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A physical rehabilitation approach on the torn hamstrings of the back muscle and its effect on the degree of pain and some physical abilities of football players

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Abstract
The hamstring tendon injury is a common injury in football, and if it is not treated, rehabilitated and returned to its pre-injury condition and full recovery, it may lead the player to stay away from training for long periods and even create negative effects. Since the requirements of football, which depend on stopping, changing direction, pivoting, turning and running, all of these movements lead to straining the tendons, ligaments and muscles, in addition to the lack of interest in warming up, as well as not strengthening the posterior thigh muscles and limiting them to strengthening the posterior femoral muscles, and this leads to a lack of muscular balance between the anterior quadriceps muscles and the posterior muscles, and these are what create suitable factors that lead to injury, also, the failure to develop rehabilitative exercises based on sound scientific foundations when the hamstring tendon ruptures, and the main objective of the research is to develop rehabilitative and physical exercises and criteria for returning to play to rupture the hamstring tendons, and from here the idea of research arose.
The study aims to identify the effect of the physical rehabilitation program for hamstring tendon rupture in football players, and to clarify the criteria for returning to play through the variables dependent on the research and the results of the researcher. The study was conducted on a sample ranging in age (18-30) years with a number of 8 injured. Where the injured were rehabilitated individually because the sample was not available at one time.
The researcher used the experimental method to measure the pre and post test, and the most important results were a clear improvement in the muscle strength of the posterior muscle, the complete disappearance of the degree of pain, and an improvement in some of the investigated physical abilities.
The most important recommendations were the need to pay attention to the treatment and rehabilitation of the hamstring muscle rupture in football players immediately after the appearance of pain and not to neglect it so that we can speed up treatment and rehabilitation and get rid of complications.
The researcher concluded that the physical exercises prepared by the researcher in his rehabilitation approach had a positive effect on the variables of the research and the return of the injured to play and competition.

Keywords: Rehabilitation, torn hamstrings, football, pain

1. Introduction
The hamstring muscle injury is a common injury in football in sports that use kicking, sprinting, stopping, changing direction and jumping, such as soccer, athletics and other games, all these factors lead to muscle strain and muscle tear, as mentioned (Gicomo *et al*. 2018) that back muscle tear injuries are among the most common injuries among athletes, especially football players. (Giacomo Severini *et al*., 2018, pg. 56) [1].
The posterior thigh muscles are one of the important muscles in the body for the exercise of sports activity, and its injury limits the athlete's ability to perform and may not be able to continue practicing sports activity, and that pulling the muscle and increasing its length to 25% of the original length at rest is one of the reasons why players are exposed to this The type of injury and usually the rupture occurs at the weakest point in the muscle, and the most torn muscle is the tendons of the hamstring muscle. (Arnlaug Wangensteen, *et al*., 2020, p. 89) [2]
Football needs high physical fitness due to the physical requirements of football players during the 90th minute of the match, as these requirements include running at high speed, running

slowly, jumping, jumping, endurance, friction with the opponent, and the player's need for muscle strength and strong docking to take the ball from the opponent requires muscle strength from the thighs and muscles. Obesity in order for the player to maintain high performance.

Sports medicine physicians and researchers from the College of Physical Education and Sports Sciences are constantly under pressure to facilitate a quick and safe return of the injured athlete to training and competition. To meet these challenging requirements it is necessary to combine a set of training criteria to ensure that the athlete is able to return to play or his ability while ensuring that the injured tissues have enough time to heal.

If a player progresses too quickly during rehabilitation, there may be a risk to the player and a worsening of the injury, thus delaying the time to return to sport (RTS). However, following an unscientific and unregulated rehabilitation program can keep the athlete out of training and competition for longer than necessary.

The importance of the research lies in knowing the effect of the training curriculum and its selected physical exercises on eliminating the degree of pain in the back muscle, developing some physical abilities, and putting in place preventive exercises to not recur through the exercises used in the research, and this study may contribute to finding a solution to rehabilitate the back muscle.

