

## **Effect of Proposed Rehabilitation Program Accompanied by Therapeutic Means on Achilles Tendinopathy Among Football Players**

**Dr. Zaid Sadoun Aziz Al Saady.**

Lecturer. Ministry of Education/Missan Directory. Iraq

### **ABSTRACT**

---

This study aims to determine and identify the effect of a proposed rehabilitation treatment program on Achilles tendinitis in football players. The researcher employed the experimental method to suit the nature of the research, and intentionally he selected the research sample of (3) football players representing Al-Sulaikh clubs, Amanat Baghdad, and the Electrical Industries Club in Baghdad who were exposed to tendinopathy or inflammation of the middle part of the painful Achilles tendon. The following instruments were used: a Goniometer to measure the range of motion of the ankle joint, a Dynamometer to measure muscle strength during contraction and relaxation of the foot, a short heat wave device to treat inflammation and swelling, and a survey form to measure pain intensity.

The results were statistically processed using arithmetic means, standard deviations, and the T-test to indicate the differences between pre-and post-test.

The results showed that the proposed rehabilitation program led to reduced pain intensity, especially posterior heel pain among players with Achilles tendinopathy and restored the functional state of the affected Achilles tendon, as the program showed its effectiveness in improving the lengthening of the fat muscle and other muscles working on the foot joint, which led to an increase in the range of motion of the joint and reaching its normal range. Muscle strength exercises have increased the level of strength of the muscles working on the leg and ankle joint to the level of strength to the same as in the unaffected leg. This indicates the program's effectiveness in restoring the Achilles tendon's functional state and raising its efficiency. The most

important recommendation was the use of the proposed rehabilitation program in the rehabilitation of Achilles tendinopathy.

**Keywords:** Achilles tendinopathy, Sports Rehabilitation, Therapeutic Exercises

## **Introduction**

Sports injuries are considered one of the most important problems that most athletes suffer from, especially in the field of competitive sports, as competing to obtain advanced positions, especially in international tournaments, requires raising the level of training in terms of its quality and increasing training loads in proportion to each type of sport, which increases the effort placed on athletes' bodies, thus increasing the possibility of injury (5,9).

The injuries that athletes are exposed to may include different types, such as muscle strains and tears, bone injuries, including all kinds of fractures, bruises, joint injuries including dislocations, ligaments injuries and tendons, such as tearing, stretching, or inflammation (1).

Among the injuries that negatively affect the performance of athletes are Achilles tendon injuries, as Achilles tendinopathy is a common injury in the lower extremities and constitutes about %5.9 in the general population, while the percentage is higher in athletes, especially running sports (11, 40), where the injury percentage ranges from %9.1 to %10.9 in male runners and lifetime risk exceeds 50% in male distance runners and is most prevalent in individuals aged 21-60 years (11).

As indicated by the American National Football League, soccer players are at increased risk of Achilles tendon injury because the game involves speed, jumping, and sudden changes of direction (12).

The Achilles tendon is the strongest tendon inside the human body, which connects the calf muscle to the heel, as it can bear loads (11). The cartilage

matrix (extracellular) contains most of the tendon volume, where collagen constitutes 30% of the wet weight and 80% of the dry weight. Collagen is mostly type I and may give strength and rigidity to tendons when loaded and flexibility when bent or compressed (33). The Achilles tendon helps reduce the force of landing and absorbs it during movement and jumping. Therefore, people who practice sports with high physical exertion, such as mountain climbing, running, basketball, football, etc., are more susceptible to inflammation or Achilles tendinopathy.

Tendinopathy is characterized by changes in the microscopic structure of the tendons and is accompanied with pain, swelling, and loss of function, such as lack of flexibility and movement, as well as tendon thickening and weakness, decreased or deteriorated collagen, and the growth of blood vessels.(10,15,34).

