

The effect of neuromuscular training on improving some skill performances in basketball

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Abstract:

The aim of the recent study was to examine the effect of neuromuscular training on performance layup and free throw shots performance among female basketball students. Study sample was female students of physical education and sport sciences department (Age 20.21 ± 39.0) who volunteered to participate in this study. Thirty-seven female students participated in this study, where (21) female students were selected to be experimental group of neuromuscular exercises. A sample of (16) female students was used for the exploratory study from the original community. Results showed that neuromuscular exercises can improve the chosen basketball skills (free-throw and layup-shot shooting). The contribution of neuromuscular training in a positive way to the free-throw and layup-shooting skills.

Keywords: shooting, basketball, neuromuscular exercises.

Introduction

Neuromuscular training is defined as a combination of exercises that promote motor sensory function during physical performance in most sports (Sañudo et al., 2019), and Rogasch et al., 2009) considers that it is an integrative training program aimed at enhancing fitness and preventing the accumulation of neuromuscular fatigue residues, as well as improving the motor efficiency of working muscles.

Studies have shown that neuromuscular training improves responses between the nervous system and the muscular system, which activates muscles and their recruitment patterns and promotes compatibility and strength in athletes (Santos et al, 2021, Akbar, et al, 2022). In addition, studies have demonstrated that neuromuscular training can help athletes develop compatibility and balance, which are necessary to carry out complex motor tasks accurately and efficiently during various sporting activities in group games in particular, which can make the difference between success and failure in competitive sports (Pardos et al, 2021, Roso-Moliner et al, 2023

Neuromuscular training can also improve an athlete's ability to produce force quickly, known as Rate of Force Development. (RDF) which is critical in sports requiring explosive movements, such as jumping, jump and running where enhancing RFD through neuromuscular training can lead to significant improvements in athletic performance (Maffiuletti et al, 2016). Neuromuscular function affects an athlete's stamina and ability to resist fatigue during exercise for long periods,

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as the muscle nervous system continuously recruits muscle fibers to maintain continuity of effort allowing well-trained neuromuscular pathways to use energy efficiently and delay the appearance of fatigue and improve overall stamina. (Akbar et al, 2022, Jurasz et al, 2022)

Several studies have also shown that neuromuscular training can reduce the risk of injury especially in the lower limbs of the body (Bergeron et al, 2015 Schmidt et al, 2022). This was the conclusion of a study by Hadzovic et al., 2020, where researchers found that a program of neuromuscular exercises on knee injuries had led to improvements in motor balance, allergic abilities, balance and flexibility, as well as vital mechanical abilities related to anterior cruciate ligament injuries, which contributed to improved athletic performance among female basketball players.

Basketball is one of the most widespread group games in the world after football as it is a highly popular fan game between females and males alike. Playing basketball requires a lot of physical skills such as speed, strength, ability to change direction, balance, endurance and other fitness elements that contribute to an athlete's performance efficiency (Torres-Ronda et al, 2016, Sebastian Hernandez et al, 2018, Stojanović et al, 2018, Cherni et al, 2021.)

Many studies have addressed the impact of neuromuscular training on the skill and physical performance of basketball, where studies have shown that neuromuscular training programmers have significantly improved the vertical jumps of female basketball players (Benis; M. L. Russo; A. La Torre. 2014, Cherni et al, 2021, Kooroshfard et al 2022, Brini et al, 2023)

In a study of Noyes et al., 2015, to determine whether a sports training program could improve the indicators of neuromuscular performance of female high school basketball players, 57 female athletes between the ages of 14 and 17 were studied in a 6-week program at a rate of 3 days per week for approximately 90-120 minutes per session. Researchers have concluded that there has been a marked improvement in the jump test and maximum aerobic strength of high school basketball players.

