The Effect of Plyometric training on the development of Muscular strength to improve Snatch Lift among CrossFit players at CrossFit club in Jeddah

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Abstract: The current research aims to identify the extent of the effect of plyometric training on the development of the muscle strength component to improve the snatch lift for a sample of female CrossFit players in the CrossFit Club in Jeddah. To achieve the research objectives, the research was conducted on a deliberate sample of female CrossFit players in some health clubs in Jeddah, consisting of (8) players. The research was conducted using the experimental method due to its suitability to the nature of the research conducted, and the use of qualitative analysis, questionnaire and tests as a tool for collecting data. The research results showed statistically significant differences in the dimensional measurements, as the sample showed an improvement in the tests of strength characterized by speed and explosive strength. The researcher recommended using plyometric training to improve strength characterized by speed and achieve achievement in the snatch lift from the sport of CrossFit.

Keyword: Plyometrics Training, Muscular Strength, Snatch Lift, Cross fitters .

Introduction: The current era is witnessing a rapid development in sports sciences, especially those related to sports training; due to the intertwining of life and the diversity of training needs for all segments of society. The rapid development in the science of sports training has appeared in the methods used and followed in it, as regular sports training regulated by scientific standards leads to an increase in the efficiency of the muscular system as a result of anatomical and physiological changes, which leads to an improvement in the elements of physical fitness related to performance such as strength, endurance, and speed (Al-Hajj, 2017). The diversity and comprehensiveness of training using plyometric training is an effective means to reach the highest possible competitive level, as it leads to avoiding the negative effects resulting from training, such as the phenomenon of overload and sports burnout, in addition to that it will add fun to training and keep boredom away from players and coaches, and lead to the development of the work of the body's various systems and help distribute the training load on them in a proportional manner (Hassan, 2010, 82). Therefore, sports training itself shows the importance of relying on the type of exercises that take the form of performance and the nature of muscle work, and thus economizing on motor performance by developing and improving the general and specific physical condition of the muscle groups that participate in that performance.

Study Problem:

Through the academic and training experience of the researchers, they noticed that female CrossFit players in Jeddah have a weakness in the element of muscle strength, and this weakness appears when lifting the snatch; which prompted the researchers to design a program based on plyometric training to develop the element of muscle strength and improve the snatch lift for players in the CrossFit Club in Jeddah. Hence, the problem of the research came to evaluate the effect of plyometric training on developing the element of muscle strength to improve the snatch lift, and through direct questioning of CrossFit players to know the exercises that have an effect in order to verify the effectiveness of plyometric training on developing the element of muscle strength to improve the snatch lift for CrossFit players.

The problem of the study appeared through the following questions:'

- Are there differences between the pre- and post-measurement of muscle strength (characterized by speed for the arms - characterized by speed for the legs - characterized by speed for the trunk - explosive power for the arms - explosive power for the legs - explosive power for the arms and legs) among female CrossFit players in the city of Jeddah?
- Are there differences between the pre- and post-measurement of explosive power for the arms and legs and improvement in achievement in the snatch lift among female CrossFit players in the city of Jeddah?

Importance of the study:

The rapid and successive development of training science and the diversity of its methods and means, made it urgent to develop the element of muscle strength; which may be reflected in the skill performance of the players, and the importance of the study lies in the following: - Emphasizing the importance of plyometric training in developing the element of muscle strength to improve the snatch lift. - Providing trainers with modern programs to develop training and improve the level of performance. - The two researchers were able to design a training program to demonstrate the effect of plyometric training on developing the element of muscle strength and improving the snatch lift for CrossFit players.

Objectives of the study:

The current study aimed to the following: - Identifying the existence of differences between the pre- and post-measurement of muscle strength (characterized by speed for the arms - characterized by speed for the legs - characterized by speed for the trunk - explosive power for the arms - explosive power for the legs - explosive power for the arms and legs) among CrossFit players in the city of Jeddah.

- Identifying the differences between the pre- and post-measurement of explosive strength of the arms and legs and improving the achievement in the snatch lift among female CrossFit players in the city of Jeddah.

Study Hypotheses:

What is the effect of plyometric training on developing the muscle strength component to improve the snatch lift for a sample of female CrossFit players at the CrossFit Club in Jeddah? Accordingly, the following sub-questions branched out from the main question: - There are no statistically significant differences at the significance level (0.05) between the pre- and post-measurement of muscle strength (characterized by speed for the arms - characterized by speed for the legs - characterized by speed for the trunk - explosive power for the arms - explosive power for the legs - explosive power for the arms and legs) among female CrossFit players in Jeddah.

- There are no statistically significant differences at the significance level (0.05) between the pre- and post-measurement of explosive power for the arms and legs and improving achievement in the snatch lift among female CrossFit players in Jeddah.