1.1. Research problem

The researcher noticed the frequent injury of the hamstrings of the hamstrings of football players, and this requires scientific efforts in how to develop rehabilitation and physical programs that seek to return the player to the sports competition, the researcher also noted not to put flexibility and stretching exercises and muscle strength exercises for the posterior muscles and limiting them to strengthening the quad muscles only, and this led to a large number of ruptures of the posterior muscle due to the muscular imbalance between the front muscles and the back muscles.

Through the researcher's work in the field of physical fitness and rehabilitation of sports injuries, he did not see a physical approach to hamstring tendon injury that depends on physical exercises that seek to develop the physical fitness of the injured players based on scientific tests aimed at achieving the injured's return to play and competition, and from this point of view he decided The researcher has to design a physical rehabilitation program.

The researcher believes that although there are many studies that examine the study of hamstring muscle ruptures, there are some shortcomings in physical programs, in addition to not putting flexibility, stretching and strength exercises in some training programs, how much the researcher noticed not putting exercises to prevent recurrence of injury, and from those reasons all in the rehabilitation of the back muscle came the research problem.

1.2. Research objectives

1. Designing a physical approach for football players' hamstring tendon ruptures.
2. Knowing the differences between the pre and post tests in muscle strength, agility and the degree of pain for football players with hamstring tendon ruptures.
3. Knowing the differences between the pre and post tests in the physical abilities of football players with hamstring tendon ruptures.

1.3. Research assignments

1. There are differences between the pre and post tests in muscle strength and agility and the degree of pain in the hamstring muscle tear.
2. Knowing the differences between the pre and post tests in the physical abilities in the tearing of the back muscle**.**

1.4. Research areas

1.4.1. Human Field: Football players with hamstring tendon ruptures, ages ranged between (18-25) males in Thi Qar Governorate - Iraq

1.4.2. Spatial Field: Baghdad Clinic, Al-Tamayiz Clinic, Al-Hussein Teaching Hospital, Ministry of Youth and Sports Stadiums/Thi Qar, Iraq

1.4.3. Temporal Field: from (2/1/2022) until (2/6/2022).

2. Research methodology and field procedures

2.1. Research community

The researcher used the experimental method for its relevance to the nature of the problem to be solved, and it is an attempt to control all the variables and basic factors.

2.2. The research sample

The researcher chose the research sample by the intentional method, a sample of people with hamstring tendon ruptures and from the Thi Qar governorate football clubs, and their ages ranged between (18-25) years and with one experimental group for pre- and post-measurement, and their number was (8) and the degree of injury was diagnosed through a group From specialist doctors through resonance and sonar devices.

2.3. Research tests and measurements

2.3.1. Measure the degree of pain: (Askling CM, Nilsson J, Thorstensson A. A, 2010) [3].

Test name: Askling H test.

The purpose of the test: To measure the degree of pain in the posterior muscle.

Tools used: (Registration form, pen, medical bed).

Description of the test: The casualty lies on a bench or a medical bed from the lying position with the legs extended and puts down the laboratory puts his hand on the healthy leg and fixes it, and the injured raises the injured leg three consecutive raises.

Register: The degree of pain is recorded from (0-10).

Fig 1: Showing the degree of pain test

2.3.2. Back muscle stretch test: (www.aspetar.com) [4]

Test name: Torso flexion forward.

The purpose of the test: To measure the degree of pain in the posterior muscle.

Devices and tools: (data registration form, pen).

Description of the test: The casualty stands with the body straight, with the knees and hands not touching the body, and the casualty begins to go down to the farthest point, and when the pain stops.

Register: The score is scored from (0 - 10).

Fig 2: Showing back muscle stretching pain test

2.3.3. Back muscle endurance test: (Arnlaug Wangensteen, *et al*., 2020, p.237) [5]

The purpose of the test: To measure the force endurance of the posterior muscle.

Tools used: (Registration form, pen, medical mat).

Test description: The casualty lies on a medical mat from a prone position, bends the injured leg and raises it the healthy body is high and the torso is straight and the hands are extended parallel to the body the injured person lifts the torso upwards by pushing the ground with the injured leg, as shown in the figure

Register: Three attempts, and the best is taken by repetition.

