Influence of Swiss Ball Crunches on the Technical Performance of Swallow Skills on Rings for Under 14 Years-Old Gymnastics Team

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Abstract:

This research aims to identify the influence of swiss ball crunches on the technical performance of swallow skills on rings for under 14 years-old gymnastics team. The researcher used the experimental method for pre-post measurement of one group due to its suitability to the nature of the research. The research sample was chosen intentionally from gymnasts under (14) years-old in the following sports clubs: Al-Ahly Club and Tala'ea El-Geish Club, who are registered with the Egyptian Gymnastics Federation in the 2022/2023 training season. The basic research sample was (10) gymnasts, a number of other (10) gymnasts were chosen randomly as a sample for the exploratory study, representative of the original community and from outside the basic research sample, in order to select appropriate Swiss ball crunches related to swallow skills on rings understudy, and codifying the training load for these crunches. The most important results were as follows: The percentage of improvement in the muscular strength variables understudy ranged between (18.8% - 39.2%). and the highest percentage of improvement was for (muscular power of the abdominal muscles) by (39.2%), while the percentage of improvement for the technical variables ranged between (20.1% - 24.3%), and that the highest percentage of improvement was for the Inverted Swallow skill on rings, which reached (24.3%). The researcher recommends using Swiss ball crunches to develop muscular strength and technical performance of swallow skills on rings for under 14 years-old gymnastics team.

Keywords: Swiss ball crunches, Muscular strength, Swallow skills, Rings apparatus, Gymnastics

الملخص:

يهدف البحث إلى التعرف على تأثير تدريبات الكرة السويسرية على الأداء الفني لمهارات سواللوعلى جهاز الحلق لفريق الجمباز تحت 14 سنة، تم استخدام المنهج التجريبى باستخدام التصميم التجريبى للقياس القبلى البعدى لمجموعة واحدة لمناسبته لطبيعة البحث، تم اختيار عينة البحث الأساسية بالطريقة العمدية من ناشئى الجمباز تحت (14) سنة بالأندية الرياضية التالية :

النادى الأهلى ونادى طلائع الجيش ، والمسجلين بالإتحاد المصرى للجمباز في الموسم التدريبي 2023/2022 ، حيث بلغ حجم عينة البحث الأساسية (10) ناشئين، تم اختيارهم بالطريقة العمدية، كما تم إختيار عدد (١٠) ناشئين كعينة البحث الإستطلاعية، ممثلة للمجتمع الأصلي و من خارج عينة البحث الأساسية، تم اختيارهم بالطريقة العشوائية بهدف انتقاء تدريبات الكرة السويسرية المناسبة والمرتبطة بمهارات Swallow قيد البحث، وتقنين الحمل التدريبى الخاص بهذه التدريبات، و جاءت أهم النتائج كالتالى، تراوحت نسبة التحسن لمتغيرات القوة العضلية بين (18,8% ، 39,2%)، وأن أعلى نسبة للتحسن كانت لمتغير (القدرة العضلية لعضلات البطن) بمقدار (39.2%)، بينما تراوحت نسبة تحسن المتغيرات المهارية بين (20,1% ، 24,3%)، وأن أعلى نسبة للتحسن كانت لمهارة Inverted Swallow على جهاز الحلق حيث بلغت (24,3%)، ويوصى الباحث باستخدام تدريبات الكرة السويسرية لتطوير القوة العضلية ومستوى الأداء الفني لمهارات Swallow على جهاز الحلق لفريق الجمباز تحت 14 سنة.

الكلمات المفتاحية: تدريبات الكرة السويسرية – القوة العضلية - مهارات Swallow – جهاز الحلق – رياضة الجمباز.

Influence of Swiss Ball Crunches on the Technical Performance of Swallow Skills on Rings for Under 14 Years-Old Gymnastics Team

Introduction and Research Problem

Training process took a form, structure and organization consistent with the state of new development of methods and means used in the training process. Scientific and technical development has added many new and modern methods in a way that is compatible with the nature of the trainee's age group through the trainers' endeavor to choose the best and latest methods that are appropriate for the specialized activity. And the training age of the player, to raise the level of performance. **(Ayubovna, S., 2023: 338)**

Sports movement has developed rapidly and effectively over the past years, and this development has appeared through training programs that allow participants to develop their physical abilities, and this will only happen through continuous and effective sports training. **(Orunbayev, A., 2023: 39)**

Auxiliary devices and tools play an effective role in developing the level of technical performance of the gymnast through acquiring special physical fitness, developing the ability to carry out the required motor task, adding an element of suspense and breaking boredom during training, and improving some of the psychological characteristics associated with skill performance. **(Othman, S., 2023: 357)**

The development occurring in the technical performance of a gymnast depends on the progress of his physical abilities and the increase in performance requirements to obtain the highest achievements. Coaches must always notice the impact of this progress and its role in influencing the training and competition system. **(Abdel Basir, A., 2019: 123)**

Gymnast depends on his individual abilities to accomplish the skill task on the various gymnastics' equipment. Through practice, the gymnast is able to compare his performance with the level of another player's performance. Accordingly, the results in gymnastics are evaluated through competitions in accordance with the established legal rules. **(Shehata, M., 2017: 11)**

Physical preparation of the gymnast is considered an essential step, especially when developing the special physical fitness elements related to artistic performance, to work to raise the physical level of the player to the maximum extent permitted by his abilities so that he can master and achieve high levels of artistic performance. **(Alhady, A., 2016: 18)**

Auxiliary tools such as Swiss ball help the coach save time and effort. It also increases motivation and prevents boredom during training for players. It contributes significantly to develop physical abilities, for example, muscular strength, balance and coordination. **(Kumar, D., 2023: 261)**

Swiss ball permits a range of exercises that are based on the ability of the user to move with the motion of the ball while performing the exercise, using the ball to both supports the body during the movement as well as to provide a measure of resistance to the muscles employed in the movement. The classic Swiss ball exercises involve the abdominal muscles, with corresponding responses from the groin and the stabilizers of the lower back, the oblique muscles that run parallel to the spine above the pelvis. **(Judy, S., & Tamilarasi, K., 2023: 314)**

Swiss ball movements require a greater degree of coordination by the user than do conventional floor stretches. The Swiss ball also permits the execution of both static stretches (where the target body part is fully extended), as well as more demanding dynamic stretches, where the user directs force into or through the extended joint. **(Thevan, A., & Kalaiselvi, M., 2022: 6380)**

The athlete, positioned on top of the Swiss ball, can take the abdominals through a complete range of motion to strengthen the abdominals, twisting, where the upper body twists in opposite directions

during the movement to extend the muscular effect across the abdomen, and the flexion of the thoracic spine, the vertebrae of the mid-back to improve balance and overall flexibility. **(Singara, S., et al., 2023: 133)**

