



Impact of Functional Strength Exercises on Core Muscles and the Level of Technical Performance of L-cross Skill on Rings

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Abstract

This research aims to identify the impact of functional strength exercises on core muscles and the level of technical performance of L-cross skill on the rings apparatus in gymnastics. The gymnastics team players at Qassim University, and the basic research sample included (10) players, while the exploratory study was conducted on a sample of players representing the original community and from outside the basic research sample. Its training loads, and the most important results were as follows, the percentage of improvement in the strength variable of the abdominal muscles was (39.8%), and the percentage of improvement in the variable of strength of the back muscles was (28.7%), and the percentage of improvement in the variable of strength of the muscles of the legs reached (25.3%), while the percentage of improvement in the fixed balance variable was (19.3%), and finally the percentage of improvement in the technical performance variable understudy was the skill L-cross (24.9%), and the researcher recommends using functional strength exercises to develop core muscular strength and level of technical performance of the L-cross skill on the rings apparatus in gymnastics.

Keywords

Functional strength, Core muscles, L-cross skill, Rings apparatus, Gymnastics

Introduction and Research Problem:

Sports training science is concerned with the manufacture of the sports champion through the comprehensive preparation of the player to reach the highest possible level for each component of the training situation, with the aim of reaching the sports format, so the coach has become required to follow up on everything that is modern in the field of sports training and on an ongoing basis in order to be able to provide the best Possible results (Al-Hadi, A. 2016: 17)

Sports training methods have achieved a clear leap in various sports fields with their individual and team competitions, as it aims to reach the player to the best sports levels. Upgrading the player's level depends primarily on the physical aspect, which is the basis of the player's training status. (Abdel-Baseer, A. 2008: 179)

Method of training for the development of physical attributes is preferable to be appropriate for the type of muscle work, in order to raise the physical level of the player to the maximum extent permitted by his abilities through the development of physical attributes that are the basic rule that It is based on the processes of mastering and achieving high levels of technical performance. (Schultz,

G. W. 2017: 84); (Baumgartner, T. A., & Jackson, S.J. 2012: 54)

Functional strength training is one of the advanced and modern training methods in the sports field, as it is unconventional. (Jones, R. 2003: 12)

Functional strength training is a combination of strength and balance training carried out simultaneously, and that balance is a major component of functional training, and that some players practice functional strength training under the name of qualitative training, but functional exercises differ from training Specificity in that functional exercises focus on strengthening the muscles of the center, as the trunk is the origin of the movement. (Comana, F. 2004:7)

Exercises for the center muscles perform integrated movements, while qualitative exercises are performed on muscles specific to the nature of skill performance, in addition to that qualitative exercises are a major part of functional exercises. (Cunningham C. 2000: 86)

Functional strength training should be added to most training programs. (Gaines S. 2003: 54)

Strength of the core muscles works to transfer the force dynamically from the lower end to the upper end and back, as the legs are the origin and fulcrum from which the muscles of the arms derive the thrust, and the center muscles work to transfer the movement with the same speed and force to the upper limb with repetitive movements. (Faries, M. & Greenwood, M. 2007: 29); (Lukaski, H.C. 1996: 110)

Muscular strength and balance are among the main elements of functional training. The integration between muscular strength and balance results in functional strength. While the integration between muscular strength and kinetic speed results in muscular ability, therefore, training programs must include functional strength training. (Gaines, S. 2003: 9)

Functional strength exercises are integrated and multi-level movements (front, side, transverse), which include acceleration and deceleration as well as stabilization in order to develop the strength of the central muscles (abdominal muscles and back muscles), and these groups The muscles are completely connected to the spine and pelvis, and there must be a stable base to strengthen them, thus improving muscle strength and developing the kinetic ability of the body and limbs. (Ibrahim, R. 2009: 5)

Functional strength training consists of 3 main components: (core stability, core strength, and core power). (Boyle, M. 2004: 96)

Developing the strength of the core muscles in a balanced manner protects the player from injury, allows more control over skill performance, does not deviate the body from the required motor path, and makes optimum use of the exerted force and not waste it far On the requirements of technical performance, which means an economy in effort and a high level of achievement. (Abdelbaky, F. & Ibrahim A. 2014: 94)

One of these modern methods is functional strength exercises and its use within training programs to prepare

players physically and technically, given the importance of the role of groups. The muscles working in the center of the body (pelvis and trunk), and the extent of their contribution to the development of the physical, technical level, in addition to protecting the player from injuries. (Kibler et al., 2012: 190); (Jones, R. 2003: 114)

Gymnastics is characterized by the diversity of its equipment and skills, as there is a huge amount of gymnastics skills performed on each device, reaching the extent that knowledge of the technical design and the minute details of the performance of each skill constitutes a difficulty for workers in the field of gymnastics training. (Shehata, M. 2019: 294)

Artistic gymnastics competitions require a great variety of dynamic and static skills, with control of body positions against gravity, in addition to some skills that require strength and balance. (Atilgan, O. E. 2013: 16)

The group of strength and stability skills in gymnastics is one of the skill groups for each of the rings apparatus, parallel bars, and floor movements, and in light of this it becomes clear that there is a special importance for this group, as it contributes to the transmission of a positive impact of the uses of force on the rest of the gymnastics devices. It has all the levels of difficulty set by the international law of gymnastics, in addition to working on developing the performance of weights skills. (International Gymnastics Federation. 2020: 38)

