that might affect the testing procedure on Wednesday, January 24, 2024. Blood was drawn from the specialist before the effort during rest for hormone analysis. After that, the research sample was exposed to a standardized anaerobic effort. After completing the effort, a blood sample was taken to conduct a triiodothyronine hormone test. In this test, the level of free triiodothyronine (T3) hormone in the blood serum is checked. The thyroid gland, which is located in the front of the neck, produces triiodothyronine (T3) hormones that regulate metabolic processes in the body.

The researchers used the statistical package (SPSS), and the arithmetic mean, standard deviation, t-distribution, and skewness coefficient were automatically calculated.

Results

table(2) ***Shows the arithmetic means, standard deviations, calculated t-value, and significance level of the T3 measurement results for anaerobic exercise***

Measurements	N	Measure before effort		Measurement after effort		The calculated	Sig Score	significance
		Q	± A	Q	± ع			
Triiodothyronine	12	1.11	0.20	1.37	0.18	3.20	0.009	Dal

Degree of freedom = 11 and significance level(0.05) Table t = 1.79

Discussion

It is clear from Table (2) on the statistical treatments of the triiodothyronine hormone and by looking at the data representing the concentrations of the hormone in the blood plasma of the individuals in the research sample, a group before and after the effort, we notice a difference in those concentrations between the two efforts in the aforementioned measurement. By looking at the same data, it becomes clear that a noticeable increase occurred in the concentration of the hormone after performing physical efforts in the

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measurement after the effort for the research group. The researchers explain this increase to the urgent need for the role of the hormone in some functions of the body's organs that fall within the spectrum of the effect of that hormone, including the heart, respiratory system, liver and other organs, as the pace of their functions increases during physical effort to provide energy and construction requirements, as the activity of the endocrine glands increases in order to secrete multiple hormones from performing physical effort. This also occurs before a person begins training or training to participate in competition, and the activity of the endocrine glands continues in their secretions of hormones during the performance of physical efforts, especially those that are characterized by their high intensity and require continuation for a long period of time.

When looking at the same table and through the mathematical means, it became clear that there is a clear difference between before and after the effort, but within the normal limits for the individuals in the research sample. The more important the competition is to the player, the greater the stimulus for the secretion of hormones. There is a group of responses that express an increase in the activity of the endocrine glands under the influence of physical effort. This was clearly evident in the hormone iodothyronine, which is affected like other hormones. This increase is considered normal as a result of the exerted efforts, which affect the functions of the body in general and the hormones in particular. The results of the measurements also agree with the results of Shephard, quoting Baha 'al-Din Salama (that practicing sports for regular and long periods contributes to a decrease in the hormone triiodothyronine during rest) (Salama, 2009, p. 111).

As for the results of the measurements after the effort, the researchers noticed that there were increased differences between the measurements before and after the effort for the sample members, and the results were consistent with the results of (Boen) (where he noticed an increase in the triiodothyronine hormone after anaerobic physical effort) (Salama, 2009, page 112)

The results also agree with what was indicated by (Ibrahim Salama, 1999) (that there is an increase in the concentrations of the hormone triiodothyronine as a result of work, reaching (31%) for anaerobic effort in the hormone triiodothyronine, and the results of the measurements after the effort also agree with the results of (Bahaa El-Din Salama, 1991, page 43)

Conclusions

After presenting the statistically extracted results, the researchers reached the following conclusions:

- The research results are within normal limits.
- Triiodothyronine was crucial in its effect at rest and after exercise, indicating an important effect of exercise.
- Anaerobic exercise has an effect on the secretion of triiodothyronine.
- The research sample members were distinguished by their return to normal levels of triiodothyronine secretion after exertion, which indicates the significant effect of exercise.

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The Effect of Nutritional Supplements and Rehabilitation Exercises on The Functional Adequacy of The Injured Deltoid Muscle in Bodybuilders

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Abstract

This study aimed to identify the effect of nutritional supplements and rehabilitative exercises on the functional recovery of advanced bodybuilding players with anterior deltoid injuries. The experimental method was applied to two groups of eight injured athletes from the Baghdad/Al-Rusafa Gym. The first group performed rehabilitative exercises, while the second group combined them with nutritional supplements. Functional competence was assessed through measurements of muscle strength and range of motion using a dynamometer. The results showed significant improvement in both groups, with the combined program producing greater recovery. The study concluded that integrating nutritional supplements with rehabilitation exercises effectively restores the anterior deltoid muscle's function and accelerates the return of injured bodybuilders to normal performance.

Keywords: Functional competence, nutritional supplements, body building, rehabilitative exercises.