While a Swiss ball routine may have both aerobic and anaerobic benefits, depending on the intensity, duration, and the frequency with which the exercises are performed. **(Nuhmani, S., 2021: 9)**

Rings apparatus is considered one of the gymnastics apparatuses of a great privacy, due to its specificity in terms of its mechanical structure, as its rings are unstable, which requires a high degree of muscular strength and balance for the gymnast, to control the movement of the two rings, while performing stability or motor skills, and the skills have developed over the rings apparatus has developed significantly and its degree of difficulty has increased, which necessitated a similar development in the methods of training gymnasts. **(Yassin, A., 2019: 15)**

Through the latest amendments to the International Gymnastics Arbitration Code, motor skills on the rings apparatus have been divided into 4 skill groups, with difficulty levels ranging from the least difficulty level (A) to the maximum difficulty level (F). **(International Gymnastics Federation. 2022: 82)**

The gymnastics judging law stipulates that the exercise on the ring apparatus must include one movement at least the difficulty level (B) for each of the following skill groups:

Table (1)
Skill groups on rings apparatus (4 groups)

Groups	Elements
Groups 1	Kip and swing elements & swings through or to handstand
Groups 2	Strength elements and hold elements (2 sec.)
Groups 3	Swing to Strength hold elements (2 sec.).
Groups 4	Dismounts

(International Gymnastics Federation. 2022: 82 - 98)

Table (2)
Difficulty levels for skills on rings apparatus (6 levels)

Difficulty	(A)	(B)	(C)	(D)	(E)	(F) – (G) – (H)
Value	0.1	0.2	0.3	0.4	0.5	0.6 – 0.7 – 0.8

(International Gymnastics Federation. 2022: 82)

The International Gymnastics Federation has placed great importance on placing two independent movement groups for strength movements on

rings apparatus, out of a total of four groups, to control the structure of technical routine on rings apparatus, provided that the gymnast performs skills from all four skill groups. **(I.G.F., 2022: 81)**

In accordance with the rules of the local competitive organization for artistic gymnastics in Egypt issued by the Egyptian Gymnastics Federation (E.G.F), the technical committee for men's artistic gymnastics has established a competitive organization that includes several levels starting from the age stages under (7, 8, 9, 10, 11, 12, 13, 14, 15). The second class and the first class, is received by the clubs, including the technical conditions required for performance by preparing the players according to those conditions and qualifying them to participate in the competitions, provided that the evaluation of the players begins in the second class, first class competitions in accordance with the rules of the (I.G.F).

To improve technical performance in gymnastics, this requires the similarity between time direction of the motor forces represented by working muscle groups during the exercise along with its time direction during the technical performance of the skill, as well as in the positions that together constitute the final form of the movement.

From the above, it becomes clear the importance of each of the strength movements, in addition to the fact that it is possible to obtain improvement degrees when performing strength movements of difficulty (D, E), which confirms their importance for the gymnast when performing the artistic movement on rings apparatus, and during the performance of the strength movements the gymnast works against constant resistance. It is represented by the weight of his body while raising or lowering this weight and hold on. Therefore, the relationship of the player's weight, the direction and position of the body during the performance to the muscular strength exerted becomes of special importance that must be considered, which confirms the importance of developing this type of strength by using exercises similar to the nature of the motor performance of those skills.

Through the researcher's work as an assistant professor in the department of physical education and movement sciences - Qassim University, and the department of sports training at the faculty of physical education - Mansoura University, and through continuous communication with the technical staff of the Egyptian clubs understudy, the researcher noticed a deficiency in the level of technical performance of Swallow skill on rings understudy. The implementation of stability skills depends on overcoming the force of gravity and maintaining the correct anatomical position of the skill, which requires a sufficient amount of muscular

strength and balance. To accomplish the skills, the player must have the ability to integrate both elements in one framework, as a requirement for executing the motor task. This is done by using a method of muscular work similar to technical performance, and then implementing the skills understudy in a correct technical performance.

From here the research problem emerged, as the researcher used personal observation as a tool of data collection, relying on his training and refereeing experience that exceeded 25 years, where the researcher noticed a varying defect in the players' ability to perform Swallow skill on rings understudy, which negatively affects the player's overall score. Deductions for formal performance errors range between (0.1 - 0.3 - 0.5) of a grade depending on the type of error. The discount may also reach (1 full grade) in the event that the player loses his balance and falls while performing the basic technical stage of the skill and thus is unable to compete for a medal. The researcher also noticed the recurrence of technical errors by the players when executing Swallow skill on rings understudy, and this became clear through competitive evaluation situations. The researcher assumes that this problem is due to the players' lack of the ability to integrate the exerted muscular strength with the ability to the dynamic and static balance, due to its importance in executing the motor duty in the required technical performance, which affects the player's score.

Through the researcher's follow-up to the tremendous development in modern training methods, to develop special physical abilities as one of the basic requirements for the technical performance, the researcher believes that Swiss ball crunches can be used, as it is a training method that relies primarily on resisting the body's weight, it works to strengthen the core muscles by focusing on physical effort without weights. and this type of training is distinguished by it's in the same motor path for Swallow skill on rings understudy and with the same type of muscle work used when performing the motor task.

The researcher believes that raising the technical performance of players must be through standardized training programs, and the use of the latest exercises, such as Swiss ball crunches, which contribute to developing the players' performance, as they work to develop the physical abilities related to technical performance such as strength, balance, coordination, and develop muscle work towards motor performance similar to skill, also develop the level of performance, as the success of skill performance requires the development of special physical qualities. Special physical qualities do not appear separately when performing technical performances, as this contributes to developing the type and nature of the

work required in technical performance. This is what prompted the researcher to conduct a study targeting Swiss ball crunches, its influence on muscular strength and the technical performance of swallow skills on rings for under 14 years-old gymnastics team.

By reviewing the related studies in the field of gymnastics, the researcher noticed that there is a scarcity of training programs using Swiss ball crunches in gymnastics, especially on Swallow skill on rings understudy, which requires conducting an experimental study as an attempt to develop the level of technical performance of the players understudy. Therefore, the researcher resorted to designing and codifying a group of swiss ball crunches, to identify its influence on muscular strength, and the technical performance of swallow skills on rings understudy.

Research Aims:

The research aims are to identify the influence of swiss ball crunches on the technical performance of swallow skills on rings for under 14 years-old gymnastics team understudy. through research goals:

- Developing the muscular strength variables understudy.
- Developing the technical performance of swallow skills understudy.

Research Hypotheses:

- There are statistically significant differences between pre & post measurements of the experimental group in muscular strength variables understudy in favor of the post measurement.
- There are statistically significant differences between pre & post measurements of the experimental group in technical performance of Swallow skills understudy in favor of the post measurement.