Correction is a key skill in the basketball game, which directly contributes to the team's success. Effective shooting includes accurate correction, muscular compatibility and effective accuracy to guide the ball towards the basket. The ability to shoot from different distances and angles and in different playing situations is crucial to scoring points and winning games. Basketball correction requires the integration of multiple physiological mechanisms for optimal performance. In a study conducted by Bahmani et al. (2019), the importance of muscle strength and the consistency of its work in the efficiency and accuracy of correction performance were highlighted. The results revealed that elite basketball players showed superior muscle strength in the upper body, especially in the shoulders, forearms and wrists, directly affecting the accuracy of their correction. Furthermore, the researchers concluded that the correction process requires high muscle compatibility, including synergistic action of different muscle groups to generate the perfect force to push the ball towards the basket.

In a Canli study (Canli, 2019) assessing the impact of the 8-week neuromuscular training program on the motor and basketball skills selected by male basketball players before puberty, the study found that neuromuscular training has important effects on the motor and correction skills of male basketball players before puberty. Hence, it is clear that basketball correction depends on a complex interaction between the nervous system and the muscle system in order to improve the accuracy of basketball correction performance. Understanding the multifaceted role of basketball correction will help players, coaches and researchers develop effective training strategies and enhance overall performance on the field.

The researcher noted the low level of female students in peaceful correction and free throwing skills in basketball despite the efforts made in the teaching process and to ascertain that observation, reference was made to the results of two previous semesters education ", where the overall level of peaceful correction and free throwing skills was weak for most female students And this may be due to the use of only one method of education, which depends entirely on the teacher and the learner's role is to implement what he is asked to do strictly without thinking, Also, the non-use of various exercises with a thoughtful effect such as neuromuscular drills, which may contribute to improving students' skill performance And that's what led the researcher to use a set of neuromuscular exercises .

Research Objective:

-Identify the impact of neuromuscular workouts on the skill level of peaceful correction and free throwing skills of basketball course students

Search Assumptions:

-There are statistically significant differences between the mediums of tribal and post measurement of the research group in the skill level of peaceful correction skill in basketball in favor of dimensional measurement

-Statistical discrepancies between the averages of tribal and post measurement scores in the skill performance of the basketball free throw skill in favour of dimensional measurement

Search Terms:

Neuromuscular drills:

A set of enhanced exercises for unconscious motor responses by stimulating both incoming signals and central mechanisms responsible for dynamic joint control. (Risberg, Mork, Jenssen, & Holm, 2001)

Accuracy of correction:

Player's susceptibility to target by directing voluntary movements of working and corresponding muscles in the execution of movements in the direction required for target injury (Delimi et al., 2010)

Search Procedures:

-Research curriculum: The researcher used the one-set experimental curriculum to suit the type and nature of this research using tribal and postgraduate measurement.

-Areas of research:

Human Field: The research was applied to some female basketball course students

Spatial field: Gymnasium in the Department of Physical Education and Sports Sciences - Sultan Qaboos University.

Time field: First semester of the university year 2023-2024.

-Research society: Students of basketball course - Department of Physical Education and Sports Sciences - Sultan Qaboos University - for the university year (2023-2024)

-Sample research: The sample of the research was chosen in a deliberate manner from the original research community. 37 students were selected. 21 students were selected to apply the group of neuromuscular trainings. A sample was also used for the survey study from the original community of 16 students.

Procedures for the implementation of the study:

Implementation of the program: The training program lasted for six weeks at the rate of three units per week with a time of 45 minutes per training module. The implementation of the training program was selected on the basis of (Brini et al., 2023;Canli) 2019

Devices and tools used:

- Rastameter for Height Measurement - Medical Device for Weight Measurement - Computer to
- PhotoCell - Data Collection Form - Conquer
- Stopwatches - Core Basket

Tribal measurement: The researcher performed the tribal measurement of the research group between 7/9 and 11/9/2023.