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Introduction

At the beginning of the twenty-first century, rehabilitation of injuries and rehabilitation methods became one of the important and safe matters to which the world's attention began to turn with great strides, especially in sports rehabilitation, a science based on scientific foundations and principles. This science developed until it became an independent science from the sciences of physical education and sports sciences, and this science did not stop. To a certain extent, there has been progress in diagnosing the most important and precise causes and developing appropriate solutions of valuable benefit that enable the athlete to return to practicing training in the normal way before the injury occurred. Individual sports, especially bodybuilding, are characterized by high-intensity physical requirements that It is performed by players during training, and it is considered one of the common sports practiced in the world. It is one of the individual sports that aims to adapt and develop the strength and muscle mass of a group of muscles, to give the players a beautiful and harmonious figure, and to develop the physical and functional aspects of its practitioners. It aims to develop its players and reach advanced levels in building muscle mass of size and consistency. Which reflects the aesthetics of the body, and this is what made this sport spread widely in recent years with the large number of individuals practicing it. In its training, it relies mainly on free weights and training equipment, as it is characterized by In its training, using high loads that cause stress on the athlete's body, and this is the primary goal in training in order to adapt and develop the muscle mass of a group of muscles, and requires the player to perform these exercises correctly, and this leads to the players bearing pressures and great training loads that help in the development of the player. But at the same time, these high loads can cause various sports injuries to these players, as the rate of sports injuries increases with the level of unregulated training loads that exceed the player's ability, and thus they put pressure on the joints, ligaments, Synovial capsules, tendons, muscles, and bones.

This is what Frank Jobe, eta, 1987 agrees with, that the ultimate goal of rehabilitation approaches is to restore the range of motion and strength to the injured muscle, and these ranges put great pressure on the muscles, ligaments, and tendons surrounding the joint, as injury to a muscle or tendon that works on the shoulder joint affects its function. Movement: the natural movement of the joint stops.

Among the studies that dealt with the tear of the anterior deltoid muscle of the shoulder joint (study Talal Hamdi Mahmoud 2022)

(The effect of a rehabilitation program on the physiology of tearing the deltoid muscle of the shoulder joint in boxing players).

The researcher used the experimental method using a pre-post experimental design for one experimental group, the research sample, due to its suitability to the nature of the research. The researcher deliberately selected the research sample from boxing players from the Pioneers Club

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in the Tenth of Ramadan City in Sharkia Governorate, who numbered (10) players. The researcher applied the exploratory study to a number of (3) boxing players from outside the research sample to calculate the scientific coefficients for the tests used in the study. The researcher conducted pre- and post-test measurements on a number of (10) players who were regular in implementing the basic experiment of the study. The research aims to identify the effect of a rehabilitation program on the physiology of the tear of the deltoid muscle of the shoulder joint for boxing players. The most important conclusions are that there are statistically significant differences between the pre- and post-measurements. In the variables of the range of motion of the shoulder joint (abduction) in favor of the post-measurement of the sample under study, there are statistically significant differences between the pre- and post-measurements. Measuring the variables of the electrical activity of the shoulder muscles (Anterior deltoid muscle - posterior deltoid muscle) in favor of the post-test for the sample under study. There are statistically significant differences between the pre- and post-measurements in the "Shoulder Pain Scale" in favor of the post-measurement for the sample under research. And(Study by Mahmoud Ibrahim Mahmoud 2019).

(The effectiveness of using technology in some aquatic therapeutic exercises to rehabilitate shoulder injuries for swimmers). The research aims to design a rehabilitation program using technology to rehabilitate shoulder injuries for swimmers and to identify the effect of the rehabilitation program on the level of pain, range of motion, and muscle strength of the injured shoulder joint. The method used was the experimental method, and the study sample was (27 infected people). The most important results were that the proposed rehabilitation program in the aquatic environment contributed to the flow of blood to the muscles of the shoulder joint and the removal of pain. It also contributed to restoring the normal range of motion and flexibility of the muscles of the shoulder joint, and restoring balanced muscle strength to the moving working muscles and the corresponding (reverse) muscles on the shoulder joint, and it has a role In rehabilitating the muscles of the shoulder joint, training in the water environment contributes to eliminating pain and restoring movement to the muscles of the shoulder joint faster than land-based training, and the use of modern technological means has contributed to the rapid absorption of A research sample of the rehabilitation program exercises and performing those exercises correctly.

Methodology

The nature of the problem determines the researchers to choose the appropriate method for this problem. The method is "the correct method that the researcher adopts to reach his desired goal that he specified at the beginning of his research." (Amer, 2012, p. 10), so the researchers adopted the experimental approach to suit the nature of the problem.

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The research community was identified from the infected gym-goers in Baghdad/Al-Rusafa, which numbered (28) infected players, and the researchers selected the research sample from the same research community, which numbered (8), divided into (4) first experimental and (4) second experimental, As shown in Table (1).

And I was hired The following devices, tools, and means of collecting information: (paper forms, laptop, electronic calculator, Arab and foreign sources, field visits to collect information, information network (Internet), personal interviews). Auxiliary device (steel frame), portable digital dynamo meter, juniper meter).

In order to achieve the goal of the research, this requires a measurement tool, and functional competency measurements were used (muscular strength measurements - range of motion measurements) Measurements of range of motion of the shoulder joint:

The range of motion of the shoulder joint was measured in (5) different movements:

1- Name of measurement : Measurements of range of motion of the shoulder joint:.