Research Terms:

- **Swiss ball**

An exercise ball constructed of soft elastic with a diameter of approximately (35 – 85 cm) filled with air. The air pressure is changed by removing a valve stem and either filling with air or letting the ball deflate. It is most often used in physical therapy, athletic training and exercise. It can also be used for muscular training. The ball, while often referred to as a Swiss ball, is also known by a number of different names, including stability ball, balance ball, fitness ball, gym ball, gymnastic ball, physio ball, body ball, Swedish ball, therapy ball. Swiss ball is an ideal supplement to an existing training program, such as yoga or Pilates, which promote greater strength, Balance and flexibility in a safe and controlled physical setting. **(Thevan, A., & Kalaiselvi, M., 2022: 6380)**

- **crunches**

High-intensity exercises, with a motion that brings of the upper thighs and the sternum [breastbone] toward one another, to strengthen the abdominals); twisting crunches, where the upper body twists in opposite directions during the crunch to extend the muscular effect across the abdomen. **(Judy, S., & Tamilarasi, K., 2023: 314)**

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).
- **Spatial Domain:** Gymnastics hall - Al-Ahly Club and Talaie El-Geish Club - Cairo - Egypt.
- **Time Domain:** The exploratory study was conducted in the time period from Saturday, June 3, 2023 to Saturday, June 10, 2023, and the pre-measurement was conducted on Monday, June 12, 2023. The basic study was carried out during the period from Wednesday, June 14, 2023, until Monday, August 14,2023, and the post-measurement was conducted on Wednesday, August 16,2023.

- **Research Sample**: The researcher selected a number of (10) gymnasts intentionally selected from junior gymnasts under 14 years-old, who are registered with the Egyptian Gymnastics Federation in the 2022/2023 training season, as the main research sample, in the following sports clubs: Al-Ahly Club and Tala'ea El-Geish Club. A number of (10) junior gymnasts were selected randomly as the exploratory research sample, representative of the original community and outside the main research sample, with the aim of selecting appropriate Swiss ball exercises related to Swallow skill on rings understudy, and codifying the training load for these exercises.

  The researcher calculated the equivalence of the distribution of individuals in the research sample in growth rates (age - height - weight - training age), as well as the equivalence of the distribution of individuals in the research sample in the physical variables understudy, and also the level of technical performance of Swallow skill on rings apparatus for junior gymnasts under (14) years old, and it becomes clear This is done statistically through tables (1), (2), (3).

Statistical description of sample

Table (3)
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	151.1	2.23	151	0.134
	2	Weight	Kg	48.93	1.86	49.3	-0.596
	3	Age	Year	13.72	0.257	13.8	-0.932
	4	Training age	Year	9.81	0.213	9.8	0.140

From Table (3) it is clear that the values of the torsion coefficient for each of the growth rates variables understudy ranged between (-0.932, 0.140) 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 (4)
Statistical description of muscular strength variables

(n = 10)

Muscular Strength Variables	Test	Measuring unit	Mean	Standard deviation	Median	Coefficient of torsion
Grip strength	Dynamometer	Kg	36.7	1.888	36.5	0.317
Legs strength	Dynamometer	Kg	52.5	2.013	53.0	-0.744
Back strength	Dynamometer	Kg	48.1	2.078	47.5	0.865
Muscular Strength (Arms)	Pull Ups	reps	11.6	1.075	12	-1.116
Muscular Endurance (Arms)	Push the parallel bars	reps	13.2	1.032	13.0	0.580
Muscular Power (Abs)	Raise the legs from hanging on the bar	reps /15s	10.2	0.788	10	0.760

From Table (4) it is clear that the values of the coefficient of torsion for each of the muscular strength variables understudy ranged between (-0.744, 0.865) and these values were limited between (±3) which indicates the moderation of the values for the muscular strength variables of the sample individuals understudy before experimenting.

Table (5)
Statistical description of technical variables

(n = 10)

Technical variables		Measuring unit	Mean	Standard deviation	Median	Coefficient of torsion
1st skill	**Swallow** (Support scale at rings high)	degree	7.55	0.699	7.35	0.857

2nd skill	**Inverted Swallow** (Support scale at rings high)	degree	7.11	0.542	7.2	-0.497

From Table (5) it is clear that the values of coefficient of torsion for technical variables understudy ranged between (-0.497, 0.857) and these values were limited between (±3) which indicates the moderation of the values for 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 anthropometric measurements.
- Means of collecting data related to muscular strength variables understudy.
- Means of collecting data related to technical variables understudy.

Means of collecting data related to anthropometric measurements:

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 stadiometer device to measure the body tall up to the nearest 1cm.
- The medical scale device to measure the player's weight up to the nearest 1kg.

Means of collecting data related to muscular strength variables understudy:

muscular strength tests understudy attachment (5)

- Grip strength test (dynamometer).
- Legs muscular strength test (dynamometer).
- Back muscular strength test (dynamometer).
- Pull Ups test (to measure muscular strength of the arms muscles)
- Push the parallel bars test (to measure muscular endurance of arms muscles)
- Raise the legs from hanging on the bar (to measure muscular power of abs muscles)

(Allawi, M. & Radwan, M. 2017: 236); (Hassanein, M. 2015: 149)

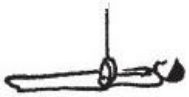
Means of collecting data related to technical variables.

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 skill understudy, each arbitrator puts a score of ten degrees for each technical

skill understudy, the highest and lowest score has been deleted so that the player's score is the average of the two middle scores.

Subjective Evaluation is the type of evaluation that does not depend on the standards, norms and criteria, but depends on the experiences of the measurers (arbitrators), subjective evaluation is used in many of sports activities, especially gymnastics, diving, rhythmic gymnastics and water ballet, where unified international legal conditions are set, agreed upon in advance between the arbitrators, in order to reach the greatest degree of objectivity in evaluating the degree. **(Khalil, M. 2020: 9); (Hassanein, M. 2015: 42)**

Table (6)
"Swallow" Skills understudy

Skills	**Swallow** (Support scale at rings high)	**Inverted Swallow** (Support scale at rings high)
		
Difficulty	D = 0.4	E = 0.5

(G.I.F. 2022: 86)

Selecting the assistants:

The researcher selected two assistant coaches, who are members of the technical staff of the two clubs understudy, as assistants, in order to assist the researcher in applying the research procedures.

The Exploratory Study:

The exploratory study was conducted in the time period from Saturday, June 3, 2023 to Saturday, June 10, 2023, on a sample of (10) gymnasts, randomly selected from junior gymnasts under 14 years-old, who are registered with the Egyptian Gymnastics Federation in the 2022/2023 training season, in the following sports clubs: Al-Ahly Club and Tala'ea El-Geish Club, representative of the original community and outside the main research sample, The pre-measurement was conducted on Monday, June 12, 2023.