In light of the latest amendments to the International Law of Gymnastics Arbitration, the motor skills on each device have been divided into five skill groups, with difficulty levels ranging from the lowest difficulty level (A) to the maximum difficulty level (G), with the exception of the Rings apparatus, where the skill levels were divided on a device. Throat in particular into six levels ranging from least difficulty (A) to maximum difficulty (F), meaning that each group has a level of difficulty. (International Gymnastics Federation. 2020: 39)

*Table (1)
Difficulty levels for skill performance on rings apparatus (6 levels)*

Difficulty	(A)	(B)	(C)	(D)	(E)	(F)
Value	1.1	1.2	1.3	1.4	1.5	1.6

The technical sentence on the throat device is divided in terms of installation into six skill groups, (skills that lead from pronation and swings, swing skills that end with standing on the hands, skills that lead from swings to movement stability by force, strength skills and stability movements, motor endings. (International Gymnastics Federation. 2020: 69)

The International Gymnastics Federation has obligated players to perform at least one skill from each group within the motor sentence to obtain (2.5 degrees) as a special requirement, at (0.5 degrees) for each group, and the

number of skills from each group within the motor sentence should not exceed (4 skills). The degree of difficulty is calculated based on the level of performance, so that it is calculated for the player with the highest (9 skills) in terms

of the level of difficulty in addition to the kinetic end that the International Gymnastics Federation required that it be of difficulty (D) at least. (**International Gymnastics Federation. 2020: 14**)

Through the researcher's work as an assistant professor in the Department of Physical Education and Movement Sciences - Qassim University, and technically responsible for the men's artistic gymnastics team at the same university, the researcher noticed a deficiency in the level of technical performance when implementing some strength and stability skills on rings apparatus, as the implementation of these skills depends on the strength of The Core Muscles, in addition to controlling the position of the body and balance, which requires the player to exploit the functional strength in implementing the skills under research in a correct technical manner, from here the research problem appeared, where the researcher noticed a varying defect in the players' ability to perform strength and stability skills The search, which negatively affects the player's total score on the rings apparatus.

Where the discounts for the formal errors of performance range between (0.1 - 0.3 - 0.5) of the degree according to the type of error, and the opponent may reach (1 full degree) in case the player loses his balance and falls from the apparatus. The researcher noticed the repeated technical mistakes of the players on the rings apparatus, including the technical skills under research, and this became clear through competitive evaluation positions, and the researcher assumes that this problem is due to the players' lack of functional strength of the core muscles, due to their importance in implementing the motor duty as required, which affects the level of technical performance of the skills under research.

Through the researcher's follow-up to the innovations in training methods and methods, the functional strength training method has recently emerged, which is a modern method of exercises aimed at developing the two components of muscle strength and balance together, by focusing on the core muscles, which are the origin of movement, and it is important to use This method of exercises is part of the training programs to prepare the players physically and technically, given the importance of the role of the muscle groups working in the center of the body (pelvis and trunk), and the extent of their contribution to the development of the physical and skill level, in addition to protecting the player from injuries.

By reviewing the researcher's studies related to gymnastics, the researcher noticed a dearth of functional strength training programs, especially on the rings apparatus, which requires conducting an experimental study as an attempt to develop the level of technical performance of the players understudy on the rings apparatus.

Therefore, the researcher resorted to designing and codifying a set of functional strength training exercises, to

identify their impact on developing the muscles of the center and the level of technical performance of the skill L-cross on the rings apparatus, and thus raising the scores of the players understudy.

Research Goals:

Identifying the impact of functional strength exercises on the level of technical performance on the rings apparatus in gymnastics for the members of the research sample, through:

- Developing the level of some physical variables for the members of the sample understudy.
- Developing the level of technical performance of L-cross skill on the rings apparatus understudy.

Research Hypothesis:

- There are statistically significant differences between the pre and post measurements of the experimental group in the physical variables understudy in favor of the post measurement.
- There are statistically significant differences between the pre and post measurements of the experimental group in the level of technical performance of L-cross skill on the rings apparatus understudy in favor of the post measurement.

Research Terms:

- **Functional Strength Exercises**
A modern method of exercises aimed at developing both muscular strength and balance, by focusing on the core muscles, which are the source of movement. (**Abu Zaid, Y. 2019: 231**)
- **Functional strength exercises features**
functional strength training is characterized by the most important characteristics:
 - Focus on the core muscles: Core Muscles are the abdominal muscles and the back muscles. The strong core muscles help connect the lower end to the upper and vice versa.
 - Controlling Body Balance: Multi-level skills require balance. Balance improves skill performance and the resulting sense of strength. Where the player spends a long time under the influence of gravity, so the focus should be on the main stabilizing muscles located in the center of the body.
 - Qualitative performance: It is important to understand the technical performance requirements of the specialized sports activity.
 - Qualitative speed: To achieve speed of performance, training must be fast, and to achieve control and stability, training must be slow.
 - Multiple joints: Emphasis should be placed on using more than one joint, rather than one joint. (**Schmitz, D. 2003: 36**)

Research Procedures:

- **Research Methodology:**

The researcher used the experimental method using the experimental design of one group and by making the two measurements (pre-post).

measurement was conducted on Saturday, corresponding to 28/8/2021.