Purpose of measurement : Measuring the range of motion of the shoulder joint in flexion movement.

Unit of measurement: Degree.

Used tools : Pen, sticky marking tool, juniometer, registration form.

Performance method : The tester sits with his arm at the side of the body and down.

- The arm of the juniometer is placed on the acromial process of the shoulder blade, and on the lateral side of the arm.
- The tester raises his arm forward and upward, and in the sagittal plane.
- The fixed arm of the joniometer is parallel to the humerus.
- Movement is within the limits of pain.

Registration method

- The angle achieved between the arms of the juniometer is read and recorded.
- The ideal range of motion for shoulder flexion movement is (0-170) degrees.

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2- Measurement name: Range of motion of the shoulder joint.

Purpose of measurement: Measuring the range of motion of the shoulder joint in extended movement.

Tools used: Pen, sticky marking tool, juniometer, registration form.

Performance description:

- The tester sits, with his arm at the side of the body and down.
- The arms of the juniometer are placed on the acromial process of the shoulder blade and on the lateral side of the arm.
- The tester moves his arm backwards and upwards, and in the sagittal plane.
- The fixed arm of the juniometer is parallel to the torso.
- The moving arm of the juniometer is connected to the humerus.
- Movement is within the limits of pain.

- Registration method

- The angle achieved between the arms of the juniometer is read and recorded.
- The ideal range of motion for shoulder flexion is (0-60) degrees.

3-Measurement name:- Range of motion of the shoulder joint.(Klaus Buckup.2004)

Purpose of measurement: Measuring the range of motion of the shoulder joint in the abduction movement.

Tools used: Pen, sticky marking tool, juniometer, registration form

- Performance description:

- The tester sits with his arm at the side of the body and down.
- The arms of the juniometer are placed on the acromial process of the scapula and on the back of the shoulder.
- The tester raises his arm to the side, up, and at the coronal level.
- The fixed arm of the juniometer is parallel to the torso.

- The moving arm of the juniometer is parallel to the humerus.
- Movement is within the limits of pain.

Registration:

- The angle achieved between the arms of the juniometer is read and recorded.
- The ideal range of motion for shoulder flexion movement is (0-170) degrees.

4- Measurement name: Range of motion of the shoulder joint.

Purpose of measurement : Measuring the range of motion of the shoulder joint in the horizontal abduction movement.

Unit of measurement : Degree.

Used tools : Pen, sticky marking tool, juniometer, registration form.

Performance method : The tester sits with the arm bent at an angle of (90) degrees from the shoulder joint so that the palm of his hand is facing down and his arm is parallel to the surface of the ground.

- The arms of the juniometer are placed on the acromial process of the scapula.
- The tester moves his arm away from the body's bisecting line and in the transverse plane.
- The fixed arm of the juniometer is parallel to the top of the shoulder.
- The moving arm of the juniometer is parallel to the humerus.
- Movement is within the limits of pain.

Registration method: The angle achieved between the arms of the juniometer is read and recorded.

The ideal range of motion for shoulder flexion is (0-90) degrees.

5- Measurement name: Range of motion of the shoulder joint. (Klaus Buckup.2004):

Purpose of measurement : Measuring the range of motion of the shoulder joint in the horizontal adduction movement.

Unit of measurement : Degree.

Used tools : Pen, sticky marking tool, juniometer, registration form.

Performance method :

- The tester sits with the arm bent at a 90-degree angle from the shoulder joint so that the palm of his hand is down and his arm is parallel to the ground.
- The arms of the juniometer are placed on the acromial process of the scapula.
- The tester moves his arm inward, approaching the midline of the body and in the transverse plane.
- The fixed arm of the juniometer is parallel to the top of the shoulder.
- The arm is mobile Is the jaw meter parallel to the humerus?
- Movement is within the limits of pain.

Registration method:

- The angle achieved between the arms of the juniometer is read and recorded.
- The ideal range of motion for shoulder flexion is (0-45) degrees.
- Measurements of muscle strength of the shoulder joint:
- The muscle strength of the shoulder joint was measured in (5) different movements:

1- Name of measurement : Lateral pull to approximate the shoulder joint. (Klaus Buckup.2004):

Purpose of measurement : Measure the strength of the adductor muscles of the shoulder joint.

Unit of measurement: Kilogram.

Used tools : Auxiliary device (iron structure), dynamo meter device Portable digital hook (dyn), string, grip and registration form.

Performance method :

- The laboratory stands in the middle of the auxiliary device (iron structure).
- The dynamo meter is fixed at shoulder height.

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- The tester holds the dynamo meter handpiece with an outstretched arm.
- The tester slowly returns the arm to the starting position.
- The tester raises his arm forward and upward, and in the sagittal plane.
- The fixed arm of the joniometer is parallel to the humerus.
- Movement is within the limits of pain.

Registration method

Each tester gives (3) attempts and the best attempt is recorded.