This study has targeted:

- Ensure the safety of the proposed Swiss ball crunches.
- Training the assistants to take measurements and ensure that the tests are applied according to the specified conditions.

- Selection and experimenting Swiss ball crunches and their compatibility with the technical performance of "Swallow" skills understudy.
- Rationing of training load variables for the Swiss ball crunches understudy.
- Conducting scientific transactions for the tests used (validity and reliability) and ensuring their suitability to the research sample.
- Setting the best camera angle to facilitate the process of evaluating the technical performance of "Swallow" skills understudy.

The Exploratory Study resulted in:

Ensure that all of its objectives are achieved, and that the suggested Swiss ball crunches understudy is appropriate for the nature of the sample age, as the members of the exploratory sample performed the suggested Swiss ball crunches 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 (validity of differentiation), between two groups, one distinguished and numbered (5) players, and the other less -distinguished numbered (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. (7)

Table (7)
Differentiation validity of physical and technical tests understudy

n1=n2=5

Variables		Test	Measure unit	distinguished group		less distinguished group		Subtract averages	(T) value	(Z) value
				Mean	St.D.	Mean	St.D.			
Grip strength	1	Dynamometer	Kg	37.02	0.807	35.20	0.836	1.82	3.859 *	-2.023 *
Legs strength	2	Dynamometer	Kg	52.50	1.500	51.00	1.581	1.50	4.743 *	-2.060 *
Back strength	3	Dynamometer	Kg	49.24	1.123	46.40	0.894	2.84	5.790 *	-2.032 *
muscular Strength	4	Pull Ups	reps	12.80	0.836	10.80	0.836	2.00	4.472 *	-2.041

(Arms)										*
Muscular Endurance (Arms)	5	Push the parallel bars	reps	15.40	1.140	12.40	0.547	3.00	5.477 *	-2.041 *
Muscular Power (Abs)	6	Raise the legs from hanging on the bar	reps /15s	12.20	0.836	9.60	0.547	2.60	5.099 *	-2.032 *
1st skill	7	**Swallow** (Support scale at rings high)	degree	8.02	0.712	6.98	0.327	1.04	5.674 *	-2.032 *
2nd skill	8	**Inverted Swallow** (2 s.)	degree	7.38	0.083	6.66	0.320	0.72	5.308 *	-2.060 *

Tabular T value at a significant level of 0.05 = 1.860 on one side * = significant
***** Tabular value (Z) at the level of 0.05 = ± 1.96

It is clear from Table No. (7) 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" values, which ranged between (3.308, 5.790), are greater than the tabular "T" value at a significant level. (0.05), which amounted to (1.860). Also the calculated values of (Z) for the variables understudy have ranged between (-2.060 , -2.023) and these values are not limited to (± 1.96), 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 Saturday, June 3, 2023, on a sample of (10) players, while the second application took place on Saturday, June 10, 2023, with an interval of (6) days between the two applications. and calculate the correlation coefficient between them, as shown in Table (8).

Table (8)
Reliability coefficient of physical and technical tests understudy

n=10

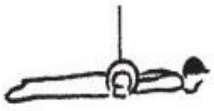
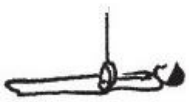
Variables		Test	Measure unit	TEST		RE-TEST		Correlation Coefficient (r)
				Mean	Std. D.	Mean	Std. D.	
Grip strength	1	Dynamometer	Kg	36.70	1.888	36.87	1.992	1.000*
Legs strength	2	Dynamometer	Kg	52.50	2.013	52.68	2.044	0.988*
Back strength	3	Dynamometer	Kg	48.10	2.079	48.310	2.020	0.985*
muscular Strength (Arms)	4	Pull Ups	reps	11.60	1.074	12.00	0.666	0.918*
Muscular Endurance (Arms)	5	Push the parallel bars	reps	13.20	1.032	13.80	1.135	0.906*
Muscular Power (Abs)	6	Raise the legs from hanging on the bar	reps /15s	10.20	0.788	10.90	0.875	0.852*
1st skill	7	**Swallow** (Support scale at rings high)	degree	7.55	0.699	7.69	0.701	0.951*
2nd skill	8	**Inverted Swallow** (2 s.)	degree	7.11	0.542	7.23	0.581	0.969*

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

It is clear from Table (8) that the values of “r” of physical and technical tests understudy ranged between (0.852, 1.000), which are 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**
- **Determine the working muscles through the performance requirements of Swallow skills understudy:**

Table (9)
Basic working muscles of Swallow skills understudy

Skills	 **Swallow** (Support scale at rings high)	 **Inverted Swallow** (Support scale at rings high)
working muscles	• eltoid muscle •	• eltoid muscle •

	riceps brachii • ip extensor muscles • luteus maximus • amstrings	riceps brachii • ip flexor muscles • bdominal muscles • uadriceps

(G.I.F. 2022: 86)

- **Suggested Swiss ball crunches:**

The researcher applied a group of Swiss ball crunches attachment (6) that correspond to the motor paths of the technical skills understudy. workouts are divided into:

1- Swiss ball crunches for arms muscles.
2- Swiss ball crunches for legs muscles.
3- Swiss ball crunches for Abs muscles.
4- Swiss ball crunches for back muscles.

The researcher also considered when designing these workouts, the following:

- Pay attention to the anatomical position of the body while performing exercises.
- It must contain the technical stages of the skill or some of its parts.
- Simulating the actual performance of skills in terms of the force exerted.
- Analyze Swiss ball crunches to determine the training load variables for each exercise.
- Gradual exercises, from easy to difficult, from simple to complex, with variety.

- **Training load variables for the proposed Swiss ball crunches:**

The researcher has codified the training load variables for the proposed Swiss ball crunches by reviewing previous and related studies, specialized references, sports training science references and the international information network. attachment (7)

- **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 = resting pulse rate + target load intensity x (heart rate reserve)

Table (10)
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

The researcher considered the gradual increase in the intensity through the gradual control of its variables, and the times of the training loads were organized and distributed over the training weeks and the appropriate degrees of load during the period of training application.