- **Spatial Domain:** gymnastics hall - halls complex at Qassim University - Buraidah City - Kingdom of Saudi Arabia.
- **Time Domain:** The exploratory study was conducted in the time period from Sunday 23/5/2021 to Sunday 30/5/2021, and the pre-measurement was conducted on Monday, 31/5/2021. The basic study was carried out during the period from Tuesday, corresponding to 1/6/2021, until Thursday, corresponding to 26/8/2021, and the post-

- **Research Sample:**

The sample of the basic study was chosen intentionally from the gymnastics team players at Qassim University, and the sample included (10) players, while the exploratory study was conducted on a sample of players representing the original community and from outside the basic research sample, and their number reached (10) players who were chosen randomly with the aim of selecting suitable functional strength exercises related to the technical skill understudy, and codify the training load of these exercises.

Statistical description of sample

Table (2)
*Statistical description of growth rates variables
(Height - Weight - Age - Training Age)
(n=10)*

		Statistical data Variables	measuring unit	Mean	standard deviation	Median	Coefficient of torsion
Growth rates	1	Tall	cm	169.6	1.71	169.5	0.175
	2	Weight	Kg	66.52	1.93	66.8	- 0.435
	3	Age	Year	19.32	0.69	19.15	0.734
	4	Training age	Year	14.09	1.43	14.25	- 0.335

From Table (2) it is clear that the values of the torsion coefficient for each of the growth rates variables understudy ranged between (-0435, 0.734) and these values were limited between (± 3) which indicates the moderation of the values of the growth rates of the individuals in the sample understudy before experimenting.

Table (3)
*Statistical description of physical & technical variables
(n = 10)*

Variables	Test	measuring unit	Mean	standard deviation	Median	Coefficient of torsion
Functional strength	Abs strength	s	23.1	2.84	22.5	0.632
	Back strength	Kg	139.7	2.301	139.5	0.181
	Legs strength	Kg	137.6	3.533	137.5	0.084
Static Balance	Stork Stand	s	17.86	1.104	17.8	0.027
Technical performance	L-cross skill	degree	6.62	0.43	6.65	- 0.209

From Table (3) it is clear that the values of the torsional coefficient for each of the physical variables understudy ranged between (- 0.209, 0.632) and these values were limited between (± 3) which indicates the moderation of the values for the physical & technical variables of the sample individuals understudy before experimenting.

Means of data collection:

The researcher used the following methods to collect data:

- Means of collecting data related to physical variables
- Means of collecting anthropometric data.
- Means of collecting technical performance level data understudy.

Means of collecting data on the physical variables understudy:

Physical Variables Tests understudy attachment (5)

- Raising legs from lying down (Abs Strength test).
- Back muscular strength test (Dynamometer).
- Legs muscular strength test (Dynamometer).
- Stork Stand (Static Balance test)

Anthropometric data collection methods:

The means and tools for data collection that are appropriate to the nature of the study were identified by looking at the scientific references, research and previous studies in the field of gymnastics training and some other sports. The researcher has used the following tests, measures and devices:

- A rest-meter device for measuring the total length of the body up to the nearest 1 cm.
- The medical scale device to measure the student's weight up to the nearest 1 kg.

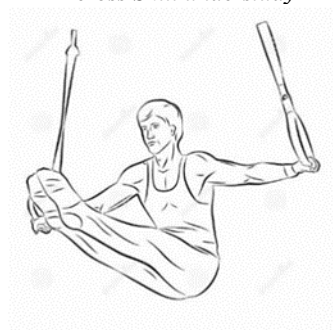
Means of collecting data on the technical performance level of the skills understudy:

The technical skill understudy was filmed using the "video camera" and the videos were shown to four arbitrators accredited by the Egyptian Gymnastics

Federation to evaluate the technical performance of the skills understudy, where each rule monitored a score of ten degrees for each technical skill of the high bar apparatus understudy, and was deleted The highest and lowest score for a player's score is the average of the two middles.

Subjective Evaluation is the type of evaluation that does not depend on the standards, levels, and criteria, but depends on the experiences of the measurers (arbitrators), and the legal evaluation is used in many of sports activities, especially gymnastics, diving, rhythmic gymnastics and water ballet, where uniform international legal conditions are established, agreed upon in advance between the arbitrators, so that the greatest degree of objectivity can be reached in assessing the degree. (Khalil, M. 2020: 9); (Hassanein, M. 2015: 42)

Figure (1)
L-cross Skill understudy



Selecting the assistants:

A number of (2) assistants from the Department of Physical Education and Kinesiology were chosen to assist the researcher in applying the study procedures.

The Exploratory Study:

The researcher conducted the exploratory study in the time period from Sunday 23/5/2021, to Sunday 30/5/2021, on a sample of players representing the original community and from outside the main research sample, and their number reached (10) players who were chosen by random method. Pre measurement was carried out on Monday, May 31, 2021.

This study has targeted:

- Ensure the safety of the devices and tools used

- Discovering and handling difficulties while making measurements.
- Training assistants to take measurements and ensure that tests are applied according to the specified conditions
- Selecting and experimenting with Functional strength exercises and their suitability for the technical skill understudy.
- Rationing of training load variables for Functional strength exercises understudy.
- Conducting scientific transactions for the tests used (validity and reliability) and ensuring their suitability for the research sample.
- Adjust the best angle of shooting with the camera to facilitate the process of assessing the technical performance of the skills understudy.