2- Measurement name: Lateral pull to abduct the shoulder joint. (Klaus Buckup.2004):

Purpose of measurement: Measuring the strength of the abductor muscles of the shoulder joint.

Tools used: Auxiliary device (steel frame), portable digital dynamo meter (hook) (dyn), chain, grip and registration form.

Performance description:

- The laboratory stands in the middle of the auxiliary device (iron structure).
- The dynamo meter is fixed at shoulder level on the side opposite the injured side.
- The tester holds the dynamo meter in front of the chest with an outstretched arm.
- The laboratory pulls the dynamo meter to the lateral side of the body with a retracting motion.
- The tester slowly returns the arm to the starting position.

- Registration method

Each tester gives (3) attempts to record the best attempt.

3-Measurement name:- Pull up to raise the shoulder joint. (Klaus Buckup.2004):

Purpose of measurement: Measuring the strength of the levator muscles of the shoulder joint.

Tools used: Auxiliary device (steel frame), portable digital dynamo meter (hook) (dyn), chain, grip and registration form.

- Performance description:

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- The laboratory stands in the middle of the auxiliary device (iron structure).
- The dynamo meter is installed under the frame in front of the injured party.
- The tester holds the dynamo meter with a forward grip.
- The tester raises his outstretched arm as high as possible within pain limits.
- The tester slowly returns the arm to the starting position.
- Movement is within the limits of pain.

Registration:

Each tester gives (3) attempts to record the best attempt

4- Measurement name: Lateral downward pull of the shoulder joint. (Klaus Buckup.2004):

Purpose of measurement : Measuring the strength of the shoulder joint depressors.

Unit of measurement : Kilogram.

Used tools : Auxiliary device (steel frame), portable digital dynamo meter (hook) (dyn), chain, grip and registration form.

Performance method

- The dynamo meter is attached to the auxiliary device (iron structure) and in front of the laboratory on the affected side.
- The tester stands in the middle of the device (the iron structure) and holds the dynamo meter at shoulder level with an outstretched arm.
- The tester lowers his arm down as low as possible within pain limits.
- The tester slowly returns the arm to the starting position.

Registration method: Each tester gives (3) attempts to record the best attempt.

5- Measurement name: Forward pull (pulling movement of the shoulder). (Klaus Buckup.2004):

Purpose of measurement : Measure the strength of the pulling muscles of the shoulder joint.

Unit of measurement : Kilogram.

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Used tools : Auxiliary device (steel frame), portable digital dynamo meter (hook) (dyn), chain, grip and registration form.

Performance method

- The dynamo meter is attached to the auxiliary device (iron structure) in front of the laboratory.
- The tester holds the dynamo meter handpiece with an arm extended in front of the body.
- The tester pulls the device as far as possible within the pain limits.
- The tester slowly returns the arm to the starting position.

The exploratory experiment "is a mini-experiment of the main experiment, the purpose of which is either to reveal some scientific facts or to test the work to reveal the obstacles and negatives facing the implementation of the main experiment or for the purpose of training some cadres to assist in the work" (Kazim, 2015, p. 128). In order to find the best methods for implementing field research procedures, the researchers conducted a reconnaissance experiment on a group within the research community, the purpose of which is: (to ensure the validity of the devices and tools used in the research, to ensure the harmony of the assistant work team and their competence in conducting tests and recording the results, Identifying the times required to carry out tests, verifying the suitability of the place, identifying obstacles that may appear during performance and avoiding errors. After the procedures mentioned, the researchers conducted the main experiment by applying functional competency measurements, as well as photographing the research sample as they performed the rehabilitation exercises under study, on (Sunday), corresponding to (11/27/2023), in Al-Ghaith Hall, Baghdad/Al-Rusafa gym.

Results

Table 1. *shows the arithmetic means, their deviations, the skewness coefficient, the calculated (T) values, and the statistical significance of the pre- and post-tests for the first experimental group of the motor range test*

Variables	Group	Arithmetic mean	Standard deviation	F	FH	Calculated T value	Significance level value
First test	previous	135.250	4.573	14.750	4.479	3.293	0.046

	the next	150.000	7.348				
Second test	previous	26.500	3.696	12.750	3.966	3.215	0.049
	the next	39.250	9.776				
Third test	previous	44.500	9.882	11.750	1.973	5.953	0.009
	the next	56.250	7.500				
Fourth test	previous	54.500	9.882	11.750	2.839	4.138	0.026
	the next	66.250	6.291				
Fifth test	previous	24.000	3.915	5.000	0.408	12.247	0.001
	the next	29.000	3.366				

Table 2. *shows the arithmetic means, their deviations, the torsion coefficient, the calculated (T) values, and the statistical significance of the pre- and post-tests for the first experimental group to test muscle strength*