- **Volume, (Repetitions – Sets):**

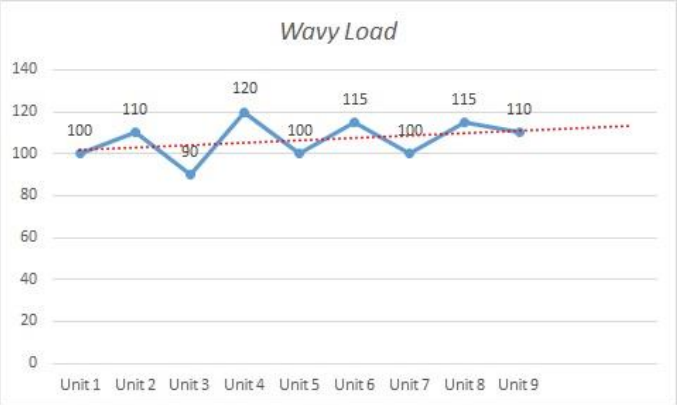
Swiss ball crunches were applied in the main part of the training unit, and the exercise performance time was for (20-30) seconds with high intensity, followed by (10-15) seconds of positive rest, and the exercise was repeated (3-5) sets, the time for performing 4 sets of each exercise reached (2) minutes, rest after each exercise, (1) minute in a session extending to (20-40) minutes.

- Rest Periods: Determining the appropriate intermittent rest time after performance based on Swiss ball crunches, the exercise performance time was for (20-30) seconds with high intensity, followed by (10-15) seconds of positive rest.

- **Swiss ball crunches duration:**

- The duration of Swiss ball crunches was (9 weeks), with 4 training units per week.
- The researcher determined the time of the training unit in the week with an average load between (90 - 120 min), considering the wavy load between the training units.
- The time of the duration of Swiss ball crunches within the training unit was on average (20-40) minutes. The load intensity used (medium, high and maximum).

Figure (1)
Wavy Load of training units



The distribution of training load degrees over the training weeks during the stages of the training program to the degree of the medium load between (50 -74%), the high load between (75 - 84%) and the maximum load between (85 - 100%).

- **Stages of applying Swiss ball crunches:**

Table (11)
Stages of applying Swiss ball crunches

Stages	Weeks	Units/ week	unit time	Load Cycle
1st stage	3	4	90 - 120 minutes	1 : 2
2nd stage	4			
3rd stage	2			

Training methods: The researcher used: High Intensity Interval Training.
Training Load Cycle: Formation the training load cycle on 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 Wednesday, June 14, 2023, until Monday, August 14,2023, and the post-measurement was conducted on Wednesday, August 16,2023, and the pre & post technical performance was filmed at the in the gymnastics hall of the following sports clubs, Al-Ahly Club and Talaie El-Geish Club. As shown in the time distribution table of research application, attachment (10).

Swiss ball crunches were applied to the main research sample in the physical preparation part of the training program, where the time of performing these exercises per week ranged between (80 - 160) minutes, for a period of (9) weeks, with (4) training units per week.

Table (12)
Axes of the Swiss ball crunches

Axes		Content	
1	program duration	9 weeks	
2	Number of training units in the program	36 training units	
3	Number of training units per week	4 training units	
4	training unit time	(90 - 120) minutes	average 105 minutes
5	Swiss ball crunches time in the training unit	(20-40) minutes	average 30 minutes
6	Total program time	3780 minutes	100%
7	General physical preparation time	1814.4 minutes	48% of the total time
8	Private physical preparation time	1161.2 minutes	64% of physical preparation
9	Swiss ball crunches time in the program	545.2 minutes	47% of private preparation
10	Technical preparation time in the program	1965.6 minutes	52% of the total time
11	Training load degrees used	Medium - High - Max	
12	Training load weekly cycle	(1 : 2)	
13	Number of Swiss ball crunches	(80) exercises	

Statistical Treatments: The researcher used the program (Statistical Package for Social Sciences) (SPSS v25) Using the following statistical parameters:
Mean - Standard Deviation - Correlation Coefficient - T test - Wilcoxon test - Improvement Percentage.

Presentation and discussion of the results:

Presentation the results:

Presenting results of first hypothesis:

Table (13)
Significance of differences between pre & post measurements for the experimental group in muscular strength variables understudy

n = 10

Muscular Strength Variables	Test		Measure unit	Pre mean	Post mean	Positive ranks		Negative ranks		(Z) Value
						Mean rank	Sum of ranks	Mean rank	Sum of ranks	
Grip strength	1	Dynamometer	Kg	36.70	43.60	5.5	55	0.00	0.00	-2.810 *
Legs strength	2	Dynamometer	Kg	52.50	64.80	5.5	55	0.00	0.00	-2.818 *
Back strength	3	Dynamometer	Kg	48.10	62.70	5.5	55	0.00	0.00	-2.814 *
muscular Strength (Arms)	4	Pull Ups	reps	11.60	14.70	5.5	55	0.00	0.00	-2.820 *
Muscular Endurance (Arms)	5	Push the parallel bars	reps	13.20	17.10	5.5	55	0.00	0.00	-2.831 *

Muscular Power (Abs)	6	Raise the legs from hanging on the bar	reps /15s	10.20	14.20	5.5	55	0.00	0.00	-2.820 *

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

From Table (13) it is clear that the calculated value of (Z) for each of the muscular strength variables understudy has ranged between (-2.831 , -2.810) 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 muscular strength variables understudy.

Figure (2)
Significance of differences between pre & post measurements of the experimental group in muscular strength variables understudy