Tendinitis occurs when the affected person feels pain in the back of the ankle accompanied by Achilles tendinopathy with changes in the tendon's structure and mechanical properties. The most common symptoms as mentioned previously are pain and swelling around the affected tendon. The source of pain in tendinopathy may be related to the neurovascular growth seen in the tendon's response to injury. The pain is usually worse at the beginning of exercise and decreases afterward. The patient may also suffer from stiffness in the tendon due to the breakdown of collagen fibers (15). Symptoms of the disease generally begin to increase gradually (16). However, Achilles tendinopathy can be divided into three categories based on location:

- Middle Achilles tendinopathy, located in the middle of the tendon and 2 cm to 6 cm away from its insertion in the heel or ankle bone. It is considered the most common and may reach 66% of cases. The reason is due to the small amount of blood or blood vessels in this place as well as the weak thickness of the tendon in this area

- The place where the tendon is inserted into the ankle bone, may occur most often in people who have a deformity in the heel bone, which in turn leads to increased friction of the tendon with the bone and then leads to inflammation in the long term.
- The location of the muscle tendinous intersection of the calf muscle with the tendon in general (Figure No. 1).



Figure No. (1) shows the locations of Achilles tendinopathy.

Despite the many causes of this injury, overload of the tendons is considered the main factor contributing to the disease or inflammation of the cartilage. Achilles tendonitis usually occurs as a result of excessive exercise, especially when overusing the ankle and foot, such as running and jumping (35). Repetitive stress may simply mean increasing the intensity of your running, jumping, or plyometric training over a very short period.

It is believed that some of the basic causes of inflammation or Achilles tendinopathy are physiological or mechanical: physiological, where there is a lack of blood supply to the Achilles tendon through the synovial sheaths surrounding it. This lack of blood supply may lead to the deterioration of collagen fibers (17). When the Achilles tendon is damaged or ruptured, there is a decrease in the proportion of collagen type 1, and a significant increase in the

amount of collagen type 3, which is responsible for the decrease in the tensile strength of the new tissue due to the reduced number of cross-links compared to collagen type 1 (33).

Other risk factors include frequent injuries, a lifestyle that includes little exercise, High-heeled shoes, rheumatoid arthritis, fluoroquinolone medications, and cortisone injections, where diagnosis generally depends on symptoms and examination. Also, calcium deposition in the tendons, known as calcific tendinopathy, may be a cause of tendinopathy (41) (40).

Most studies have proven that sports rehabilitation may give good results in increasing strength and flexibility and improving endurance and athletic performance. In addition, rehabilitative exercise can help relieve pain and inflammation and speed up the healing process and recovery from tendon damage or rupture. The exercise load depends on the severity or type of injury and must be performed in a controlled manner, based on the principle of gradation of intensity, and must be under the supervision of physical therapy and rehabilitation specialists to ensure the safety and effectiveness of sports rehabilitation. Therapeutic goals must be set, the player's abilities should be evaluated, and the rehabilitation program should be adjusted accordingly. On the other hand, good rehabilitation protects the player from the complications of recurrence of the injury or the risks of post-surgical infections, the cost of treatment, and the speed of returning to sports activity (18) (19) (20).

Eccentric exercises are considered the most common exercises in the treatment and rehabilitation of Achilles tendon injuries, as they are used to strengthen the muscles surrounding the tendon and improve its flexibility, as well as the flexibility of the foot or ankle joint and shifts in the tension length curve. These neuromuscular changes may lead to reducing the load on the tendon, thus reducing tendon stress and preventing complications or injury, thus contributing effectively to the treatment and prevention of painful Achilles tendinopathy or

inflammation (21) (22). This is what Maknesen et al., Ross et al., and Yu et al. have confirmed the effectiveness of these exercises in relieving pain, restoring strength, improving function and endurance of the Achilles tendon, as well as reducing the risk of re-injury (23)(37)(38).

The importance of these exercises may lie in the fact that they force the muscles to lengthen during contraction instead of shortening them (41). Eccentric exercises stretch the muscles and tendons during loading (i.e. when the muscle length increases), by controlling movement and deceleration during the transition from muscle contraction to relaxation. The affected muscle or tendon is also loaded with body weight or using additional weights, adopting the principle of gradual load. This type of exercise aims to stimulate the healing process, strengthen the damaged tendon, and improve its function.

