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The Effect of Nutritional Supplements and Rehabilitation Exercises on The Functional Adequacy of The Injured Deltoid Muscle in Bodybuilders

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Abstract

This study aimed to identify the effect of nutritional supplements and rehabilitative exercises on the functional recovery of advanced bodybuilding players with anterior deltoid injuries. The experimental method was applied to two groups of eight injured athletes from the Baghdad/Al-Rusafa Gym. The first group performed rehabilitative exercises, while the second group combined them with nutritional supplements. Functional competence was assessed through measurements of muscle strength and range of motion using a dynamometer. The results showed significant improvement in both groups, with the combined program producing greater recovery. The study concluded that integrating nutritional supplements with rehabilitation exercises effectively restores the anterior deltoid muscle's function and accelerates the return of injured bodybuilders to normal performance.

Keywords: Functional competence, nutritional supplements, body building, rehabilitative exercises.

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Introduction

At the beginning of the twenty-first century, rehabilitation of injuries and rehabilitation methods became one of the important and safe matters to which the world's attention began to turn with great strides, especially in sports rehabilitation, a science based on scientific foundations and principles. This science developed until it became an independent science from the sciences of physical education and sports sciences, and this science did not stop. To a certain extent, there has been progress in diagnosing the most important and precise causes and developing appropriate solutions of valuable benefit that enable the athlete to return to practicing training in the normal way before the injury occurred. Individual sports, especially bodybuilding, are characterized by high-intensity physical requirements that It is performed by players during training, and it is considered one of the common sports practiced in the world. It is one of the individual sports that aims to adapt and develop the strength and muscle mass of a group of muscles, to give the players a beautiful and harmonious figure, and to develop the physical and functional aspects of its practitioners. It aims to develop its players and reach advanced levels in building muscle mass of size and consistency. Which reflects the aesthetics of the body, and this is what made this sport spread widely in recent years with the large number of individuals practicing it. In its training, it relies mainly on free weights and training equipment, as it is characterized by In its training, using high loads that cause stress on the athlete's body, and this is the primary goal in training in order to adapt and develop the muscle mass of a group of muscles, and requires the player to perform these exercises correctly, and this leads to the players bearing pressures and great training loads that help in the development of the player. But at the same time, these high loads can cause various sports injuries to these players, as the rate of sports injuries increases with the level of unregulated training loads that exceed the player's ability, and thus they put pressure on the joints, ligaments, Synovial capsules, tendons, muscles, and bones.

This is what Frank Jobe, eta, 1987 agrees with, that the ultimate goal of rehabilitation approaches is to restore the range of motion and strength to the injured muscle, and these ranges put great pressure on the muscles, ligaments, and tendons surrounding the joint, as injury to a muscle or tendon that works on the shoulder joint affects its function. Movement: the natural movement of the joint stops.

Among the studies that dealt with the tear of the anterior deltoid muscle of the shoulder joint (study Talal Hamdi Mahmoud 2022)

(The effect of a rehabilitation program on the physiology of tearing the deltoid muscle of the shoulder joint in boxing players).

The researcher used the experimental method using a pre-post experimental design for one experimental group, the research sample, due to its suitability to the nature of the research. The researcher deliberately selected the research sample from boxing players from the Pioneers Club

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in the Tenth of Ramadan City in Sharkia Governorate, who numbered (10) players. The researcher applied the exploratory study to a number of (3) boxing players from outside the research sample to calculate the scientific coefficients for the tests used in the study. The researcher conducted pre- and post-test measurements on a number of (10) players who were regular in implementing the basic experiment of the study. The research aims to identify the effect of a rehabilitation program on the physiology of the tear of the deltoid muscle of the shoulder joint for boxing players. The most important conclusions are that there are statistically significant differences between the pre- and post-measurements. In the variables of the range of motion of the shoulder joint (abduction) in favor of the post-measurement of the sample under study, there are statistically significant differences between the pre- and post-measurements. Measuring the variables of the electrical activity of the shoulder muscles (Anterior deltoid muscle - posterior deltoid muscle) in favor of the post-test for the sample under study. There are statistically significant differences between the pre- and post-measurements in the "Shoulder Pain Scale" in favor of the post-measurement for the sample under research. And(Study by Mahmoud Ibrahim Mahmoud 2019).