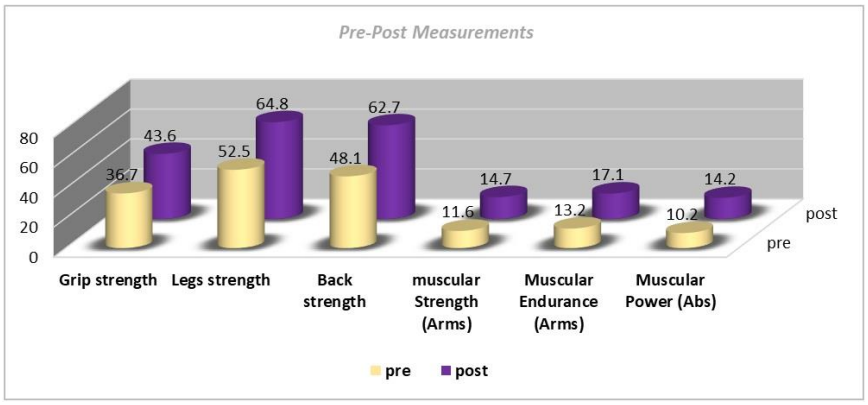


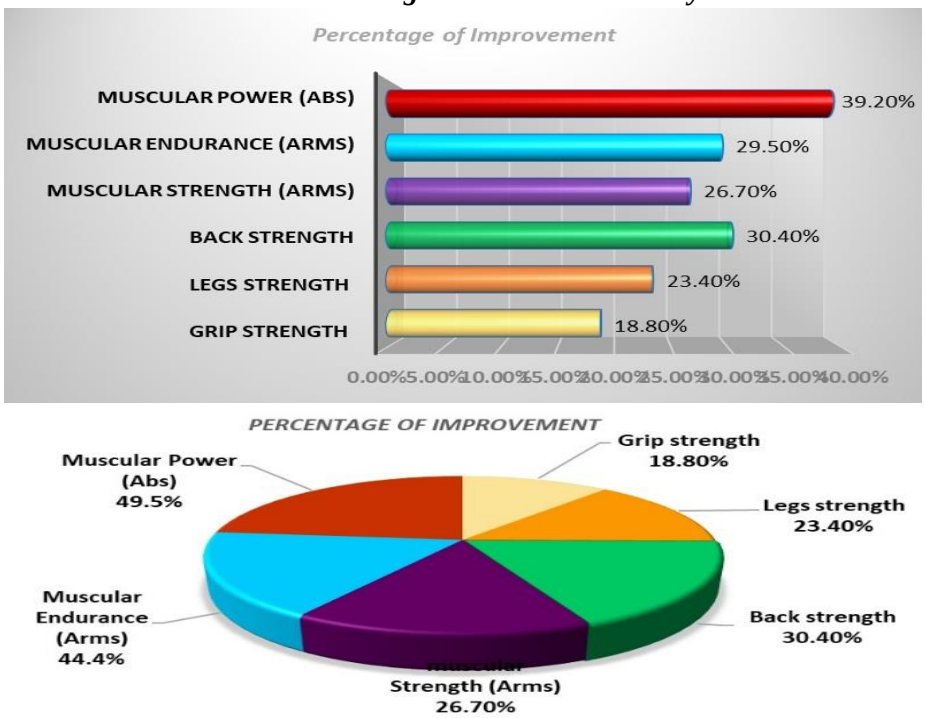
Table (14):
Improvement percentage of the experimental group in muscular strength variables understudy

Muscular Strength Variables	Test		Measure unit	Pre mean	Post mean	Means Difference	Improvement Percentage
Grip strength	1	Dynamometer	Kg	36.70	43.60	6.90	18.8%
Legs strength	2	Dynamometer	Kg	52.50	64.80	12.30	23.4%
Back strength	3	Dynamometer	Kg	48.10	62.70	14.60	30.4%
muscular Strength (Arms)	4	Pull Ups	reps	11.60	14.70	3.10	26.7%
Muscular Endurance (Arms)	5	Push the parallel bars	reps	13.20	17.10	3.90	29.5%
Muscular Power (Abs)	6	Raise the legs from hanging on the bar	reps /15s	10.20	14.20	4.00	39.2%

From Table (14) it is clear that the percentage of improvement of the experimental group in the muscular strength variables understudy

ranged between (18.8% , 39.2%) and the highest percentage of improvement was for the variable of abs muscular power by (39.2%), and the lowest percentage of improvement was for the variable of grip strength by (18.8%), and the percentage of improvement of the rest variables ranged between them.

Figure (3)
Improvement percentage in the muscular Strength variables understudy



Presenting results of second hypothesis:

Table (15)
Significance differences between pre & post measurements of the experimental group in technical variables understudy

n = 10

Technical Variables			Pre mean	Post mean	Positive ranks		Negative ranks		(Z) Value
					mean rank	Sum of ranks	mean rank	Sum of ranks	
1st skill	1	**Swallow** (Support scale at rings high)	7.55	9.07	5.5	55	0.00	0.00	-2.807 *
2rd skill	2	**Inverted Swallow** (2 s.)	7.11	8.840	5.5	55	0.00	0.00	-2.805 *

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

From Table (15) it is clear that the calculated value of (Z) for technical variables understudy have ranged between (-2.807, -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 technical variables understudy.

Figure (4)
Significance differences between pre & post measurements of the experimental group in technical variables understudy

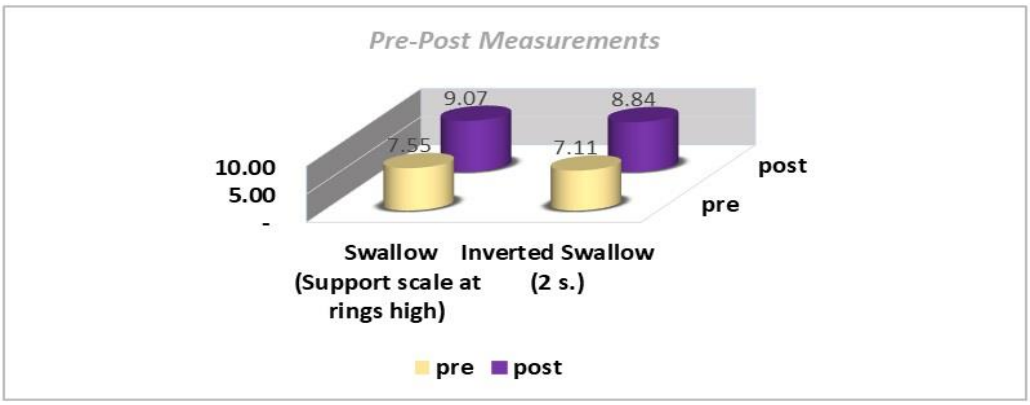


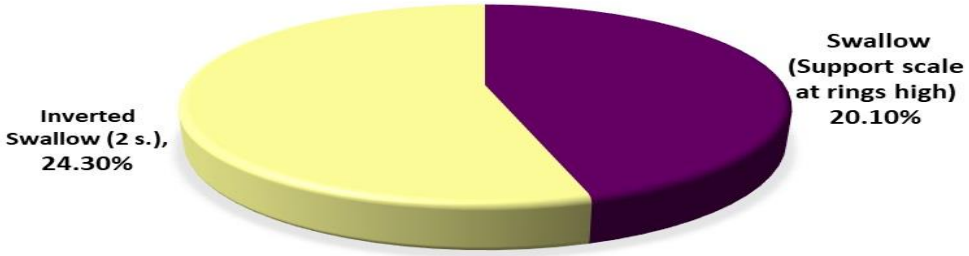
Table (16)
Improvement percentage of the experimental group in technical variables understudy

Technical Variables			Pre mean	Post mean	Means Difference	Improvement Percentage
1st skill	1	**Swallow** (Support scale at rings high)	7.55	9.07	1.52	20.1 %
2rd skill	2	**Inverted Swallow** (2 s.)	7.11	8.840	1.73	24.3 %

From Table (16) it is clear that, the improvement percentage of the experimental group in technical variables understudy ranged between (20.1%, 24.3%) and the highest percentage of improvement was for **Inverted Swallow** on rings by (24.3%), and the lowest percentage of improvement was for **Swallow** on rings understudy by (20.1%).

Figure (5)
Improvement percentage of the experimental group in technical variables understudy

PERCENTAGE OF IMPROVEMENT



Discussion the results:

Discussion results of first hypothesis:

Which states, "There are statistically significant differences between pre & post measurements of the experimental group in muscular strength variables understudy in favor of the post measurement."