Other physical therapy methods also contribute to reducing pain, improving motor function, promoting tissue healing and strengthening the muscles and tendons surrounding the Achilles tendon. Deep massage of the muscles surrounding the calf and tendon contributes to the rehabilitation of the Achilles tendon by improving blood flow, relieving tension, improving flexibility, and preventing further injuries. Different massage techniques, such as deep massage and sports massage, can be used to relieve spasms and improve the condition of muscles and tendons. Deep transverse friction massage, which is a type of connective tissue massage, can help stimulate cell activity and generate new collagen fibers. Cold and hot therapy can also be used separately. Or continue to relieve pain and inflammation at the site of the Achilles tendon. Ice (cold therapy) is used to reduce inflammation and relieve pain, while heat (hot therapy) is used to improve blood flow and relieve muscle tension (24)(25)(42).

Ultrasound is also considered one of the physical therapy techniques that can be used in the treatment and rehabilitation of Achilles tendon injuries. Ultrasound improves blood circulation and relieves inflammation and helps heal damaged

tissues and also reduces pain and improves motor function (28)(29). Acoustic shocks stimulate the healing process of the tissue, promoting blood flow and repairing damaged tissue. It is also believed to relieve pain and improve motor function (28).

### **Importance of study**

The foot is considered one of the basic pillars of the body's balance, as the player relies completely on all his activities, movements, and weights on the safety and strength of it. Therefore, the safety of the foot is useful in maintaining the flow of movement and withstanding shocks and all external influences, as the player can practice the activity with high efficiency if he has strong, healthy feet with high flexibility in all their components, whether muscular, bone, or ligamentous. So, if there is a disorder or inflammation in the Achilles tendon, this negatively affects the function of the ankle and foot, and thus the efficiency of the force exerted and the motor ability in practicing sporting activities or playing a game of football, in addition to the pain, swelling, and some other symptoms caused by these injuries.

Therefore, it is possible to treat the affected tendon while avoiding its partial or complete rupture by removing inflammation and increasing the length of the calves and flexibility of the ankle joint, that is, treating deficiencies in the Achilles tendon through planned rehabilitation programs that include targeted therapeutic exercises. Therefore, the importance of the current study emerged through designing a rehabilitation program. A proposal based on therapeutic exercises with accompanying physical therapy methods to return the Achilles tendon to its normal position.

### **Research problem**

Based on the researcher's professional experience in the field of rehabilitation and sports injuries, as well as observations made during visits to several Iraqi sports clubs, it was noted that some players frequently experience pain in the

lower part of their legs during competition or exercise. This pain specifically involves the tendon connecting the calf muscle to the heel bone and directly impacts essential movements such as walking, running, and jumping.

Upon review and diagnosis by the specialist doctor of this sample, he confirmed what the researcher observed, prompting the researcher to focus on this area. Achilles tendonitis or inflammation can severely impair the function of the ankle joint and, in some cases, the knee, ultimately affect athletic performance. Failure to treat tendinopathy early, or reliance on temporary solutions such as cortisone injections, can lead to prolonged absences from training and competition. In severe cases, a complete rupture of the Achilles tendon may occur, potentially ending an athlete's career.

In the previous study showed that 4.0% of patients who were previously diagnosed with Achilles tendinopathy caused a tendon rupture (24). Hence the need to conduct this study based on scientific foundations to solve this problem by preparing proposed rehabilitation program to Achilles tendinopathy or Achilles tendinitis injured.

**Research objectives:**

1. Preparing proposed rehabilitation program for Achilles tendinopathy injury.
2. to investigate the effect of the proposed rehabilitation program among Achilles tendinopathy injured football players.

**Research hypothesis:** There are significant differences in rehabilitating the Achilles injury between pre- tests and the post-tests among football players.

There are statistically significant differences between pre- tests and post-tests in the muscular strength of the foot and leg muscles in favor of the research sample. There are statistically significant differences between pre-tests and post-tests in the degree of pain in favor of the research sample.