(The effectiveness of using technology in some aquatic therapeutic exercises to rehabilitate shoulder injuries for swimmers). The research aims to design a rehabilitation program using technology to rehabilitate shoulder injuries for swimmers and to identify the effect of the rehabilitation program on the level of pain, range of motion, and muscle strength of the injured shoulder joint. The method used was the experimental method, and the study sample was (27 infected people). The most important results were that the proposed rehabilitation program in the aquatic environment contributed to the flow of blood to the muscles of the shoulder joint and the removal of pain. It also contributed to restoring the normal range of motion and flexibility of the muscles of the shoulder joint, and restoring balanced muscle strength to the moving working muscles and the corresponding (reverse) muscles on the shoulder joint, and it has a role In rehabilitating the muscles of the shoulder joint, training in the water environment contributes to eliminating pain and restoring movement to the muscles of the shoulder joint faster than land-based training, and the use of modern technological means has contributed to the rapid absorption of A research sample of the rehabilitation program exercises and performing those exercises correctly.

Methodology

The nature of the problem determines the researchers to choose the appropriate method for this problem. The method is "the correct method that the researcher adopts to reach his desired goal that he specified at the beginning of his research." (Amer, 2012, p. 10), so the researchers adopted the experimental approach to suit the nature of the problem**.**

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The research community was identified from the infected gym-goers in Baghdad/Al-Rusafa, which numbered (28) infected players, and the researchers selected the research sample from the same research community, which numbered (8), divided into (4) first experimental and (4) second experimental, As shown in Table (1).

And I was hired The following devices, tools, and means of collecting information: (paper forms, laptop, electronic calculator, Arab and foreign sources, field visits to collect information, information network (Internet), personal interviews). Auxiliary device (steel frame), portable digital dynamo meter, juniper meter).

In order to achieve the goal of the research, this requires a measurement tool, and functional competency measurements were used (muscular strength measurements - range of motion measurements) Measurements of range of motion of the shoulder joint:

The range of motion of the shoulder joint was measured in (5) different movements:

1- Name of measurement : Measurements of range of motion of the shoulder joint:.

Purpose of measurement : Measuring the range of motion of the shoulder joint in flexion movement.

Unit of measurement: Degree.

Used tools : Pen, sticky marking tool, juniometer, registration form.

Performance method : The tester sits with his arm at the side of the body and down.

- The arm of the juniometer is placed on the acromial process of the shoulder blade, and on the lateral side of the arm.
- The tester raises his arm forward and upward, and in the sagittal plane.
- The fixed arm of the joniometer is parallel to the humerus.
- Movement is within the limits of pain.

Registration method

- The angle achieved between the arms of the juniometer is read and recorded.
- The ideal range of motion for shoulder flexion movement is (0-170) degrees.

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2- Measurement name: Range of motion of the shoulder joint.

Purpose of measurement: Measuring the range of motion of the shoulder joint in extended movement.

Tools used: Pen, sticky marking tool, juniometer, registration form.

Performance description:

- The tester sits, with his arm at the side of the body and down.
- The arms of the juniometer are placed on the acromial process of the shoulder blade and on the lateral side of the arm.
- The tester moves his arm backwards and upwards, and in the sagittal plane.
- The fixed arm of the juniometer is parallel to the torso.
- The moving arm of the juniometer is connected to the humerus.
- Movement is within the limits of pain.

- Registration method

- The angle achieved between the arms of the juniometer is read and recorded.
- The ideal range of motion for shoulder flexion is (0-60) degrees.

3-Measurement name:- Range of motion of the shoulder joint.(Klaus Buckup.2004)

Purpose of measurement: Measuring the range of motion of the shoulder joint in the abduction movement.

Tools used: Pen, sticky marking tool, juniometer, registration form

- Performance description:

- The tester sits with his arm at the side of the body and down.
- The arms of the juniometer are placed on the acromial process of the scapula and on the back of the shoulder.
- The tester raises his arm to the side, up, and at the coronal level.
- The fixed arm of the juniometer is parallel to the torso.

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- The moving arm of the juniometer is parallel to the humerus.
- Movement is within the limits of pain.

Registration:

- The angle achieved between the arms of the juniometer is read and recorded.
- The ideal range of motion for shoulder flexion movement is (0-170) degrees.

4- Measurement name: Range of motion of the shoulder joint.

Purpose of measurement : Measuring the range of motion of the shoulder joint in the horizontal abduction movement.

Unit of measurement : Degree.

Used tools : Pen, sticky marking tool, juniometer, registration form.

Performance method : The tester sits with the arm bent at an angle of (90) degrees from the shoulder joint so that the palm of his hand is facing down and his arm is parallel to the surface of the ground.

- The arms of the juniometer are placed on the acromial process of the scapula.
- The tester moves his arm away from the body's bisecting line and in the transverse plane.
- The fixed arm of the juniometer is parallel to the top of the shoulder.
- The moving arm of the juniometer is parallel to the humerus.
- Movement is within the limits of pain.