The Exploratory Study resulted in:

Ensure that all of its objectives are achieved, and that the suggested exercises understudy are appropriate for the nature of the sample age, as the members of the exploratory sample performed the suggested functional strength exercises without any difficulties, which made the researcher the possibility of applying these exercises to the individuals of the basic research sample.

• Scientific Transactions:

- Validity coefficient

The researcher calculated the validity coefficient using the method (honesty of differentiation), between two groups, one distinct and numbered (5) players, and the other non-distinguished number (5) players, from the same research community and from outside the basic research sample, in order to calculate the validity coefficient of the physical and technical tests understudy, as shown in Table No. (5)

Table (4)
Differentiation validity of physical and technical tests understudy

n1=n2=5

Variables		Test	Measuring unit	distinguished group		less distinguished group		difference mediocre	T test
				Mean	St.D.	Mean	St.D.		
Functional strength	1	Abs strength	s	25.40	1.816	20.80	1.303	4.60	4.600*
	2	Back strength	Kg	142.20	2.280	137.20	1.923	5.00	3.748*
	3	Legs strength	Kg	140.20	2.949	134.60	1.140	5.60	3.960*
Static Balance	4	Stork Stand	s	18.78	0.645	16.94	0.461	1.84	5.184*
Technical performance	5	L-cross skill	degree	6.96	0.207	6.28	0.294	0.68	4.217*

Tabular T value at a significant level of 0.05 = 1.860 on one side * = significant

It is clear from Table No. (4) and by applying the "T" test to calculate the significance of the differences between two independent groups, one distinguished and the other less -distinguished, that the calculated "T" value, which was limited to (3.748, 5.960), is greater than the tabular "T" value at a significant level. (0.05), which amounted to (1.860), which indicates that there are statistically significant differences between the two groups in favor of the distinguished group, which confirms the validity of the tests understudy in what they were designed to measure, and that they can differentiate between the distinguished and less -distinguished players of the same age group.

- Reliability Coefficient

The reliability coefficient was calculated using the method of applying and reapplying the test (Test - Retest), for the physical and technical tests understudy, the first application

of the tests was conducted on 23/5/2021 on a sample of (10) players. While the second application took place on 30/5/2021, with an interval of five days. And calculate the correlation coefficient between them, as shown in Table (6).

Table (5)
Reliability coefficient of physical and technical tests understudy

n=10

Variables		Test	Measuring unit	TEST		RE-TEST		Correlation Coefficient
				Mean	St.D.	Mean	St.D.	
Functional strength	1	Abs strength	s	23.10	2.84	23.40	2.71	0.979*
	2	Back strength	Kg	139.70	3.30	139.80	4.36	0.945*
	3	Legs strength	Kg	137.60	3.53	138.00	3.91	0.948*
Static Balance	4	Stork Stand	s	17.86	1.10	18.46	0.99	0.806*
Technical performance	5	L-cross skill	degree	6.62	0.43	6.67	0.40	0.991*

Tabular value "r" at the level of significance 0.05 = 0.564 on one side * = significant

It is clear from Table (5) that the values of "r" of physical and technical tests understudy ranged between (0.806, 0.991), which is greater than the tabular value of "r" at the level of significance (0.05), which amounted to (0.564), which indicates the existence of a relationship a statistically significant correlation between the Test & Re-test, which confirms the reliability of the tests understudy.

Basics of design the program**Suggested Functional Strength Exercises:**

The researcher applied a set of functional strength exercises attached (6) that correspond to the motor paths of the technical skill on the rings apparatus understudy. The exercises are divided into:

- 1- Functional strength exercises for Abs muscles.
- 2- Functional strength exercises for Back muscles.
- 3- Functional strength exercises for legs muscles.

• The researcher also took into account when designing these exercises, the following:

- It should contain the basic stages of the skill or some of its parts.
- Simulating the actual performance of skill in terms of strength, speed, direction of movement, and accuracy of performance.
- Codify the functional strength exercises to determine the maximum intensity for each exercise.

- Gradual exercises from easy to difficult and from simple to complex with its diversity.

• Training load variables for the proposed functional strength exercises:

The researcher has codified the training load variables for the proposed fitness functional strength exercises by reviewing previous and related studies, specialized references, sports training science references and the international information network. Attachment (7)

• Rationing of training load variables:

1- Intensity:

The researcher relied on calculating pulse rates to determine the intensity of the training load Using the Carvonein equation to calculate the Target Pulse Rate (TPR)

$TPR = \text{resting pulse rate} + \text{target load intensity} \times (\text{heart rate reserve})$

Table (6)
Intensity Percentage

load degrees	Percentage	Pulse Rate
Medium	50 : 74%	130 : 150 p/m
high	75 : 84%	150 : 170 p/m
Maximum	85 : 100 %	170: 200 p/m

2- Volume, (Repetitions – Sets):

Repetitions: The appropriate repetition for each player was determined by self-observation of the player while performing the exercise, It is the repetition after which a defect in performance begins Then determine the average of the repetitions to be the appropriate number of repetitions, Taking into account the skill level of the player, so that the stimulus period is sufficient to allow the movements to be performed correctly, without increasing the intensity to the degree that negatively affects the technical performance. (Abdel Maqsood, A., 2016: 183)