Dimensional measurements: After the completion of the basic study, the dimensional measurement of the research group was carried out between 20/11 and 21/11/2023

Scientific transactions of tests (Validity - consistency)
 A- Physical Test Certification Coefficient:

Table (3)
 Differences between the distinctive group and the unmarked group in physical tests to find the factor of honesty

tests	Statistical Indicators	special group n = 8		Unmarked Group n = 8		The difference between the two averages	T	Validity
		mean	Std.division	mean	Std.division			
	Reaction speed (second time)(	0.34	0.07	0.59	0.18	0.25	**4.03	0.84
	agility	12.25	0.43	13.59	0.29	1.34	**6.43	0.92
	Speed 20 m (Time)(	3.43	0.09	3.94	0.11	0.50	**14.37	0.98
balance	Right Balance	53.75	6.94	12.37	10.91	41.37	**8.64	0.96
	Left Balance	59.87	0.35	20.87	10.10	39.00	**10.74	0.97
	Vertical jump	50.12	4.54	38.12	1.81	12.00	**7.05	0.94

* ** Significant at the 0.01 level = 2.97 * ** Significant at the 0.05 level = 2.14

Table No. (3) on differences between the distinctive group and the non-distinctive group in physical tests to find the factor of honesty shows that there are statistically significant differences at the level of (0.01) where the value was (v) calculated greater than the value of (v) tabular at the same level where the value was (v) The tabular of physical tests is limited to (4.03: 14.37). The factor of honesty is between (0.84: 0.97). This indicates the sincerity of the test under schedule.

Physical Test Stability Coefficient

: Table (4)

Differences between application and reapplication Physical tests to find the stability factor

tests	Statistic al Indicat ors	Practical		Re-Practical		The differ ence between the two average s	T	Validit y
		Mean	Std.divisi on	Mean	Std.divisi on			
Reaction speed (second time)(		0.46	0.19	0.48	0.18	0.01	1.00	0.96
agility		12.92	0.78	13.04	0.71	0.12	1.27	0.87
Speed 20 m (Time)(		3.69	0.28	3.77	0.28	0.08	1.59	0.73
balance	Right Bala nce	33.06	23.12	34.94	21.04	1.87	1.46	0.98
	Left Bala nce	40.37	21.09	41.75	19.27	1.37	1.74	0.99
Vertical jump		44.12	7.01	45.43	6.47	1.31	1.42	0.85

** Significant at the 0.01 level = 2.95*

Significant at level 0.05 = 2.13

It is clear from Table No. (4), which concerns the differences between application and reapplication in physical tests to find the reliability coefficient, that there are no statistically significant differences at the level (0.01), as the calculated (t) value was less than the tabulated (t) value, as the (t) value ranged The calculation for the physical tests ranged between (1.00: 1.74), and the reliability coefficient was between (0.73: 0.99), and this indicates the reliability of the test.

Validity and reliability coefficient of skill tests:

A- Validity coefficient of skill tests:

Table (5)

Differences between the distinguished group and the non-distinctive group in testing the peaceful shot skill and the free throw skill to find the validity coefficient

Statistical Indicators tests	special group n = 8		Unmarked Group n = 8		The difference between the two averages	T	Validity
	Mean	Std.division	Mean	Std.division			
Testing the skill of shooting a ladder	6.87	1.45	3.62	0.92	3.25	**4.33	0.85
Free throw skill test	5.37	1.06	1.62	0.74	3.75	*10.25*	0.97

**Significant at the 0.01 level = 2.97*

Significant at the level of 0.05 = 2.14

Table No. (5), which concerns the differences between the distinguished group and the non-distinctive group in testing the peaceful shot skill and the free throw skill to find the honesty factor, that there are statistically significant differences at the level (0.01), where the calculated (t) value was greater than the (t) value. The tabular value is at the same level, where the tabular T value for the ladder shot skill test was 4.33 and the validity coefficient was 0.85, and the T value for the free throw skill questionnaire was 10.25, and the honesty coefficient was 0.97. This indicates the validity of the tests in the table.