Registration method: The angle achieved between the arms of the juniometer is read and recorded.

The ideal range of motion for shoulder flexion is (0-90) degrees.

5- Measurement name: Range of motion of the shoulder joint. (Klaus Buckup.2004):

Purpose of measurement : Measuring the range of motion of the shoulder joint in the horizontal adduction movement.

Unit of measurement : Degree.

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Used tools : Pen, sticky marking tool, juniometer, registration form.

Performance method :

- The tester sits with the arm bent at a 90-degree angle from the shoulder joint so that the palm of his hand is down and his arm is parallel to the ground.
- The arms of the juniometer are placed on the acromial process of the scapula.
- The tester moves his arm inward, approaching the midline of the body and in the transverse plane.
- The fixed arm of the juniometer is parallel to the top of the shoulder.
- The arm is mobile Is the jaw meter parallel to the humerus?
- Movement is within the limits of pain.

Registration method:

- The angle achieved between the arms of the juniometer is read and recorded.
- The ideal range of motion for shoulder flexion is (0-45) degrees.
- Measurements of muscle strength of the shoulder joint:
- The muscle strength of the shoulder joint was measured in (5) different movements:

1- Name of measurement : Lateral pull to approximate the shoulder joint. (Klaus Buckup.2004):

Purpose of measurement : Measure the strength of the adductor muscles of the shoulder joint.

Unit of measurement: Kilogram.

Used tools : Auxiliary device (iron structure), dynamo meter device Portable digital hook (dyn), string, grip and registration form.

Performance method :

- The laboratory stands in the middle of the auxiliary device (iron structure).
- The dynamo meter is fixed at shoulder height.

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- The tester holds the dynamo meter handpiece with an outstretched arm.
- The tester slowly returns the arm to the starting position.
- The tester raises his arm forward and upward, and in the sagittal plane.
- The fixed arm of the joniometer is parallel to the humerus.
- Movement is within the limits of pain.

Registration method

Each tester gives (3) attempts and the best attempt is recorded.

2- Measurement name: Lateral pull to abduct the shoulder joint. (Klaus Buckup.2004):

Purpose of measurement: Measuring the strength of the abductor muscles of the shoulder joint.

Tools used: Auxiliary device (steel frame), portable digital dynamo meter (hook) (dyn), chain, grip and registration form.

Performance description:

- The laboratory stands in the middle of the auxiliary device (iron structure).
- The dynamo meter is fixed at shoulder level on the side opposite the injured side.
- The tester holds the dynamo meter in front of the chest with an outstretched arm.
- The laboratory pulls the dynamo meter to the lateral side of the body with a retracting motion.
- The tester slowly returns the arm to the starting position.

- Registration method

Each tester gives (3) attempts to record the best attempt.

3-Measurement name:- Pull up to raise the shoulder joint. (Klaus Buckup.2004):

Purpose of measurement: Measuring the strength of the levator muscles of the shoulder joint.

Tools used: Auxiliary device (steel frame), portable digital dynamo meter (hook) (dyn), chain, grip and registration form.

- Performance description:

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- The laboratory stands in the middle of the auxiliary device (iron structure).
- The dynamo meter is installed under the frame in front of the injured party.
- The tester holds the dynamo meter with a forward grip.
- The tester raises his outstretched arm as high as possible within pain limits.
- The tester slowly returns the arm to the starting position.
- Movement is within the limits of pain.

Registration:

Each tester gives (3) attempts to record the best attempt

4- Measurement name: Lateral downward pull of the shoulder joint. (Klaus Buckup.2004):

Purpose of measurement : Measuring the strength of the shoulder joint depressors.

Unit of measurement : Kilogram.

Used tools : Auxiliary device (steel frame), portable digital dynamo meter (hook) (dyn), chain, grip and registration form.

Performance method

- The dynamo meter is attached to the auxiliary device (iron structure) and in front of the laboratory on the affected side.
- The tester stands in the middle of the device (the iron structure) and holds the dynamo meter at shoulder level with an outstretched arm.
- The tester lowers his arm down as low as possible within pain limits.
- The tester slowly returns the arm to the starting position.

Registration method: Each tester gives (3) attempts to record the best attempt.

5- Measurement name: Forward pull (pulling movement of the shoulder). (Klaus Buckup.2004):

Purpose of measurement : Measure the strength of the pulling muscles of the shoulder joint.

Unit of measurement : Kilogram.