Sets: The researcher used the number of repetitions and appropriate rest time for each exercise to reach the maximum possible number of sets, after which the player could not perform the exercise correctly or did not control the speed of performance, thus we reach the maximum load

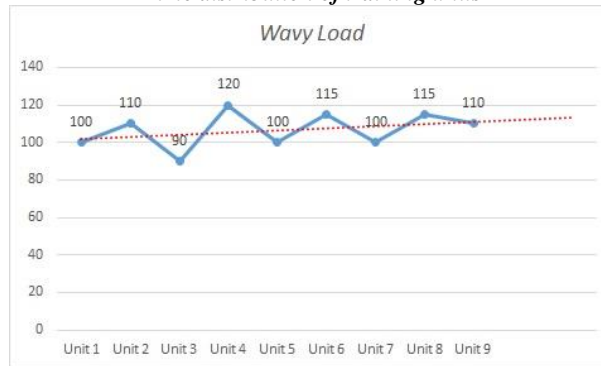
for each of the exercises and thus we get the total time to perform the exercise, the number of groups suitable for the goal of each exercise (3-4 sets).

3- Rest Periods: Determining the appropriate intermittent rest time after performance based on the pulse rate by calculating the time period during which the pulse rate reaches 110-120 pulse per minute. (Abdul-Basir A., 2018: 60)

Through the exploratory study, the appropriate time for the rest periods was determined, which amounted to (20-30 seconds).

Program Duration: The duration of the training program was (8 weeks), with 3 training units per week, The researcher determined the time of the training unit between (90: 120 minutes), taking into account the wavy load between the training units.

Figure (2)
Time distribution of training units



Training methods: The researcher used: (Interval training, Repetitive training, Circular training technique)

Training Load Cycle: Formation the training load cycle on the training units was chosen using the way of training load (1: 2), which means a medium load for one unit, followed by a high load in the following two units.

Basic study: The basic study was carried out during the period from Tuesday,1/6/2021, until Thursday, 26/8/2021, and the post-measurement was conducted on Saturday, 28/8/2021, and the pre and post technical performance was photographed at the gymnastics hall headquarters in the

halls complex. Sports at Qassim University. As shown in the schedule of the application of the research attached (10).

Statistical Treatments: The researcher used the program (Statistical Package for Social Sciences) (SPSS v25) Using the following statistical parameters:

Mean - Standard Deviation – Median - Torsional coefficient – Wilcoxon test - Percentage of improvement.

Presentation and discussion of the results:

Present the results:

Presenting the results of the first hypothesis:

Table (7)
Significance of the differences between the pre and post measurements for the experimental group in the physical variables

n = 10

Physical Variables	Test	Pre mean	Post mean	Positive ranks		Negative ranks		(Z) Value
				mean rank	Sum of ranks	mean rank	Sum of ranks	
Functional strength	1 Abs strength	23.20	32.30	5.5	55	0.00	0.00	-2.823*
	2 Back strength	139.70	179.80	5.5	55	0.00	0.00	-2.807*
	3 Legs strength	137.60	172.40	5.5	55	0.00	0.00	-2.805*
Static Balance	4 Stork Stand	17.86	21.16	5.5	55	0.00	0.00	-2.825*

* Tabular value (Z) at the level of 0.05 = ± 1.96

From Table (7) it is clear that the calculated value of (Z) for each of the physical variables understudy has ranged between (-2.825, -2.805) and these values are not limited to (± 1.96) which indicates the presence of statistically significant differences. between the mean of the pre-post measurements of the experimental group in favor of the post measurement at the level of significance (0.05) in the physical variables understudy.

Figure (3)
Significance of the differences between the pre and post measurements for the experimental group in the physical variables

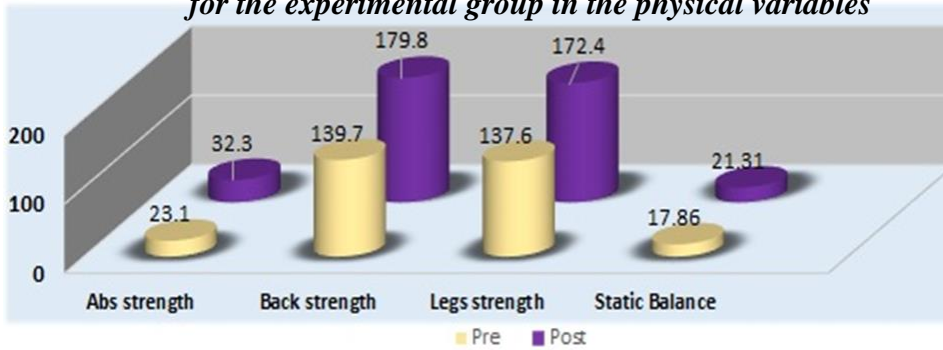
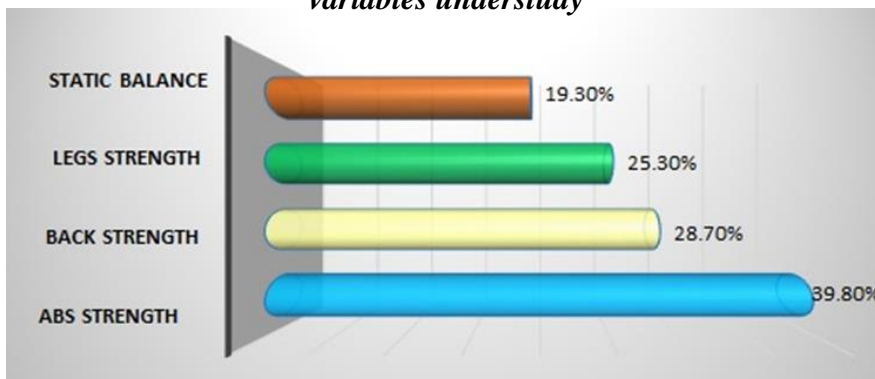