Search Terms:

The current research has three basic terms: Plyometrics:

These are sports activities that are widely used, and require the use of muscle strength and muscle contractions with a high degree of explosive ability, and improving the relationship between maximum and explosive strength (Metwally, 2020, 2709). **CrossFit:**

These are diverse functional movements that combine body weight exercises, aerobics, and high-intensity weights to improve motor functions that are performed in a directed form of muscle contractions for all parts of the body and are performed in a group or individually framework Smith; Nichols; Vidaurre ; Winkler; Behrens; Glasser; Ugurbil; Barch; Van Essen; Miller (2015).

Snatch:

It is the first Olympic lift that the athlete performs with a wide distance between the grips and in one stage from the wooden platform until the arms are extended above the head, either in a squatting manner or by opening the feet. The snatch lift from the time the weight is lifted off the ground until the end of the arms' extension above the head takes 2-4 seconds (I.W.F. 2000).

Research Areas: Human field: (8) CrossFit players in some health clubs.

Spatial field: Jeddah city.

Time field: 2023.

Theoretical Background:

One of the types of training for muscular strength is weight training for a long period of time, which made it a subject of controversy among specialists in preparing and training CrossFit.

Some of them strongly opposed weight training on the pretext that it leads to a decrease in motor speed, decreases the range of motion of the joints, and increases the degree of stiffness in the muscles, and some of them excluded weight training as an objective means of developing the different types of muscular strength that any player needs (Al-Hajj, 2017).

Plyometric training: The linguistic origin of the term (Plyometrics) goes back to the Greek word (Plyetheir) which means (increase) in the Greek language, and the term is derived from the Greek linguistic roots which are: (Plio) and (Metri), and a large number of specialists, scientists and researchers in physical education have defined (plyometric) training, and the researchers have mentioned part of those definitions. (Ballestros) defined it as: "rotational or non-rotational jumping exercises with central or concentric muscle activity in order to improve the level of strength, reaction ability and flexibility." (Dick) sees that (plyometrics) is "flexibility strength training where the stimulus is focused on the ability of muscle movement to be flexible, so this type of training is characterized by repeated jumping and jumping movements." Good scientific planning of specialized training programs for CrossFit players is one of the most important steps because of its impact on developing the element of strength and speed together by increasing the load on the muscles (Al-Hajj, 2017).

The training method occurs through adaptations in the neuromuscular system and allows for rapid and strong changes through which rapid strength develops by storing elastic energy in the muscles and tendons after being exposed to a rapid load (eccentric contraction) and exploiting this latent elastic energy in the next contraction (central contraction), which will be faster and stronger, i.e. developing the mechanical production of the muscles.

The effect of plyometric training on the development of the muscular strength component to improve the snatch lift for female CrossFit players:

Studies conducted in the field of sports training have shown that plyometric training helps improve the level of performance as a result of the development of the various physical capabilities of muscular strength such as speed-specific strength, maximum strength and strength endurance (Al-Hajj, 2017).

Therefore, it is necessary to develop a standardized program that increases the efficiency of female CrossFit players such as plyometric training, which is characterized by activities that depend on the output of maximum strength at maximum speed, as is the case in high jumping, taking into account the components of the muscle and its elasticity (Moran ; Liew ; Behm, et al. (2021).

CrossFit has become one of the global sports that different age groups pay great attention to, but it lacks carefully prepared and well-planned training programs such as plyometric training for adults or juniors.

We can confirm that most sports teams have not undergone a plyometric training program, in addition to the fact that the diversity of training methods and approaches leads to preparing and developing the athlete physically in a way that is consistent

with his capabilities and abilities according to the event and its requirements.

The strength characterized by speed and explosive ability is one of the basic qualities that face great challenges in influencing the snatch lift of CrossFit players, as the problem lies in how to apply these exercises without harming individuals (Menezes-Reis; Beirigo; Borges; Rocha de Santiago & Leite, 2024, 205-210).

Plyometric training is one of the most effective methods and techniques of sports training to develop explosive power, and it is employed in different amounts according to the specifics of sports and their demands and in conjunction with or followed by a training program for muscle strength.

The general outlines of this article explain how plyometrics are an indicator of the number of sets and repetitions and the choice of exercise type.

The notes and information mentioned in this article are also linked to plyometric exercises for the upper and lower body.