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Used tools : Auxiliary device (steel frame), portable digital dynamo meter (hook) (dyn), chain, grip and registration form.

Performance method

- The dynamo meter is attached to the auxiliary device (iron structure) in front of the laboratory.
- The tester holds the dynamo meter handpiece with an arm extended in front of the body.
- The tester pulls the device as far as possible within the pain limits.
- The tester slowly returns the arm to the starting position.

The exploratory experiment "is a mini-experiment of the main experiment, the purpose of which is either to reveal some scientific facts or to test the work to reveal the obstacles and negatives facing the implementation of the main experiment or for the purpose of training some cadres to assist in the work" (Kazim, 2015, p. 128). In order to find the best methods for implementing field research procedures, the researchers conducted a reconnaissance experiment on a group within the research community, the purpose of which is: (to ensure the validity of the devices and tools used in the research, to ensure the harmony of the assistant work team and their competence in conducting tests and recording the results, Identifying the times required to carry out tests, verifying the suitability of the place, identifying obstacles that may appear during performance and avoiding errors. After the procedures mentioned, the researchers conducted the main experiment by applying functional competency measurements, as well as photographing the research sample as they performed the rehabilitation exercises under study, on (Sunday), corresponding to (11/27/2023), in Al-Ghaith Hall, Baghdad/Al-Rusafa gym.

Results

Table 1. *shows the arithmetic means, their deviations, the skewness coefficient, the calculated (T) values, and the statistical significance of the pre- and post-tests for the first experimental group of the motor range test*

Variables	Group	Arithmetic mean	Standard deviation	F	FH	Calculated T value	Significance level value
First test	previous	135.250	4.573	14.750	4.479	3.293	0.046

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	the next	150.000	7.348				
Second test	previous	26.500	3.696	12.750	3.966	3.215	0.049
	the next	39.250	9.776				
Third test	previous	44.500	9.882	11.750	1.973	5.953	0.009
	the next	56.250	7.500				
Fourth test	previous	54.500	9.882	11.750	2.839	4.138	0.026
	the next	66.250	6.291				
Fifth test	previous	24.000	3.915	5.000	0.408	12.247	0.001
	the next	29.000	3.366				

Table 2. *shows the arithmetic means, their deviations, the torsion coefficient, the calculated (T) values, and the statistical significance of the pre- and post-tests for the first experimental group to test muscle strength*

Variables	Group	Arithmetic mean	Standard deviation	F	FH	Calculated T value	Significance level value
First test	previous	10.750	6.291	4.250	1.314	3.232	0.048
	the next	15.000	8.717				
Second test	previous	9.250	4.573	3.250	0.478	6.789	0.007
	the next	12.500	5.000				
Third test	previous	18.500	3.316	5.500	0.645	8.521	0.003
	the next	24.000	4.320				
Fourth test	previous	15.500	4.654	3.000	0.816	7.348	0.005
	the next	18.500	5.446				
Fifth test	previous	11.000	2.160	4.250	0.629	6.755	0.007
	the next	15.250	1.258				

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Table 3. *shows the arithmetic means, their deviations, the skewness coefficient, the calculated T values, and the statistical significance of the pre- and post-tests for the second experimental group for the motor range test*

Variables	Group	Arithmetic mean	Standard deviation	F	FH	Calculated T value	Significance level value
First test	previous	143.000	6.782	24.500	2.466	9.933	0.002
	the next	167.500	8.660				
Second test	previous	28.800	2.833	27.700	3.009	9.204	0.003
	the next	56.500	7.895				
Third test	previous	47.255	9.839	26.745	0.855	31.266	0.000
	the next	74.000	10.893				
Fourth test	previous	60.200	8.945	21.677	5.921	7.321	0.005
	the next	81.877	7.453				
Fifth test	previous	24.057	3.729	11.802	1.229	9.597	0.002
	the next	35.860	2.784				

Table 4. *shows the arithmetic means, their deviations, the torsion coefficient, the calculated (T) values, and the statistical significance of the pre- and post-tests for the second experimental group for testing muscle strength*

Variables	Group	Arithmetic mean	Standard deviation	F	FH	Calculated T value	Significance level value
First test	previous	11.250	6.849	18.250	0.750	24.333	0.000
	the next	29.500	7.047				
Second test	previous	8.000	4.082	24.750	0.478	51.701	0.000
	the next	32.750	4.856				
Third test	previous	19.250	3.593	13.750	0.629	21.855	0.000
	the next	33.000	2.943				

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Fourth test	previous	14.500	4.203	9.000	1.471	6.114	0.009
	the next	23.500	6.557				
Fifth test	previous	11.750	2.362	8.750	1.250	7.000	0.006
	the next	20.500	1.000				