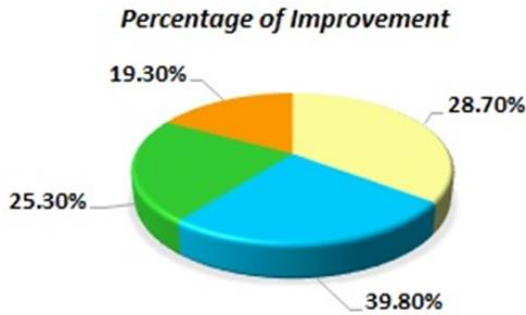
Table (8):
The percentage improvement of the experimental group in the physical variables understudy

Physical Variables		Test	Pre mean	Post mean	Difference between the two Means	Percentage of improvement
Functional strength	1	Abs strength	23.10	32.30	9.20	39.8%
	2	Back strength	139.70	179.80	40.10	28.7%
	3	Legs strength	137.60	172.40	34.80	25.3%
Static Balance	4	Stork Stand	17.86	21.16	3.45	19.3%

From Table (8) it is clear that the percentage of improvement of the experimental group in the physical variables understudy ranged between (19.3%, 39.8%) And the highest percentage of improvement was for the component of Abs muscles strength (Test of raising the legs from lying down) by (39.8%), and the lowest percentage of improvement was for the component of static balance by (19.3%), and the percentage of improvement of the rest of the elements ranged between them.

Figure (4)
The percentage improvement in the physical variables understudy





Presenting the results of the second hypothesis:

Table (9)
Significance of the differences between the pre and post measurements for the experimental group in the technical performance variable

n = 10

Technical Performance Variable	Skill	Pre mean	Post mean	Positive ranks		Negative ranks		(Z) Value
				mean rank	Sum of ranks	mean rank	Sum of ranks	
1	L-cross	6.62	8.27	5.5	55.0	0.00	0.00	-2.829*

* Tabular value (Z) at the level of 0.05 = ± 1.96

From Table No. (9) it is clear that the calculated value of (Z) for the technical performance variable understudy was (-2.829) and this value is not limited to (±1.96), which indicates that there are statistically significant differences between the mean of the pre-post measurements of the experimental group in favor of the post measurement at the level of significance (0.05) in the technical performance variable understudy

Figure (5)
Significance of the differences between the pre and post measurements for the experimental group in technical performance variable

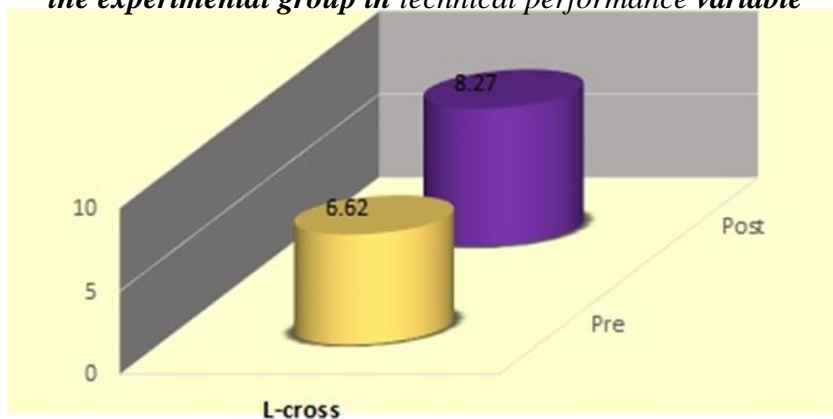
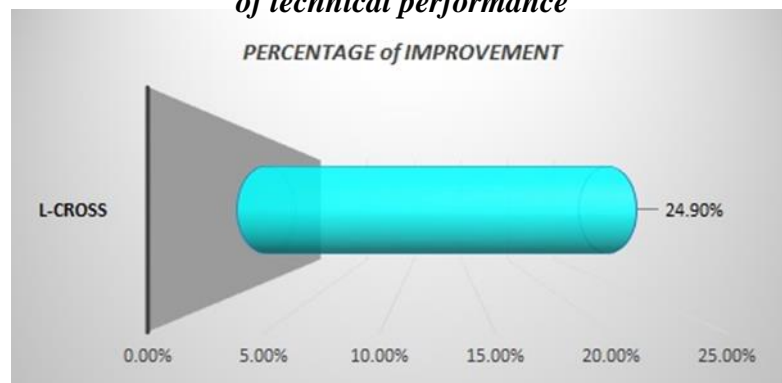


Table (10)
The percentage improvement of the experimental group
In technical performance variables

Technical Performance Variable	Skill	Pre mean	Post mean	Difference between the two Means	Percentage of improvement
	1	L-cross	6.62	8.27	1.65

From Table (10) it is clear that the percentage of improvement of the experimental group in the technical performance variable (L-cross skill) reached (24.9%).