B- Reliability coefficient of skill tests:

Table (6)

Differences between application and re-application in testing the ladder shot skill and free throw skill to find the reliability coefficient n = 16

Statistical Indicators tests	special group n = 8		Unmarked Group n = 8		The difference between the two averages	T Mean	Validity
	Mean	Std.division	Mean	Std.division			
Testing the skill of shooting a ladder	5.25	2.05	5.50	2.09	0.25	0.94	0.87
Free throw skill test	3.50	2.13	3.87	1.89	0.37	1.46	0.88

**Significant at the 0.01 level = 2.95*

Significant at level 0.05 = 2.13

Table No. (6), which concerns the differences between application and reapplication in the performance accuracy test and the performance level assessment form for the skill of scrolling forward and upward to find the reliability coefficient, that there are no statistically significant differences at the level of (0.01), as the calculated (t) value was less than the (t) value. T

Tabulation, the reliability coefficient was 0.87, and the value of (T) in the free throw skill test was 0.88, and this indicates the reliability of the test.

Homogeneity of the study sample:

A- Basic variables (age - height – weight)

Table (1)

Statistical description of the research group in basic variables before the experiment

Variables	Statistical significance of characterization			
	Mean	median	std deviation	Skewness
age	20.09	20	0.83	2.12
height	159.09	160	4.88	0.953
Weight	54.25	54.70	6.07	0.230

Clear from Table No. (1), which relates to the statistical description of the research group, that there is no dispersion in the data, as the values of the skewness coefficient for the physical variables ranged between (-3, +3), which means that they fall under the moderate curve, which indicates the homogeneity of the sample members.

B- Physical tests

Table (2)

Statistical characterization of the research group in physical tests before the experiment

Variables	Statistical significance of characterization				
	Mean	median	std deviation	Skewness	
Reaction speed (second time)(	0.47	0.50	0.16	1.76
agility	12.94	13.00	0.68	-0.41	
Speed 20 m (Time)(	3.70	3.75	0.24	-0.12
balance	Right Balance	37.14	36.00	22.70	-0.37
	Left Balance	41.52	50.00	18.94	-0.52
Vertical jump	44.00	44.00	6.15	0.63	

Table No. (2) is based in particular on the statistical assignment to the research group because there is no correlation in the distinct data, as skewness trade-off values for the variables were reached between (-3, +3), which means that they fall below the moderate level, which indicates the integration of the sample.

C- Skill performance test

Table (7)

Statistical description of the experimental group in the ladder shot skill test and the free throw skill test Before the experiment

Variables	Statistical significance of characterization			
	Mean	median	std deviation	Skewness
Testing the skill of shooting a ladder	5.38	6.00	1.80	0.44
Free throw skill test	3.14	3.00	2.00	0.52

Table No. (7), which relates to the statistical description of the research group, that there is no dispersion in the data, as the values of the skewness coefficient for the physical variables ranged between (-3, +3), which means that they fall under the moderate curve, which indicates the homogeneity of the sample members.

Discussing the results of the first hypothesis:

The first hypothesis: - There are statistically significant differences between the average scores of the pre- and post-measurements in the skill performance of the ladder shot skill in basketball in favor of the post-measurement.

Table (8)

Significance of the differences between the average measurements (pre-post) and the percentage of improvement for the skill performance of the ladder shot skill in basketball in favor of the post measurement

Measurements Variables	Pre-measurement		Dimensional measurement		The difference between the two averages	t	Improve ment rate %
	Mean	Std. di vion	Mean	Stddivi on			
Testing the skill of shooting a ladder	5.38	1.80	7.24	1.13	1.85	**5.15	34.58

Table No. (8) Regarding the significance of the differences between the average measurements (pre-post) and the percentage of improvement for the skill performance of the ladder shot skill that there are significant differences in favor of the post measurement at the level of (0.01), where the calculated (t) value was greater than the (t) value. T) Tabular, and the percentage of improvement for the skills test was (34.58%).(

According to the studies, the researcher believes that neuromuscular training focuses on developing muscular strength, coordination, balance, and accuracy, both of which are necessary to implement precise shooting techniques and maintain effective shooting performance, as Preisel

et al. (2007) point out in a study to examine the effect of motivational training on participants' shooting performance in basketball. Those who received proprioceptive training had enhanced shooting accuracy and coordination compared to the control group. The researchers attribute this improvement to the precise sense of body position and movement that is achieved through training in neuromuscular exercises and through enhancing proprioceptive capabilities. The study proved that players can maintain a more stable aiming performance, which leads to improved performance results.