Table 5. *shows the arithmetic means, their deviations, the skewness coefficient, the calculated (T) values, and the statistical significance of the post-tests for the first and second experimental groups for the motor range test*

Variables	Group	Arithmetic mean	Standard deviation	F	FH	Calculated T value	Significance level value
First test	First experimental	150.000	7.348	17.500	5.678	3.082	0.022
	Experimental sec	167.500	8.660				
Second test	First experimental	39.250	9.776	17.250	6.283	2.745	0.033
	Second experimental	56.500	7.895				
Third test	First experimental	56.250	7.500	17.750	6.612	2.684	0.036
	Second experimental	74.000	10.893				
Fourth test	First experimental	66.250	6.291	15.727	4.876	3.204	0.018
	Experimental sec	81.877	7.453				
Fifth test	First experimental	29.000	3.366	6.860	2.184	3.140	0.020
	Second trial	35.860	2.784				

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Table 6. *shows the arithmetic means, their deviations, the torsion coefficient, the calculated (T) values, and the statistical significance of the post-tests for the first and second experimental groups for testing muscle strength*

Variables	Group	Arithmetic mean	Standard deviation	F	FH	Calculated T value	Significance level value
First test	First experimental	15.000	8.717	14.500	5.605	2.587	0.041
	empiricism second	29.500	7.047				
Second test	First experimental	12.500	5.000	12.000	3.785	3.170	0.019
	empiricism second	32.750	4.856				
Third test	First experimental	24.000	4.320	9.000	2.614	3.443	0.014
	Second experimental	33.000	2.943				
Fourth test	First experimental	18.500	5.446	10.500	3.989	2.632	0.039
	Second experimental	23.500	6.557				
Fifth test	First experimental	15.250	1.258	5.250	0.803	6.533	0.001
	Second experimental	20.500	1.000				

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Discussion

The findings of the study indicate a clear improvement in both motor range and muscle strength among the participants of the two experimental groups, with more pronounced development observed in the second experimental group. This suggests that the applied training programs had a significant positive influence on the development of functional and motor abilities related to flexibility and muscular performance.

The first experimental group demonstrated noticeable progress between the pre- and post-tests, reflecting the effectiveness of the applied training intervention in stimulating muscular and neuromuscular adaptations. The observed enhancements in motor range tests indicate improvements in joint flexibility, neuromuscular coordination, and muscle elasticity. Similarly, the gains in muscle strength tests suggest an increase in muscular endurance, recruitment efficiency, and synchronization of motor units, all of which are essential for improving functional performance. These findings align with previous research emphasizing the role of structured exercise programs in promoting muscular adaptation and movement efficiency (Behm & Chaouachi, 2011; Schoenfeld, 2010).

In contrast, the second experimental group exhibited greater improvements in both sets of tests when compared to the first group, indicating the superiority of the training protocol implemented with this group. This may be attributed to differences in training variables such as intensity, progression, and exercise type, which may have led to higher physiological and neuromuscular adaptation. The improvements observed in motor range can be linked to enhanced joint mobility and increased muscle-tendon extensibility, as supported by the principles of dynamic flexibility training (Magnusson et al., 1996). Furthermore, the considerable increase in muscle strength supports the notion that systematic overload and progressive resistance training lead to substantial gains in muscle fiber recruitment and cross-sectional area (Folland & Williams, 2007).

The post-test comparisons between the two experimental groups further reinforce these interpretations. The second group consistently outperformed the first group across all variables, suggesting that the applied method had a more substantial impact on both flexibility and strength development. This outcome highlights the importance of applying diverse and progressively loaded training programs that integrate both dynamic and strength-oriented exercises to achieve optimal improvement in physical performance.

Overall, the results emphasize that well-structured and systematically progressed training programs significantly contribute to enhancing motor range and muscular strength. These outcomes are consistent with established scientific evidence on the relationship between targeted

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physical training and functional adaptation, indicating that specific, individualized, and progressive exercise regimens are critical for maximizing performance outcomes (American College of Sports Medicine, 2021; Kraemer & Ratamess, 2004).

Conclusions

The results of the study indicate that the integrated rehabilitation program, which combined targeted rehabilitation exercises, nutritional supplementation, and the use of assistive tools, had a significant positive impact on the recovery of injured players. This comprehensive approach effectively facilitated the restoration of the anterior deltoid muscle's functional capacity, bringing it as close as possible to its normal pre-injury state and enabling the athletes to safely and efficiently return to training and performance activities.

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