Figure (6)
The percentage improvement in variable
of technical performance



Discuss the results:

Discussing the results of the first hypothesis:

Which states, "There are statistically significant differences between the pre and post measurements of the experimental group in the physical variables under study in favor of the post measurement."

It is clear from Table No. (7) and Figure No. (3) that there are statistically significant differences at the level (0.05) between the tribal and remote measurements of the experimental group in favor of the post measurement in the physical variables under study, where the tabular (Z) value was at the level of $0.05 = (\pm 1.96)$, while the calculated (Z) value for each of the physical variables under study ranged between (-2.805, -2.825) and that all of these values are less than (-1.96), meaning that they are not limited to between (± 1.96), which indicates the existence of statistically significant differences between the mean The pre- and post-measurements of the experimental group in favor of the post-measurement at the level of significance (0.05) in the variables of the physical variables under study. The researcher attributes these results to the impact of functional strength exercises used, and the regularity of training weekly at a rate of (3) training units per week.

It is also evident from Table No. (8) and Figure No. (4) that there are statistically significant differences between the pre and post measurements of the experimental group in favor of the post measurement in the physical variables under study, with an improvement rate ranging between (19.3%, 39.8%), where The average degrees of the Abs muscles strength variable in the pre measurement reached (23.10 kg), and it increased in the post measurement and reached (32.30 kg) with an improvement rate of (39.8%), while the average degrees of the back muscles strength variable in the pre measurement (139.70 kg) and it increased in the post measurement and reached (179.80 kg) with an improvement rate of (28.7%), and the average degrees of Legs muscular strength variable in the pre-measurement reached (137.60 kg) and increased in the post measurement and reached (172.40 kg). An improvement rate of (25.3%). While the average degrees of the static balance variable in the pre measurement reached (17.86 s), and increased in the post measurement and reached (21.16 s), with an improvement rate of (19.3%).

The researcher attributes the positive effect on the physical variables under study (Abs muscles strength, back muscles strength, legs muscles strength, in addition to static

balance) to the functional strength exercises used. Where the researcher took into account, during the design of the exercises, the diversity of muscular work trends, and the employment of the physical variables understudy in the motor pathways of the skill variable understudy, which contributed to the development of the physical fitness of the research sample members.

These results are in agreement with the results of the studies of (Zina, A. et al., 2021: 184); (Rushdi, S. 2021: 229); (Abdul Karim, S. 2021: 9); (Hassan, A. 2021: 1214); (Ismail, E. & Abdul Latif, S. 2020: 91); (Mosa, M. 2020: 737); (Wahdan, A. 2017: 167), which confirms the positive role of functional strength exercises in developing comprehensive physical fitness, as well as the balanced development of the core muscles, which increases the optimum use of the exerted strength.

Functional strength exercises are a combination of strength and balance training carried out simultaneously, and that balance is a major component of functional training, and that some players practice functional strength training under the name of qualitative exercises, but functional exercises differ from qualitative exercises in that functional exercises focus on strengthening the core muscles, as the torso is the source of movement. (Comana, F. 2004: 27)

It was evident from the improvement rates for the physical variables understudy, which ranged between (19.3%, 39.8%), where the researcher believes that these results are consistent with what was indicated by (Smits-Engelsman, B. C., et al., 2017: 327); (Martins, M. et al., 2016: 131); (Seiler, H., 2013: 51); (Carter, A. et al., 2007: 208), that the development of muscle strength for the limbs alone is not sufficient to achieve the optimum use of the functional strength of the body, but it is necessary to interest in developing the strength of the core muscles in order to prepare a comprehensive for the player, by employing strength and ease of transferring it from the center to the extremities.

The researcher also attributes these statistically significant differences between the mean pre and post measurements and the percentages of improvement in the physical variables understudy, to the positive impact of functional strength exercises and its inclusion of various exercises core muscles, which in turn led to an improvement in the physical variables understudy, and this is consistent with what was indicated (Labib, L., 2014: 104); (Newton, R., et al., 2006: 971); (Ives J., et al. 2003: 177); (Schmitz, D., et al. 2013: 36), that Functional strength exercises contributes to the development of core muscles strength, balance and other physical elements.

It was also evident from the improvement rate of the static balance variable, which amounted to (19.3%), and this is due to the selection of the appropriate functional exercises that target the muscles of the Core Muscles, focusing on and strengthening them during the standardized

training units, which led to the transmission of the training effect and the improvement of the player's ability to control the conditions of his body, and this is consistent with what was indicated by (Mustafa, R., 2020: 31); (Nabil, W., 2005: 20), that balance is one of the qualities that can be acquired by continuous training, by focusing exercises on nervous stimulation to control the body balance.

Based on the foregoing results, the first hypothesis that states: "There are statistically significant differences between the pre and post measurements of the experimental group in the physical variables understudy in favor of the post-measurement" has been achieved.