Fig 3: Showing back muscle strength test.

2.3.4. Leg Strength Test: (Mackenzie, Brain, 2005, p.122) [6]
Purpose of the test: To measure the speed characteristic of the legs.

Tools used: (an area of not less than (35 m), and a width of not less than (1 m) signs, a stopwatch, a registration form, a whistle).

Test description: The player performs a full body warm-up. We put the signposts at a distance of (25 m), and when the whistle is heard, the player jumps on the injured leg from the beginning of the sign to the finish line.

Register: The player is given two attempts for the injured leg, and the best attempt is taken. time/sec.

2.3.5. Agility Test: Rod Whiteley, *et al*. (2020 pt 10) [7]

Purpose of the test: Agility.

Devices and tools used: (Registration form, pen, signs, whistle).

Performance description: After warming up, the player runs around the cones according to his ability and as shown in the figure.

Register: The player is given three attempts and the best attempt / time / second (2) is taken.

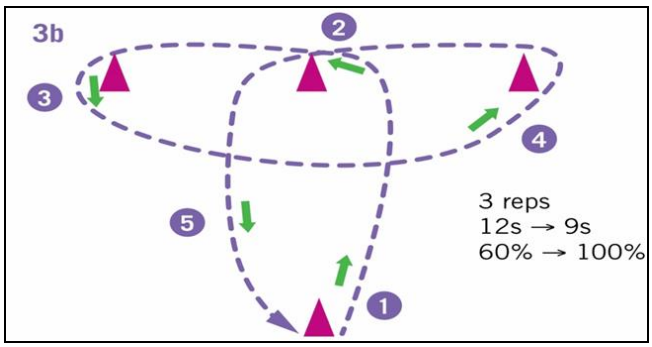

Fig 4: Showing agility test

2.3.6. Frontal muscle strength test standing on one leg: (Kyritsis, P., E. Witvrouw, and P., 2015. 4: p. 1503-15) [8]

Test name: squat on one leg.

The purpose of the test: To measure the strength of the front muscles.

Test description: The player stands on the injured leg with the arms open to the side and goes down and up.

Register: The player is given three attempts, and the best attempt is taken by repetition.

Fig 5: Showing anterior muscle strength test.

2.4. Details of the rehabilitation and physical program

The proposed qualifying exercises were designed based on scientific studies and research and analysis of their content to find out the differences and shortcomings when designed and applied in the program. The researcher aimed to rehabilitate the torn hamstrings of the hamstring muscles through the development of rehabilitation exercises and exercises for the specialized activity of football.

The criteria for moving from one stage to another have been established, which are the squatting tests on one leg that the patient must perform without pain, the stationary bike for 5 minutes as well as without pain, and the agility test (T). The program was divided into basic exercises targeting the back muscle and additional exercises targeting other muscles, in addition to developing a program to develop physical fitness. According to the condition of each injured person and after obtaining the doctor's approval, the rehabilitation exercises were conducted in the Iron Hall, at the rate of 5 rehabilitation units per week, and the total in the program amounted to (60) training sessions.

The aqueous medium was used at a rate of 3 sessions per week, and it amounted to 24 sessions in the rehabilitation program. After 4 weeks of injury, we went to the stadium and trained to develop physical fitness for some physical characteristics by 40 training units that included endurance, agility and strength exercises distinguished by speed. In the last stage, we moved to zigzag running and a quick stop, and plyometric exercises and skill exercises with the ball. The researcher also put exercises similar to the cases of playing in the training program. The researcher also used the principle of gradual training with the training load. The duration of the training program lasted 3 months.

2.4.1. Conditions to be fulfilled in the training program

1. Taking into account the individual differences between the injured.
2. Taking into account the implementation of fixed exercises in the first stage
3. Taking into account the psychological state that the player is going through due to the injury.
4. The exercises should be implemented in the presence of the researcher
5. The player must be dealt with well from the beginning of the injury to the return to the field.
6. Training should be 5-6 times a week
7. Pay good attention to the warm-up.
8. The affected muscle should be directly targeted with exercises.
9. Attention to strengthening the muscles surrounding the injury
10. Applying the program individually.
11. Gradual exercises from easy to difficult.