Cross Fit is the name of a sports company and its gyms include practicing a sport that combines aerobics and body weight training (Swedish), weightlifting and gymnastics (Maynart; Mazuquin; Costa; Santos; Brant; Rodrigues & Lourdes (2024)

Al-Hamd; Al-Qawasmeh; Awdat (2014) indicated the effect of using plyometric training in improving some gymnastics skills among a sample of female students at Hashemite University in Jordan, and statistically significant differences were observed in the effect of using plyometric training in Learn floor movement skills in gymnastics. Sports training is not limited to the muscular system, but rather works to develop the effectiveness of the nervous and muscular systems, which in turn increases the speed and strength of motor performance, which reduces the performance time, which regulates the effectiveness of muscle strength and other sports activities that require explosive strength (Al-Hajj, 2017).

The advantages of plyometric training appear through improving coordination within the muscle, which then leads to rapid gains in strength level without an increase in body weight mass. It is of great importance in activities in which explosive strength plays an important role, such as long jump. It constitutes training content for high-level strength speed players who find it difficult to advance their strength level (Chen; Yan; Xie; Zhang; Zhang; Wang, 2024).

Plyometric exercises include box jumps and ballistic training, which build body strength and develop the strength and muscular capacity of the legs and arms. They also include aerobic endurance activities, including water jogging exercises, using the treadmill and stationary training wheel, as well as anaerobic endurance activities, including speed training.

Research procedures:

- **Research methodology:** Based on the study objective, the researchers adopted the experimental method due to its suitability to the nature of this research using an experimental design (two groups, one experimental and the other control) by conducting the pre-measurement and post-measurement of the research sample.

- **Research community and sample:** The study stratum was based on a purposive sample of women consisting of (8) CrossFit practitioners in a health club in Jeddah, Kingdom of Saudi Arabia.

- **Tools and devices used in the research:** Experimental tests were conducted for explosive power and distinctive power Experimental test for explosive power and distinctive power in order to improve the snatch lift:

- Speed distinctive power test - Explosive power test Using the following tools and devices: - Medical scale to measure weight - Iron bar with iron discs of different weights - Medicine ball - Stopwatch - Iron chairs of different heights - Field research procedures: - The researcher coordinated with trainers and practitioners of CrossFit

- A health club was selected as a place to implement the research due to its suitable location and because most of the sample members are from it.

- The researcher implemented the research procedures on the selected sample - Data analysis and statistical processing.

- Interpretation of the results throught the theoretical framework and previous studies. - **Providing recommendations and suggestions**.

- **Statistical methods:**

The Wilcoxon test was used to answer the main question of the study:

What is the effect of plyometric training on developing the muscle strength component to improve the snatch lift for CrossFit players?

Presentation and discussion of results

- Presentation of results in tables without analysis.

- The related results showed the effect of plyometric training on developing the muscle strength component to improve the snatch lift for female CrossFit players in Jeddah as follows:

- The extent of the effectiveness of plyometric training on developing the muscle strength component.
- The researcher used the Wilcoxon test to determine the statistically significant differences in the pre - and post-measurement of muscle. Strength (characterized by speed for the arms - characterized by speed for the legs - characterized by speed for the trunk - explosive power for the arms - explosive power for the legs - explosive power for the arms and legs) in different variables (Table 1).

Table (1): The Value of the differences for the Variable of Strength Characterized by Speed

	Variables	Values	Mean Rank	Sum of Ranks	Value Z	Level Significance
Arm Speed Strength	Flexion and extension of the arms for 10 seconds (Pre-Post)	Negative Ranks	0	0	2.58−	*0.01
		Positive Ranks	4.50	36.00		*0.01
	Throwing the medicine ball against the wall for 10 seconds (Pre-Post)	Negative rank	0	0	2.64−	*0.01
		Positive Ranks	4.50	36.00		*0.01
	Pull up on the bar (repeat) (Pre-Post)	Negative rank	0	0	2.83− 2.58−	*0.01
		Positive Ranks	0	0		*0.01
Legs Speed Strength	Leg flexion and extension for 10 seconds (Pre-Post)	Negative Rank	4.50	36.00	2.64−	*0.01
		Positive Ranks	0	0		*0.01
	Medicine ball throw against the wall for 10 seconds (Pre-Post)	Negative Rank	4.50	36.00	2.83−	*0.01
		Positive Ranks	0	0		*0.01
	Pull up on the bar (repeat) (Pre-Post)	Negative Rank	0	36.00	2.83−	*0.01
		Positive Ranks	4.50	0		*0.01
Trunk Speed Strength	Sitting up from lying down within 10 seconds (pre-post)	Negative Rank	0	36.00	2.53−	*0.01
		Positive Ranks	4.50	36.00		*0.01
			4.50	0		*0.01
Arm Explosive Strength	Throwing a medicine ball (3 kg) with the arms from a stationary position backwards (Pre-post)	Negative Rank	0	28.00	2.71−	*0.01
		Positive Ranks	4.00	0		*0.01
	Throwing a medicine ball (2 kg) from a sitting position (Pre-post)	Negative Rank	0	36.00	2.56−	*0.01
		Positive Ranks	4.50	0		*0.01
	Throwing a medicine ball (6 kg) against the wall within (10 seconds) (Pre-post)	Negative Rank	0	36.00	0.32-	*0.01
		Positive Ranks	4.50	4.00		0.75
Legs Explosive Strength	Vertical Jump from Standing (Pre-Post)	Negative Rank	12.00	3.00	2.55-	*0.01
		Positive Ranks	9.00	0		*0.01
	Back Squat Exercise (Pre-Post)	Negative Rank	0	36.00		*0.01
		Positive Ranks	4.50			*0.01