There are statistically significant differences between pre- tests and post-tests in the range of motion in favor of the research sample.

### **Research areas**

Human field

Football players Diagnosed with Achilles tendinopathy injury Distributed at Salikh, Amanat Baghdad, and Electrical Industries Clubs in Baghdad Governorate

Time domain

5/12/2021-15/1/2022

Spatial field

Captain Raad Salman Center for Rehabilitation of Sports Injuries - Amanat Baghdad Club Stadium

### **Study procedures.**

Study Approach

The researcher used the experimental method with a single group design for measurements (pre-post), and it was used for its suitability to the nature of this study.

Study community

The study community consisted of football players with mild Achilles tendinopathy from Baghdad Governorate

The research sample

The research sample consisted of (3) male players with mild Achilles tendinopathy. The sample was chosen intentionally from first-class players who belonged to the clubs of Amanat Baghdad, Sulaikh, and the Electrical Industries Club. The researcher conducted the exploratory experiment on (2) football players from outside the research sample

### **Tools used in the study**

- A goniometer device to measure the range of motion of the ankle joint in flexion and extension
- Goniometer device to measure the rate of pain
- A dynamometer device to measure the muscle strength of the muscles working on the ankle joint.
- Pain intensity measurement form (Visual Analogue Scale) Appendixes No(4).
- Shortwave thermal device to treat the joint due to Achilles tendinopathy.
- A measuring tape is listed in centimeters to measure the length and thickness of a bag tendon.
- Rubber band.
- Stopwatch.
- Medical scale for measuring weight.

### **Exploratory experiment**

On Sunday (5/12/2021). The exploratory experiment took place to uncover the obstacles that the researcher might face while carrying out the main experiment and to prepare in advance the requirements of the experiment in terms of time, cost, auxiliary personnel, suitability of devices and tools, etc...

### **Pre- measurements**

The Pre-test of the study variables conducted on Monday 12/6/2021 where the researcher used scientific sources and specialists in the field of sports injuries and rehabilitation, physiology, and football. Appendix No. (3).

### **Research tests**

#### **Range of motion:**

The angles of the ankle joint for plantar and dorsiflexion were measured from the sitting position on the chair with the leg lowered down and in a relaxed state, and the foot joint is in its natural position, as the goniometer device is fixed on

the ankle joint from the lateral side and the fulcrum of the angle axis is on the point of articulation in the ankle. The test begins by extending the affected foot forward, then flexing it backward, then measuring the maximum dorsiflexion and plantar flexion angles. (39).

Recording: Three attempts are given. The best attempt is recorded by calculating the angle of flexion and extension of the foot using a range-of-motion device.

Unit of measurement used: degree

### **Muscular strength:**

First test: muscular strength test (29).

The purpose of the test is to measure the strength of the muscles surrounding the Achilles tendon and ankle

The test takes a long sitting position on a Swedish chair with the back touching the wall.

The leg is fixed with a belt at the knee. It is necessary to have wooden support behind the seat when the laboratory's back is in contact with the wall. The belt is connected to the dynamometer attached to the injured person's foot.

Method of performance: The strength of the foot flexor muscles is measured

Second test: muscular strength test (29)

The strength of the muscles surrounding the Achilles tendon and ankle is the goal of the test to measure

The test takes a long-time sitting position on a Swedish chair, facing the wall, to measure the strength of the foot extensor muscles.

The leg is fixed with a belt at the knee. It is necessary to have a wooden support behind the seat when it is facing the wall. The belt is connected to the dynamometer attached to the injured person's foot.

Method of performance: The strength of the extensor muscles is measured

Recording: The injured player records the amount of force in kilograms

### **Level of pain intensity:**

The researcher prepared a special form using a visual analogue pain scale to measure the degree of pain, which includes numbers showing the extent of pain, which range from 0 to 10 degrees, where the number that represents the intensity of pain is chosen, the higher the degree, the greater the pain. A score of 0 indicates the absence of pain.