Variables	Group	Arithmetic mean	Standard deviation	F	FH	Calculated T value	Significance level value
First test	previous	10.750	6.291	4.250	1.314	3.232	0.048
	the next	15.000	8.717				
Second test	previous	9.250	4.573	3.250	0.478	6.789	0.007
	the next	12.500	5.000				
Third test	previous	18.500	3.316	5.500	0.645	8.521	0.003
	the next	24.000	4.320				
Fourth test	previous	15.500	4.654	3.000	0.816	7.348	0.005
	the next	18.500	5.446				
Fifth test	previous	11.000	2.160	4.250	0.629	6.755	0.007
	the next	15.250	1.258				

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Table 3. *shows the arithmetic means, their deviations, the skewness coefficient, the calculated T values, and the statistical significance of the pre- and post-tests for the second experimental group for the motor range test*

Variables	Group	Arithmetic mean	Standard deviation	F	FH	Calculated T value	Significance level value
First test	previous	143.000	6.782	24.500	2.466	9.933	0.002
	the next	167.500	8.660				
Second test	previous	28.800	2.833	27.700	3.009	9.204	0.003
	the next	56.500	7.895				
Third test	previous	47.255	9.839	26.745	0.855	31.266	0.000
	the next	74.000	10.893				
Fourth test	previous	60.200	8.945	21.677	5.921	7.321	0.005
	the next	81.877	7.453				
Fifth test	previous	24.057	3.729	11.802	1.229	9.597	0.002
	the next	35.860	2.784				

Table 4. *shows the arithmetic means, their deviations, the torsion coefficient, the calculated (T) values, and the statistical significance of the pre- and post-tests for the second experimental group for testing muscle strength*

Variables	Group	Arithmetic mean	Standard deviation	F	FH	Calculated T value	Significance level value
First test	previous	11.250	6.849	18.250	0.750	24.333	0.000
	the next	29.500	7.047				
Second test	previous	8.000	4.082	24.750	0.478	51.701	0.000
	the next	32.750	4.856				
Third test	previous	19.250	3.593	13.750	0.629	21.855	0.000
	the next	33.000	2.943				

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Fourth test	previous	14.500	4.203	9.000	1.471	6.114	0.009
	the next	23.500	6.557				
Fifth test	previous	11.750	2.362	8.750	1.250	7.000	0.006
	the next	20.500	1.000				

Table 5. *shows the arithmetic means, their deviations, the skewness coefficient, the calculated (T) values, and the statistical significance of the post-tests for the first and second experimental groups for the motor range test*

Variables	Group	Arithmetic mean	Standard deviation	F	FH	Calculated T value	Significance level value
First test	First experimental	150.000	7.348	17.500	5.678	3.082	0.022
	Experimental sec	167.500	8.660				
Second test	First experimental	39.250	9.776	17.250	6.283	2.745	0.033
	Second experimental	56.500	7.895				
Third test	First experimental	56.250	7.500	17.750	6.612	2.684	0.036
	Second experimental	74.000	10.893				
Fourth test	First experimental	66.250	6.291	15.727	4.876	3.204	0.018
	Experimental sec	81.877	7.453				
Fifth test	First experimental	29.000	3.366	6.860	2.184	3.140	0.020
	Second trial	35.860	2.784				

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Table 6. *shows the arithmetic means, their deviations, the torsion coefficient, the calculated (T) values, and the statistical significance of the post-tests for the first and second experimental groups for testing muscle strength*

Variables	Group	Arithmetic mean	Standard deviation	F	FH	Calculated T value	Significance level value
First test	First experimental	15.000	8.717	14.500	5.605	2.587	0.041
	empiricism second	29.500	7.047				
Second test	First experimental	12.500	5.000	12.000	3.785	3.170	0.019
	empiricism second	32.750	4.856				
Third test	First experimental	24.000	4.320	9.000	2.614	3.443	0.014
	Second experimental	33.000	2.943				
Fourth test	First experimental	18.500	5.446	10.500	3.989	2.632	0.039
	Second experimental	23.500	6.557				
Fifth test	First experimental	15.250	1.258	5.250	0.803	6.533	0.001
	Second experimental	20.500	1.000				

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Discussion

The findings of the study indicate a clear improvement in both motor range and muscle strength among the participants of the two experimental groups, with more pronounced development observed in the second experimental group. This suggests that the applied training programs had a significant positive influence on the development of functional and motor abilities related to flexibility and muscular performance.

The first experimental group demonstrated noticeable progress between the pre- and post-tests, reflecting the effectiveness of the applied training intervention in stimulating muscular and neuromuscular adaptations. The observed enhancements in motor range tests indicate improvements in joint flexibility, neuromuscular coordination, and muscle elasticity. Similarly, the gains in muscle strength tests suggest an increase in muscular endurance, recruitment efficiency, and synchronization of motor units, all of which are essential for improving functional performance. These findings align with previous research emphasizing the role of structured exercise programs in promoting muscular adaptation and movement efficiency (Behm & Chaouachi, 2011; Schoenfeld, 2010).