2.5. Statistical processors:

- Mean
- Std. deviation.
- Percentage.
- T value.

3. Results & Discussion

3.1. Results

Calculated for each of the pre and post tests in T Table No. (1) Shows the values of the means and the value of some variables (pain degree, hamstring pain degree, agility, strength endurance, muscular strength, strength characteristic of speed).

Table 1: Shows the values of the means and the value of some variables (pain degree, hamstring pain degree, agility, strength endurance, muscular strength, strength characteristic of speed).

Variables	Pre-test		Post-test		Difference Means	T test	Percentage	Sig value
	Mean	Std. deviation	Mean	Std. deviation				
Pain degree	8.000	0.7559	1.375	0.51755	6.6250	15.777	89%	0.000
Pain degree stretching posterior muscle	8.000	0.9258	1.750	0.70711	6.2500	11.180	98%	0.000
Agility	16.846	0.96346	11.067	0.77814	5.7787	14.790	88%	0.000
Speed characteristic of the injured leg	15.766	1.2352	11.265	0.6555	4.5010	8.485	88%	0.001
Muscular strength	2.875	0.8345	8.875	1.3562	6.0000-	18.33-	91%	0.000
Endurance force for the posterior muscle	2.875	0.8345	13.250	2.1213	10.3750-	14.20-	86%	0.000

3.2. Discussing

3.2.1. Discussing the results of (muscular strength, strength characteristic of speed, endurance of force).

The researcher attributes the reasons for the significant differences between the results of the pre and post tests of the physical variables (muscular strength, and strength characteristic of speed) and in favor of the results of the post tests for the members of the research sample to the nature of the exercises used in the rehabilitation and training program according to the methods.

1. Training method for the use of isometric muscle contraction exercises.
2. Second method: training using muscular contraction exercises (isotonic).
3. Third method: training using mixed muscle contraction exercises (fixed and mobile).

And this is Tariq Sadiq (2000) that the development of muscle strength in the three methods is one of the most important means used in rehabilitation and training. (Sadek, Tarek Mohamed, 2000, p 54) [9]

Herslon (1991) sees that as a result of injuries and loss of movement, muscle atrophy and loss of muscle strength of the injured muscle can be overcome by using muscle strength training methods.(Herrelson G.L,1991, p. 76) [10]

The researcher also attributes the significant differences in strength characterized by speed and strength endurance to the plyometric training method to three forms: Rhythm type, Power type, and Speed type:

Plyometric exercises lead to improving the ability of football players, each of the previous types has a certain specificity, for example, rhythm exercises lead to the development of harmonic motor skills and basic ballistic strength, as the ability training combines the output of maximum strength and maximum speed in the activity, as in explosive exercises, and speed exercises, it reduces the time required to perform the required movements. (Amy Allmann. Orlando Brenes and Roger Bryant, 2012, p. 96) [11]

The researcher also attributes the reason for the development of endurance of force and strength that is characterized by

speed to the use of the resisted sprinting training method.

3.2.2. Discussing the results of the degree of pain variable

The researcher attributes the reasons for the significant differences between the results of the pre and post tests for the variable (pain degree) and in favour of the results of the post tests for the members of the research sample to the nature of the exercises used in the rehabilitation and training program. The pain gradually decreased from the beginning of the injury until the return to the field, through the use of rehabilitation exercises in the training program this is what Dahan (1999) confirmed. We must gradually reduce the pain and preserve the amount of blood reaching this area. We must reduce the pressure on the back muscles in rehabilitation and gradually increase the physical load. (Dahan, R., 1999, p. 124) [12].

3.2.3. Discussing the results of the variable degree of lengthening the posterior muscle

The researcher attributes the reasons for the significant differences between the results of the pre and post tests for the variable (the degree of posterior muscle lengthening) and in favor of the results of the post tests for the members of the research sample to the nature of the exercises used in the rehabilitation and training program.