*Statistically significant at the level of (0.05) The effectiveness of plyometric training on developing the element of muscle strength to improve the snatch lift among female CrossFit players .

-The researcher used the Wilcoxon test to find out the statistically significant differences in the pre- and post-measurement of explosive strength of the arms and legs and improving the achievement in the snatch lift among female CrossFit players, as shown in Table (2).

Table (2) The value of the differences for the variable of explosive strength of the arms and legs and improving the achievement in the snatch lift among female CrossFit players

	Variables	Values	Mean Rank	Sum of Ranks	Value Level Z	Significance
Explosive power of arms and legs	Snatch lift (pre-post)	Negative ranks	0	0	-	*0.01
		4.50	36.00	2.54		

Discussion of the Results:

The results related to the effect of plyometric training on developing the muscle strength component to improve the snatch lift for female CrossFit players in Jeddah indicated the following:

The extent of the effectiveness of plyometric training on developing the muscle strength component:

The results indicated the effect of plyometric exercises on developing the speed-characterized strength of the arms, legs and trunk, reaching a value of (Z) (-2.58, -2.64, -2.83) consecutively, which is statistically significant at the level of (0.05) for the speed-characterized strength of the arms, while the value of (Z) (-2.83) for the two tests reached a statistically significant level of (0.05) for the speed-characterized strength of the legs, while the speed-characterized speed of the trunk reached a value of (Z) (-2.83) consecutively, which is statistically significant at the level of (0.05) (Table 1) The results also showed that plyometric exercises have an effect on developing explosive strength .

The legs and the explosive power of the arms, where the value of (Z) reached (-2.53, -2.71, -2.56) consecutively, and it is statistically significant at the level of (0.05) for the explosive power of the arms, while the value of (Z) reached (-2.55) for the back squat exercise test and the value of (-0.32) for the vertical jump, and it is statistically significant at the level of (0.05) for the explosive power of the legs.

- (Table 1) The effectiveness of plyometric exercises on developing the element of muscle strength to improve the snatch lift in female CrossFit players:

-The value of (Z) in Table (2) for the effect of plyometric exercises on developing the explosive ability of the arms and legs and improving the achievement in the snatch lift between the pre- and post-measurement reached (-2.54) and is statistically significant at the level of (0.05) in favor of the post-measurement, and this indicates that plyometric exercises have an effect on the explosive ability of the arms and legs in favor of high achievement in improving the snatch lift.

After presenting the research data and discussing its results in light of the answer to the extent of the impact of plyometric training on developing the element of muscle strength to improve the snatch lift for a sample of female CrossFit players at

the CrossFit Club in Jeddah, a set of facts were reached, which are as follows:

- The impact of plyometric exercises on the explosive power of the arms and legs in favor of high achievement in improving the snatch lift.

- The presence of statistically significant differences between the cardio and post-tests in favor of the post-test in developing explosive strength and speed-specific strength.

- Developing plyometric exercises for muscle strength and speed-specific strength, which led to reducing the snatch lift time.

- Conclusion: In light of the results of the study, the researchers recommend the following:

- Introducing plyometric training within the training curricula for CrossFit players, including the preparation phase for developing the snatch lift - Allocating sufficient time during the training unit or during separate days for plyometric training.

- Following the instructions of the specialized coach to avoid the risks that may result from plyometric training.

- Conducting more similar scientific studies and research on different exercises on the same sample.

- Using the results of the current research to be the basis for research and studies with new variables to determine the reality of the impact of plyometric training on sports training.

- Conducting similar studies in different regions and comparing their results with the current research.

- Raising health awareness of the importance of practicing plyometric training because of its positive impact on muscle strength. The study found that plyometric training on the snatch lift among CrossFit players, as plyometric training achieved a clear development in the strength characterized by speed and explosive ability of CrossFit players.

In addition to the positive effect of plyometric training on improving and developing the snatch lift of female CrossFit players, the study found statistically significant differences between the pre- and post-tests in favor of the post-test in the speed-specific strength tests, in addition to the presence of statistically significant differences between the pre- and post-tests in favor of the post-test in the explosive strength tests.

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