In contrast, the second experimental group exhibited greater improvements in both sets of tests when compared to the first group, indicating the superiority of the training protocol implemented with this group. This may be attributed to differences in training variables such as intensity, progression, and exercise type, which may have led to higher physiological and neuromuscular adaptation. The improvements observed in motor range can be linked to enhanced joint mobility and increased muscle-tendon extensibility, as supported by the principles of dynamic flexibility training (Magnusson et al., 1996). Furthermore, the considerable increase in muscle strength supports the notion that systematic overload and progressive resistance training lead to substantial gains in muscle fiber recruitment and cross-sectional area (Folland & Williams, 2007).

The post-test comparisons between the two experimental groups further reinforce these interpretations. The second group consistently outperformed the first group across all variables, suggesting that the applied method had a more substantial impact on both flexibility and strength development. This outcome highlights the importance of applying diverse and progressively loaded training programs that integrate both dynamic and strength-oriented exercises to achieve optimal improvement in physical performance.

Overall, the results emphasize that well-structured and systematically progressed training programs significantly contribute to enhancing motor range and muscular strength. These outcomes are consistent with established scientific evidence on the relationship between targeted

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physical training and functional adaptation, indicating that specific, individualized, and progressive exercise regimens are critical for maximizing performance outcomes (American College of Sports Medicine, 2021; Kraemer & Ratamess, 2004).

Conclusions

The results of the study indicate that the integrated rehabilitation program, which combined targeted rehabilitation exercises, nutritional supplementation, and the use of assistive tools, had a significant positive impact on the recovery of injured players. This comprehensive approach effectively facilitated the restoration of the anterior deltoid muscle’s functional capacity, bringing it as close as possible to its normal pre-injury state and enabling the athletes to safely and efficiently return to training and performance activities.

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A Rehabilitation Program for Correcting Lateral Deviation Resulting from Lumbar Disc Injuries in Young Wrestlers

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Abstract

Lumbar disc injuries are among the most common issues affecting young wrestlers, often leading to functional disorders of the spine, notably lateral deviation, which negatively impacts motor performance and physical balance. This study aims to design a rehabilitation program based on specialized therapeutic exercises intended to correct lateral deviation, enhance spinal efficiency, and reduce associated pain. The research was conducted on a sample of young wrestlers suffering from lumbar disc herniation accompanied by lateral deviation, who underwent a structured rehabilitation program over a specific period that included core strengthening exercises, balance improvement drills, and stretching and relaxation activities. The effectiveness of the program was evaluated through pre- and post-intervention measurements, assessing deviation angle, pain intensity, and physical performance level. The results revealed a marked improvement in the correction of lateral deviation, a reduction in pain levels, and an enhancement in physical performance, confirming the efficiency of the rehabilitation program in promoting spinal function and mitigating the effects of lumbar disc injuries. The study recommends adopting such programs within therapeutic plans for injured wrestlers to ensure their safe and rapid return to competitive sports.

Keywords: rehabilitation program, lumbar disc injury, lateral deviation, young wrestlers.

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Introduction

Sports injuries are among the major challenges faced by athletes in various sports, particularly in those involving direct physical contact, such as wrestling. Among these injuries, lumbar disc herniation is one of the most common conditions that has a direct impact on physical performance and the biomechanical efficiency of athletes, often resulting in issues related to stability and balance. One of the frequent complications associated with this condition is lateral deviation of posture, which can impair the athlete's ability to execute technical movements effectively, as well as affect motor performance quality and neuromuscular coordination. Wrestling, as a sport, requires high levels of strength, endurance, flexibility, and balance, in addition to an athlete's ability to control body positioning during combat. When a lumbar vertebral injury occurs, the wrestler's ability to maintain proper body alignment during training and competition is compromised, increasing the risk of secondary injuries due to movement asymmetry and biomechanical imbalance. Moreover, the lateral deviation caused by such injuries can result in excessive strain on the spinal muscles and ligaments, potentially leading to future health complications that affect the athlete's long-term career.

Given these challenges, there is a critical need to design a specialized rehabilitation program aimed at correcting the lateral deviation resulting from lumbar disc injuries among young wrestlers. Such a program should be based on well-established scientific principles derived from sports rehabilitation, biomechanics, and physiotherapy, focusing on strengthening the muscles surrounding the spine, improving motor balance, and enhancing flexibility of muscles and joint tissues. These elements collectively contribute to restoring postural stability and reducing the risk of recurrent injuries. Developing an appropriate rehabilitation program for young wrestlers also requires a precise understanding of the biomechanical demands and movement patterns involved in wrestling performance, as well as an assessment of how spinal injuries influence overall athletic efficiency. Therefore, this study seeks to present an effective rehabilitation model that can be incorporated into therapeutic and training programs for young wrestlers, enabling them to regain their functional abilities safely and efficiently, thereby improving performance and minimizing the risk of future injuries.