Static Stretching The first method is using static stretching exercises, which are positive and negative, which is in performing a voluntary muscle contraction to move one of the body parts that make up that joint to the farthest possible range of motion and stability for a specific period of time, and this is called positive static stretching, such as:

Or passive stretching with the help of our colleague Hamstring Strech to lengthen the posterior thigh muscles it is mentioned (Al-Damaqa 2017) that we can develop flexibility by using fixed stretches, both positive and negative, in performing a physical exercise in a specific position and holding it for a few seconds, while performing a graduated pressure of intensity to prolong the working muscles surrounding that joint to be developed, and then repeating it for several times. Where the researcher used this method to rehabilitate and train a hamstring muscle injury. (Al-Madamgha, Muhammad Reda Ibrahim, (2017, p. 25) [13]

The researcher also used the second method represented by using kinetic stretching exercises (Williamson 2017): The use of static and kinetic stretching method leads to the development of flexibility. (Williamson, Lexie, 2017, p. 100) [14]

The researcher agrees with (Al-Hazaa 2009): that static and kinetic stretching exercises are among the safest and most widely used types to develop joint flexibility. (Al-Haza'am Hazaa bin Mohammed, 2009, p. 89) [15]

Where the researcher used the third method in developing the lengthening of the posterior muscles in the use of Proprioceptive Neuromuscular Facilitation Neuromuscular Stretching Technique it is one of the stretching techniques in which the muscles to be lengthened are contracted maximally, and then these muscles are relaxed and then lengthened by the action of the opposite muscle contraction or by external assistance such as the colleague. Pullman and Smith (2011) mention that neuromuscular facilitation exercises are one of the best effective ways to develop the flexibility of different joints. (Williamson, Lexie, 2017, p. 105) [14]

Gamal Sabry also mentions that muscle lengthening in the rehabilitation program contributes to healing the torn muscle. (Faraj, Jamal Sabri, 2018, p. 78) [16].

3.2.4. Discuss the results of the agility variable

The researcher attributes the reasons for the significant differences between the results of the pre and post tests for the variable of agility and in favor of the results of the post tests for the members of the research sample to the exercises used in the qualification and training curriculum.

The researcher attributes the reasons for the development of agility to the use of Psycho exercises and exercises to perform multiple movements whose main title is change: such as the change in running speed (acceleration - deceleration), the change in the direction of running or running interactively and non-interactively, with or without the ball, and by learning the correct position in performance. The researcher used several forms of exercises to apply this training method, including: zagzak exercises, agility ladder exercises, catching exercises to change direction, running and jumping exercises.

The researcher agrees with (Mufti Ibrahim 2013) that the most important foundations for developing agility are that the exercises used include the element of diversification in the selected movements, and the rapid and sudden change in the direction of running for different paths on the ground or in the air and with and without the ball, the change between a sudden stop and a starting again. {Hammad, Mufti Ibrahim, 2013, p. 59) [17]

The goal is to reach an agile performance characterized by speed, accuracy, fluidity and the correct timing to implement the parts of the motor duty as a single unit, and this is what the researcher used in developing agility.

4. Conclusions and Recommendations

4.1. Conclusions

1. The vocabulary of the rehabilitation and training program used has a significant impact on the development of research variables.
2. The rehabilitation and training program for hamstring tendon rupture achieved the research objectives of the sample.
3. The time period for the rehabilitation of the injured was less compared to the other rehabilitation curricula.
4. The exercises that were selected by the researcher provoke the tendencies and motives of the injured in the performance of the rehabilitation curriculum.

4.2. Recommendations

1. The need to pay attention to the treatment and rehabilitation of the torn hamstrings of the back muscle in football players immediately after the injury so that we can speed up treatment and rehabilitation to avoid complications.
2. Take advantage of the steps of implementing the rehabilitation and physical program in research.
3. Conducting more future studies on finding criteria for returning to play and competition.
4. The need to educate players and coaches to know how to balance training the injured muscles and the surrounding muscles.
5. The use of hydrotherapy because of its role in the rehabilitation of the posterior muscles, in addition to improving the psychological state of the injured.
6. The rehabilitation program must include a program to develop the physical fitness of the injured.

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