It is clear from Table No. (13) and Figure No. (2) 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 muscular strength variables understudy, where the tabular (Z) value was at the level of 0.05 = (±1.96), while the calculated (Z) values for the muscular strength variables understudy ranged between (-2.831 , -2.810) and that all of these values are less than (-1.96), meaning that they are not limited between (± 1.96), which indicates the existence of statistically significant differences between the means of pre & post measurements of the experimental group in favor of the post-measurement at the level of significance (0.05) in muscular strength variables understudy. The researcher attributes these results to the effect of the Swiss ball crunches used, and the regularity of training weekly for a period of (9) weeks, at a rate of (4) training units per week.

It is also evident from Table No. (14) and Figure No. (3) that there are statistically significant differences between the pre and post measurements of the experimental group in favor of the post-measurement in muscular strength variables understudy, with percentage of improvement

that ranged between (18.8%, 39.2%) and the highest percentage of improvement was for the variable of abs muscular power by (39.2%), and the lowest percentage of improvement was for the variable of grip strength by (18.8%), and the percentage of improvement of the rest variables ranged between them.

In light of the previous improvement rates, it was found that the proposed Swiss ball crunches had positive influence on muscular strength variables understudy for the gymnasts, as Swiss ball crunches were characterized by specific goals and various and interesting methods that motivate the players, the researcher took into account the codifying the training loads according to the players' capabilities, considering the individual differences and gradation when implementing, adjusting rest periods to give the body's systems an opportunity to adapt, and applying the principle of privacy in training that takes into account the specificity of muscular work, the form and path of motor performance, and the prevailing energy system. The researcher considered the training of motor muscles as well as the supporting muscles, for balanced muscular development, without defect the technical performance.

The researcher attributes the positive effect on the muscular strength variables understudy to Swiss ball crunches used, where the researcher considered, during the design of the exercises, the diversity of muscular work directions, physical preparation was in the same motor paths of the technical skills understudy, which contributed to the development of muscular strength for the research sample members.

Using auxiliary tools to improve physical fitness, it is necessary to seek new methods of increasing the efficiency of training programs, exercises were used during the experimental part of the basis of the programs of "gymnastics" to increase the number of hours to be containing extended gymnastics associated with the use of tools. **(Xayrullayevich, S. 2023: 453)**

One of the important benefits of using modern assistive tools is the time factor, as many researches have proven the importance of using assistive tools during sports training for elite players, due to the importance of the time element during preparation for competitions, in addition to diversity, suspense, and breaking boredom. **(Orunbayev, A. 2023: 39)**

"SBST" Swiss Ball Stability Training is a practical training method for improving the trunk control, balance, motor skills and abdominal

muscles, increasing the abdominal muscles strength. After 9 weeks of follow-up, SBST was more effective in improving trunk control, motor skills, balance, muscular strength. **(Dehkordi, S. et al. 2023: 1755)**

Physical fitness parameters, such as flexibility and muscular strength were significantly improved after 12 weeks of Swiss ball training for girls hockey player's. It also helped to train for longer duration **(Judy, S., & Tamilarasi, K. 2023: 314)**

Swiss ball training has a positive impact on the strength of abdominal, back and legs muscles, flexibility of spine and hip and static, dynamic balance. **(Eltanahi, N. 2011: 56)**

There is a significant influence of a core stability exercise program using Swiss Ball on muscle activity, muscle thickness, maximum muscular strength, and the trunk region during a 6-weeks program involving participants who have lower back pain. A total of 21 males between the ages of 20 and 33 years old were divided into 3 Swiss ball exercise groups. **(Kim, H., & Han, W. 2011: 9)**

Swiss ball training increases the powerful of biceps muscle of volleyball players, when compare with control group. **(Thevan, A., & Kalaiselvi, M. 2022: 6380)**

Swiss ball exercises can lead to significant improvement in core stability and strength. These results are expected to help athletes, coaches, trainers, and other strength specialists who are involved in athletic training make decisions on appropriate training methods. Exercises can be gradually modified depending on needs and individual differences, a progressive training method should also be adopted to gain maximum benefits from training. **(Nuhmani, S. 2021: 9)**

Swiss ball is an extremely popular tool used for core stability and strength training, the majority of the research work done on abdominal muscles exercise were comparing and with traditional mat exercises, and benefits of swiss ball exercises. Consisting of the muscle of the abdomens, low back and hip is developed and plays an important role in maintaining balance. **(Singara, S. et al. 2023: 10)**

There is significant impact on muscular strength, in case of experimental group of swiss ball exercise for 12 weeks program, Swiss ball training program increased the muscular strength and muscular flexibility

of untrained college male students. Swiss ball exercises play a significant role in muscular strength and muscular flexibility. **(Kumar, D. 2023: 261)**

The researcher also attributes these statistically significant differences between the averages of pre & post measurements, and percentages of improvement in muscular strength variables understudy, to the positive influence of the various Swiss ball crunches, which were carefully designed to conform to the nature of the technical performance of Swallow skills understudy, by combining static and motor muscle work, by an increase in the size of the muscle fibers, and thus increasing the ability of the nervous system to produce the contraction of the fibers, which leads to an increase muscular strength.

The highest percentage of improvement was (39.2%) for the variable of abs muscular power, the researcher attributed this to the direction of muscular work of Swiss ball crunches understudy, which were carefully designed to conform to the nature of the technical performance of Swallow skills understudy. The researcher designed the training program to be directed to developing the working muscles with the skills understudy, the most important of which are the trunk muscles, and this became clear from the results.

It also agreed with the results of the following studies, **(Kumar, D. 2023: 261); (Dehkordi, S. et al. 2023: 1755); (Judy, S., & Tamilarasi, K. 2023: 314); (Thevan, A., & Kalaiselvi, M., 2022: 6380); (Al-Arabi, A. 2021: 163).** That Swiss ball training has had a positive influence on the technical performance for many diverse sports skills, due to the development of the physical requirements for executing each skill through Swiss ball training, especially the requirement of all types of muscular strength, in addition to the similarity of the performance of these training exercises with the technical performance of the skills. They recommended conducting more scientific studies of Swiss ball training to determine its effectiveness on other technical skills.

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

Discussion results of second hypothesis:

Which states, "There are statistically significant differences between pre & post measurements of the experimental group in technical performance of Swallow skills understudy in favor of the post measurement."

It is clear from Table No. (15) and Figure No. (4) that there are statistically significant differences at the level (0.05) between pre and post measurements of the experimental group in favor of the post-measurement in technical variables understudy, where the tabular (Z) value was at the significance level of 0.05 = (±1.96), while the calculated (Z) values of the technical variables understudy ranged between (-2.807, -2.805), and that these values are all 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 at the level of significance (0.05) in technical variables understudy in favor of the post-measurement.