Wrestling as a sport faces substantial challenges due to injuries that occur during training or competition, particularly spinal injuries such as lumbar disc herniation, which can lead to serious complications affecting body stability and balance. One of the most notable consequences of this condition is lateral deviation, which hinders the athlete's ability to achieve optimal performance and impacts overall motor efficiency. Despite advancements in sports rehabilitation and physiotherapy methods, there remains a shortage of specialized programs specifically

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targeting lateral deviation caused by lumbar disc injuries in young wrestlers. Most existing rehabilitation approaches emphasize improving flexibility and reducing pain but often fail to directly address the structural postural deviations caused by the injury, leading to chronic issues that may hinder the athlete's long-term performance.

Accordingly, this study seeks to answer the central question: To what extent is a proposed rehabilitation program effective in correcting lateral deviation resulting from lumbar disc injuries among young wrestlers? Additionally, it aims to explore the impact of the rehabilitation program on enhancing motor and biomechanical performance and to assess the extent to which wrestlers respond to the program in terms of restoring balance, reducing pain, and improving movement quality.

The research was conducted on first-division young wrestling athletes as the human sample. The implementation period extended from January 5, 2025, to March 10, 2025, and the study was carried out at the Al-Riyada Rehabilitation Center for Sports Injuries in Baghdad.

Methodology

The experimental method was adopted as it is the most appropriate approach for addressing the research problem. The key advantage of the experimental method, compared to other scientific approaches, is its ability to control and regulate various factors affecting the research variables, as well as its capability to reveal causal relationships between causes and effects, enabling the formulation of scientific principles and theories (Ibrahim Abdel Khalek, 2001). Furthermore, the experimental method, in addition to advancing scientific research in the humanities and social sciences—including sports sciences—represents the most reliable way to address both practical and theoretical research problems (Mohamed Hassan Allawi, 1999).

Research Population and Sample

The research population consisted of young wrestlers suffering from lateral deviations due to lumbar disc herniation. The study sample included 12 athletes, whose conditions were diagnosed by a specialist physician in physical rehabilitation and physiotherapy, confirming the presence of lateral deviations associated with lumbar disc injuries.

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Data Collection Tools and Instruments

Data were collected using various methods to ensure accuracy and reliability:

- Sources: Both Arabic and international references were utilized.
- Measurements and Tests: Standardized tests were conducted.
- Test Recording Forms: Forms were used to document individual test results.

Equipment and Tools

- Posture Pro device for postural and alignment analysis.
- Swiss balls for stability and strengthening exercises.
- Light weights for controlled resistance training.

Research Tests

Spinal Flexibility Test (Forward Bending) (Helal et al., 2022): Designed to measure spinal flexibility using a sit-and-reach box with a measuring scale in centimeters. The participant sits with legs extended, reaches forward, and the maximum reach distance is recorded.

Lateral Deviation Measurement using Posture Pro (Hébert-Losier & Abd Rahman, 2018): The device measures spinal inclination, displacement of the head, shoulders, and pelvis, identifies muscular stress points, and provides angular deviation data as quantitative indicators. Reports include pre- and post-test images, pressure distribution maps, and numerical deviation values. These data are compared to evaluate improvement after the rehabilitation program.

Field Procedures

Pilot Study: A pilot trial was conducted on January 2, 2025, to familiarize the researcher with procedures, identify challenges, and verify the adequacy of tools and tests.

Pre-Tests: Conducted on January 5, 2025, prior to starting the rehabilitation program.

Rehabilitation Program: Implemented from January 10, 2025, to March 10, 2025, the program aimed to:

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- Reduce lateral deviation through postural correction and strengthening exercises.
- Improve muscular balance and redistribute spinal loads.
- Decrease lumbar vertebral stress and prevent further complications.

Program Structure: Sessions were held 3–4 times per week, each lasting 30–45 minutes, divided into four phases:

Weeks 1–2 (Preparatory Phase – Flexibility and Mobility): Focused on spinal flexibility and activation of supportive muscles. Exercises included side trunk stretches, Child's Pose, spinal twist stretches, glute bridges, and heel-to-toe walks. Baseline Posture Pro measurements were recorded.

Weeks 3–4 (Muscle Coordination and Core Strengthening): Emphasis on strengthening core muscles and restoring balance. Exercises included single-leg glute bridges, side planks, superman exercises, single-leg balance, and resistance band side steps. Posture Pro measurements were repeated after week 4; intensity was adjusted if improvement was below 15–20%.

Weeks 5–6 (Strength and Postural Stability Development): Focused on enhancing strength and dynamic balance. Exercises included glute bridges with resistance bands, side planks with leg lifts, back extensions on Swiss balls, high knee walks, and wall push exercises. Proper movement coordination was emphasized, and pain levels were monitored.

Weeks 7–8 (Final Strengthening and Postural Assessment): Targeted maximum postural stability. Exercises included dumbbell side bends, dynamic planks, overhead squats, and final back stretching routines. Posture Pro measurements were taken at the end of week 8 and compared to baseline. If lateral deviation correction did not reach 50–70%, the program was extended with adjusted intensity.

Post-Tests: Conducted on March 15, 2025, under the same conditions as the pre-tests to ensure consistency and reliability.