Discussing the results of the second hypothesis:

Which states, "There are statistically significant differences between the pre and post measurements of the experimental group in the level of technical performance of L-cross skill on the rings apparatus in gymnastics understudy in favor of the post measurement."

It is clear from Table No. (9) and Figure No. (5) that there are statistically significant differences at the level (0.05) between the pre and post measurements of the experimental group in favor of the post-measurement in the level of technical performance of L-cross skill on the rings apparatus understudy, where the tabular (Z) value was At the significance level of $0.05 = (+1.96)$, while the calculated value (Z) the technical performance variable understudy was (-2.829) , and that is less than (-1.96) , meaning that it is not limited between $(+1.96)$, which It indicates that there are statistically significant differences between the means of the pre and post measurements of the experimental group in favor of the post-measurement at the level of significance (0.05) in the technical performance variable of L-cross skill on the rings apparatus understudy.

It is also evident from Table (10) that the percentage of improvement in the technical performance variable (L-cross skill) reached (24.9%), and the researcher attributed this improvement to the positive effect of the functional strength exercises followed as shown in Attachment (6), where the researcher took into account during The design of the exercises varied the directions of muscular work, and the employment of physical variables in the motor paths of the technical skill understudy, which clearly contributed to the development of the skill level of the research sample members with significant improvement rates.

The researcher adds that the improvement in the level of technical performance of the L-cross skill on the rings apparatus understudy is due to the development of the strength of the core muscles (abdominal and back muscles), by carrying out various functional exercises that fit the motor path of the technical performance variable understudy, and in this regard (Schultz, G. W. 2017: 84) points out, that physical abilities development exercises are preferably suitable for the type of muscle work, in addition

to having a positive effect on the level of technical performance.

It is also evident from Table No. (10) and Figure No. (6) that there are statistically significant differences between the pre and post measurements of the experimental group in favor of the post-measurement in the level of technical performance of L-cross skill on the rings apparatus understudy, with an improvement rate of (24.9%). Where the researcher believes that these results are in agreement with the results of the studies of (Ismail, M. et al., 2021: 2); (Abdul Rahman, A. 2020: 35); (Abu Zaid, Y. 2019: 231); (Serry Y. 2017: 594); (Mustafa A. et al., 2003: 193), where he concluded that the development of the strength of the core muscles (abdominal muscles and back muscles) leads to muscular balance, which positively affects the level of technical performance in gymnastics.

The researcher also attributed these differences to the functional strength exercises understudy, which made the players more control over the different parts of the body during the motor duty, which contributed significantly to the development of skill performance, and these results are

Conclusions and Recommendations:

Conclusions:

Based on what the research results showed, and in light of the research goal and hypotheses, the researcher reached the following conclusions:

- **The proposed functional strength exercises have a positive impact on core muscles understudy, through:**

- The percentage of improvement in the physical variables understudy ranged between (19.3% and 39.8%).
- The average degrees of the abdominal muscles strength variable in the pre measurement reached (23.10 kg), and it increased in the post measurement and reached (32.30 kg) with an improvement rate of (39.8%).
- The average score of the back muscles strength variable in the pre-measurement was (139.70 kg), and it increased in the post-measurement and reached (179.80 kg) with an improvement rate of (28.7%).

consistent with the results of the studies of each (Monem, J., et al., 2016: 899); (Elbadry, N., 2014: 495); (Liu Hao 2012: 40), (Schmitz, D., et al. 2013: 37), as they agreed that standardized exercises work to raise physical efficiency And also the development in technical performance and the noticeable and rapid improvement in the performance of various gymnastics skills.

Based on the foregoing results, it is clear that the proposed functional strength exercises have a positive effect on the level of technical performance of L-cross skill on the rings apparatus understudy, by developing the strength of the core muscles and employing them as a requirement for skill performance.

Thus, the second hypothesis was fulfilled, which states: "There are statistically significant differences between the pre and post measurements of the experimental group in the level of technical performance of L-cross skill on the rings apparatus, in favor of the post-measurement."

- The average degrees of the leg muscles strength variable in the pre measurement reached (137.60 kg), and it increased in the post measurement and reached (172.40 kg), with an improvement rate of (25.3%).
- The average degrees of the static balance variable in the pre measurement reached (17.86 s), and it increased in the post measurement and reached (21.16 s), with an improvement rate of (19.3%).
- **The proposed functional strength training is effective on the technical variable of L-cross skill on the rings apparatus under consideration, through:**
- The average degrees of the technical performance variable of L-cross skill on the rings apparatus in the pre-measurement reached (6.62 degrees) and improved in the post-measurement reached (8.27 degrees), with an improvement rate of (24.9%).

Recommendations:

In light of the results of the research results and the conclusions reached, the researcher recommends the following:

- The application of functional strength exercises to develop the technical performance of L-cross skill on the rings apparatus.
- The combination of physical and skill exercises in proportion to the motor paths of the skills to be developed with the aim of comprehensive preparation of the player, to reach the highest level of achievement.
- Awareness of trainers of the importance and how to apply functional strength exercises, in proportion to the requirements of technical performance on each gymnastic apparatus.
- Applying functional strength exercises in the skill preparation phase and the competition period, to take maximum advantage of mastering the technical routine on the rings apparatus.
- The application of functional strength exercises on different gymnastics equipment, and on other age stages.

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