The results of the current study are consistent with the study of Hassan et al. (2023) in which an eight-week program, consisting of weight training, plyometric exercises, and core exercises, led to improvements in muscle strength and shooting accuracy in young basketball players.

In addition to a study conducted by Dugramasi et al. (2020) in which he evaluated the effects of a neuromuscular training program on the shooting accuracy of basketball players. The training program included exercises focused on improving shooting techniques, strengthening relevant muscle groups, and improving coordination between working muscles. The results indicated that participants who underwent neuromuscular training showed better accuracy in aiming compared to the control group, which supports the fact that training in neuromuscular exercises can enhance motor control and muscle coordination, which positively affects aiming performance.

Discussing the results of the second hypothesis:

The second hypothesis: - There are statistically significant differences between the average scores of the pre- and post-measurements in the skill performance of the free throw skill in basketball in favor of the post-measurement.

Table (9)

Significance of the differences between the average measurements (pre-post) and the percentage of improvement for the skill performance of the free throw skill in basketball in favor of the post measurement

Measurements Variables	Pre-measurement		Dimensional measurement		The difference between the two averages	t	Improve ment rate %
	Mean	Std.div ion	Mean	Stddivi on			
Free throw skill test	3.14	2.00	5.09	1.67	1.95	**3.80	62.10

Table No. (9) Regarding the significance of the differences between the average measurements (pre-post) and the percentage of improvement in the skill performance of the free throw skill that there are significant differences in favor of the post measurement at the level of (0.01), where the calculated (t) value was greater than the (t) value. T) Tabular and the percentage of improvement for the skill test was (62.10% (

In this regard, the researcher points out the effectiveness of neuromuscular training on the performance of free-throw shooting skills, as it confirms the results of a study conducted by Smith et al. (2018) to evaluate the effect of neuromuscular training for a period of 12 weeks on the

shooting performance of basketball players through a program that included balance, strength, and coordination exercises. . The results showed a noticeable improvement in the aiming accuracy of the participants compared to the control group.

Likewise, the results of the current study are consistent with Johnson et al.'s (2019) study on the effect of a 10-week plyometric training program on the shooting ability of young basketball players. The applied program included plyometric exercises and explosive movements aimed at enhancing muscle strength and coordination, and the results showed a noticeable improvement in the accuracy and speed of aiming in the plyometric training group compared to the control group.

In addition, Thompson et al. (2020) conducted a review of data collected through multiple studies on neuromuscular exercise training and shooting ability, where the analysis revealed a consistent positive effect of such training on shooting performance, noting improvements in shooting accuracy and range of agreement in shooting. Performing movements related to shooting. This is consistent with what was shown by an analysis of data from previous studies conducted by Brown and colleagues (2020) who concluded that neuromuscular exercise training led to significant improvements in shooting accuracy, shooting percentage, and overall shooting performance in basketball players across different age groups and skill levels.

The results of the current study are also consistent with the study of the results of Der McInnis et al. (2017), where the study investigated the effects of a neuromuscular training program on the ability to shoot a basketball and jump performance. The results showed a noticeable improvement in shooting accuracy, jumping height, and muscular strength among the participants after completing the training program. These improvements indicate that increased muscular strength and stability developed through neuromuscular training contribute to improved shooting efficiency.

Conclusions:

-There are significant differences between the pre and post measurements in favor of the post measurement for the research sample.

-A noticeable improvement in the free throw and free throw skills among the research sample in the post-measurement.

Recommendations:

Scientific evidence supports the positive effect of neuromuscular training on the shooting ability of basketball players.

-Integrating neuromuscular exercise training into the training system for basketball players to improve shooting performance and develop skill performance.

-Conduct more research on the effect of neuromuscular training in reducing the risk of injuries.

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