Statistical Analysis

Data were analyzed using arithmetic means, standard deviations, and paired sample t-tests to determine significant differences between pre- and post-test scores and assess the effectiveness of the rehabilitation program in correcting lateral deviation and enhancing spinal function.

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Results

Table 1. *Pre- and Post-Test Results for the Experimental Group*

Test	Pre-Test (Mean ± SD)	Post-Test (Mean ± SD)	Mean Difference	SD of Difference	Sig
Flexibility	15.4167 ± 0.51493	20.5000 ± 0.52223	6.75000	0.86603	0.000
Posture Pro	14.5000 ± 0.52223	7.7500 ± 0.45227	-5.08333	0.79296	0.000

Note: Significance level ≤ 0.05 with degrees of freedom (11)

Discussion

The results of the study revealed that the applied rehabilitation program had a significant positive effect on correcting lateral deviation resulting from lumbar disc injuries in young wrestlers. This improvement was reflected in the post-intervention measurements, which showed statistically significant differences between pre- and post-tests in favor of the post-test.

These findings indicate that the therapeutic exercises included in the program contributed to strengthening the muscles supporting the spine, enhancing balance and motor stability, which consequently reduced lateral deviation. This is consistent with the findings of Anderson et al. (2018), who emphasized that corrective and strengthening exercises targeting lumbar and lateral muscles play a crucial role in restoring muscular balance and mitigating deformities caused by disc herniation. Similarly, Abd Rahman (2020) noted that rehabilitation programs based on strengthening and balance exercises help reduce spinal problems in athletes.

The current results align with those of Smith et al. (2020), which demonstrated that rehabilitation programs incorporating balance and muscular stability exercises significantly improve spinal deviation in athletes with spinal injuries. Lee et al. (2019) also supported these findings, reporting that integrating therapeutic exercises into rehabilitation programs reduces pain and improves movement biomechanics, thereby assisting in correcting lateral deviation. In addition, Al-Mahdi (2019) confirmed that therapeutic exercises can enhance muscular balance and reduce postural deformities in injured athletes.

Factors Contributing to the Success of the Program

The effectiveness of the rehabilitation program in correcting lateral deviation can be attributed to several factors:

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Use of specialized exercises: The program focused on strengthening and stretching exercises, which enhanced lumbar stability and improved body alignment, as highlighted by Al-Harbi (2021).

Gradual progression of training loads: The program was designed progressively according to the severity of the injury and the athletes' endurance levels, promoting positive development without causing additional strain, as confirmed by Jones et al. (2017).

Integration of physiotherapy techniques: Techniques such as stretching, balance training, and therapeutic massage were incorporated, which have been recommended by several studies, including Al-Maghrabi (2022), emphasizing the role of therapeutic interventions in improving lumbar injury conditions.

Based on these findings, it is recommended to implement specialized rehabilitation programs in sports clubs to prevent and treat spinal injuries among athletes, particularly wrestlers who experience continuous lumbar stress. Similar rehabilitation programs can also be developed for other athletes experiencing comparable issues. According to Abu Zeid (2023), early intervention and ongoing rehabilitation can significantly reduce the risk of lumbar injury progression.

The results of this study reinforce the effectiveness of rehabilitation programs in improving spinal alignment and reducing lateral deviation caused by lumbar disc injuries. They also open the door for further research investigating the impact of rehabilitation programs on other musculoskeletal injuries in athletes. Future studies could focus on comparing the effects of different therapeutic programs on correcting lateral deviation and alleviating symptoms associated with lumbar injuries.

Conclusions

The rehabilitation program proved to be effective in correcting lateral deviation resulting from lumbar disc injuries in young wrestlers, contributing to improved spinal alignment and reduced functional impairments. The therapeutic exercises also decreased players' pain levels, enabling them to move more comfortably and efficiently. Additionally, the program enhanced physical performance and motor balance, positively influencing the athletes' ability to return to training and competitive activities. The results further indicate that early intervention through specialized rehabilitation programs can limit the progression of chronic injuries and mitigate their negative impact on athletes' sports careers. Strengthening core muscles and improving balance were shown to play a key role in preventing injury recurrence and reducing the likelihood of future complications.

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Recommendations

It is recommended to integrate specialized rehabilitation programs into the treatment and physical preparation plans for wrestlers, particularly those with lumbar disc injuries, to ensure proper recovery. Regular spinal assessments should be conducted to detect and address any functional impairments early, preventing further complications. Promoting sports education on spinal injury prevention is essential, raising awareness among coaches and athletes about the importance of therapeutic exercises and proper training techniques. Individualized rehabilitation programs should be developed, considering players' personal differences, to optimize correction of lateral deviations and enhance motor performance. Further studies are encouraged to examine the effects of various rehabilitation programs on spinal injuries in athletes, with a focus on other high-intensity sports. Finally, collaboration between medical teams and coaches should be strengthened to ensure the effective implementation of rehabilitation programs in a manner that aligns with the nature of injuries and the demands of athletic performance.

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