As it is clear from Table No. (16) and Figure No. (5) that there are statistically significant differences between the pre and post measurements of the experimental group in favor of the post-measurement in technical variables understudy, with percentage of improvement that ranged between (20.1%, 24.3%), As the average of Swallow skill on rings apparatus in the pre-measurement reached (7,55) degrees, and the development in the post-measurement reached (9.07) degrees, with percentage of improvement of (20.1%), and the average of Inverted Swallow on rings apparatus in pre-measurement reached (7,11) degrees, and the development in post-measurement reached (8,840) degrees, with percentage of improvement of (24.3%).

The researcher attributes these statistically significant differences between the means pre & post measurements and the percentage of improvement in technical variables understudy to the influence of Swiss ball crunches used in the main part of the training unit, as shown in attachment (6), where the researcher took into account during the design of the exercises the diversity of muscular work direction, and the employment of physical variables in the motor paths of the Swallow skills understudy. The time to perform each exercise for (20-30 seconds) with high intensity, followed by positive rest for (10-15 seconds), and the exercise was repeated (3-5) sets, time for performing groups of each exercise reached (2) minutes, Rest after each exercise (1) minute in a session of (20-40)

minutes. The duration of the training program was (9 weeks), with (4) training units per week.

Sport of gymnastics depends on preparing the gymnast in an overall way, especially the physical fitness components, so that the new skill requirements on the various equipments can be met. **(Al-Hadi, A. 2016: 291)**

Muscular strength component is considered the most important element for a gymnast, because of its crucial role in implementing many gymnastics skills. Therefore, it is considered a basic physical requirement, and one of the most important components of building training programs. **(Alhenawy, S. 2024: 58); (Abdel-Baseer, A. 2019: 18)**

Rings apparatus has a special nature in gymnastics, as the rings performance requires a high degree of special muscular strength for gymnasts. Technical skills on the rings apparatus have developed and became more difficult, which has necessitated a similar development in the methods of training players. **(Hamed, A. & Abdel Malik, J. 2003: 193)**

Regularity in muscular strength training directly helps the gymnast perform the required motor duties with perfection, as the gymnast relies on his individual abilities to accomplish skill tasks on the various gymnastics' apparatuses. **(Tolan, S. & Abu Odah, M., 2016: 87)**

Use of special assistive devices and tools has shown their effectiveness in developing and raising the level of skill performance of the rings apparatus skills understudy, as the results indicate the contribution of the assistive devices and tools to develop skill performance accurately and effectively, which improves players' scores. **(Saeed, W. et al. 2022: 67); (Shuhaib, M. et al. 2022: 15)**

The researcher also attributes these statistically significant differences between the averages of the pre- and post-measurements, and the percentages of improvement in the technical performance variables understudy, to the positive influence of the various Swiss ball crunches, as the researcher used the same type of muscular work and the same motor paths for the skills understudy.The development of physical abilities using the muscular work method similar to technical performance is one of the best training methods for developing techniques.

It also agreed with the results of the following studies. **(Hanafi, I. 2023: 476); (Al-Arabi, A. 2021: 163); (Abdel Tawab, H. 2021: 64);**

(Kazem, W. et al. 2017: 104); (Elagamy, M. 2016: 61). That Swiss ball training has a positive influence on developing the level of technical performance for many diverse sports skills, due to the development of the physical requirements for executing each skill through Swiss ball training, especially the requirement of all types of muscular strength, in addition to the similarity of the performance of these training exercises with the technical performance of the skills. They recommended conducting more scientific studies of Swiss ball training to determine its effectiveness on other technical skills.

Based on the foregoing results, it is clear that the proposed Swiss ball crunches have a positive effect on the technical performance of Swallow skills understudy, through the development of muscular strength variables in the same motor path of technical performance.

Thus, the second hypothesis has been achieved, which states, "There are statistically significant differences between pre & post measurements of the experimental group in technical performance of Swallow skills understudy in favor of the post measurement."

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:

- **Swiss ball crunches have a positive influence on muscular strength variables understudy, through:**

- The percentage of improvement in muscular strength variables understudy ranged between (18.8% and 39.2%).
- The average degrees for the variable of grip strength in the dynamometer test, in the pre-measurement reached (36.70 Kg) and improved in the post-measurement and reached (43.60 Kg), with an improvement rate of (18.8%).
- Average degrees for the muscular strength variable of legs muscles in the dynamometer test, in the pre-measurement, it reached (52.50 Kg), and it improved in the post-measurement, reaching (64.80 Kg), with an improvement rate of (23.4%).
- The average degrees for the muscular strength variable of back muscles in the dynamometer test, in the pre-measurement reached (48.10 Kg), and it improved in the post-measurement and reached (62.70 Kg), with an improvement rate of (30.4%).
- The average degrees for the muscular strength variable of arms muscles in the test of pull ups, in the pre-measurement reached (11.60 reps) and

improved in the post-measurement and reached (14.70 reps) with an improvement rate of (26.7%).

- The average degrees for the muscular endurance variable of arms muscles in push the parallel bars test, in the pre-measurement reached (13.20 reps) and improved in the post-measurement and reached (17.10 reps), with an improvement rate of (29.5%).
- The average degrees for the muscular power variable of Abs muscles in raise the legs from hanging on the bar test, in the pre-measurement reached (10.20 reps) and improved in the post-measurement and reached (14.20 reps), with an improvement rate of (39.2%).

- **Swiss ball crunches have a positive influence on technical variables understudy, through:**

- The percentage of improvement in technical variables understudy ranged between (20.1%, 24.3%).
- The average degrees of "Swallow'' skill on rings apparatus understudy, in the pre-measurement reached (7.55) degree, and improved in post-measurement reached (9.07) degree, with an improvement rate of (20.1%).
- The average degrees of "Inverted Swallow" skill on rings apparatus understudy, in pre-measurement reached (7.11) degree, and improved in post-measurement reached (8.840) degree, with an improvement rate of (24.3%).

- **Recommendations:**

- Applying Swiss ball crunches to develop the muscular strength variables understudy.
- Applying Swiss ball crunches to develop the technical performance of "Swallow" skills understudy.
- The combination of physical and technical training in proportion to the motor paths of the skills required to be developed with the aim of comprehensive preparation of the gymnast, to reach the highest level of achievement.
- Awareness of trainers about the importance and how to apply Swiss ball crunches, in proportion to the requirements of technical performance on each gymnastics apparatus.
- Applying Swiss ball crunches in the technical preparation phase and the competition period, to make the most of mastering the technical routine on various gymnastics apparatuses.
- Applying Swiss ball crunches on different gymnastics apparatuses, and to other age stages.

- Applying Swiss ball crunches instead of weight training for juniors to avoid injuries.

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