(Visual Analog Scale (30)).

Test to measure the degree of pain in the tendon of the back leg muscle (calf):

Test objective: To measure the degree of pain in the tendon of the posterior leg muscle (calf) from the foot-flexed position.

Testing tools: bed, pain scale

Sitting on the bed with the affected leg extended in front of you, the examiner pushes the affected foot toward flexion slowly and gradually, while maintaining moderate intensity and observing any increase in pain. If the injured person does not feel pain, the examiner asks the affected player to flex his foot three times to the maximum extent possible.

Registration method: Recording the grade from zero to ten points.

Test objective: To measure the degree of pain in the tendon of the posterior leg muscle (calf) from the foot-supplied position.

Testing tools: bed, pain scale

Sitting on the bed with the affected leg extended in front of you, the examiner pushes the affected foot toward the extension slowly and gradually, while maintaining moderate intensity and monitoring for any increase in pain. If the injured person does not feel pain, the examiner asks the affected player to extend his foot three times to the maximum extent possible.

Scoring method: Recording the score from zero to ten points.

### **Stages of the rehabilitation program**

The rehabilitation program contained three stages for (6) weeks. The duration of each stage is two weeks, at the rate of three units per week. The time of one rehabilitation unit is from (40-50) minutes, depending on each stage. The treatment method used (rehabilitation exercises and some physical therapy methods).

The exercises were performed in the main section of the training unit, with a time ranging from (25-35) minutes, and immediately after the warm-up. The number of qualifying exercises was (18 exercises).

The main experiment was applied to the experimental sample starting on Tuesday, 7/12/2021, in the following manner:

- The first stage: included the use of a short-wave thermal device, massaging the affected area, stretching and strength exercises, taking into account (Short wave), gradual intensity, especially when using weights.
- The second stage: included the use of a short-wave thermal device and the massage of the affected area. Balance exercises, standing on the tips of the toes and then on the instep, and stretching and flexibility exercises
- The third stage: included the use of a short-wave thermal device, massaging the affected area, and strength and flexibility exercises.

### **The details of the qualification to program were as follows:**

General warm-up: "Light jogging and rotating the arms in and out, then stretching exercises for the muscles of the upper body, rotating the torso, and stretching exercises for the muscles of the lower body." Time (seven minutes).

Special warm-up: (Perform stretches for all parts of the body and focus on the basic muscles, which are the calf muscle and other muscles that work on the leg and ankle joints, as well as the flexibility of the ankle joint). In a time (eight minutes).

The main section: This section included performing rehabilitation exercises to rehabilitate the injured Achilles tendon, and it took (25-35) minutes depending on each stage. During the rehabilitation process, the researcher focused on using stretching and flexibility exercises, in the form of repeated plantar and dorsal flexion of the foot joint in Stretching the Achilles tendon and the calf muscle while increasing the flexibility of the joint. The tendon is the best solution to enable the tendon to function. It also includes strengthening exercises using weights and rubber bands of varying intensity, which should contribute to strengthening the tendon and increasing its thickness, as well as the calf muscle and the muscles working on the ankle joint.

The performance of these exercises includes procedures Medical massage with the hands to obtain the greatest amount of relaxation to stimulate blood circulation to the tendon and calf muscle as well as the muscles working on the ankle joint. When using the rehabilitation exercises, the researcher took into account the gradation from easy to difficult and the emphasis on correctly performing the exercises, as well as continuous emphasis on the sample members in the event of feeling pain, so they must Stop performing immediately to change the exercise or modify it to prevent the appearance of pain. The transition from the first phase of the program is also achieved through indicators of improvement in the range of motion of the joint and the muscle strength of the calf muscle and other muscles working on the ankle joint.

### **Post- test**

The researcher conducted the post-tests on Saturday, January 15, 2022

All final tests were repeated using the same method as the previous measurements.

### Statistical coefficients used

- Arithmetic Mean
- Standard deviation
- Pearson correlation coefficient
- T-test

### Present and discuss the results.

#### Range of Motion

Table (1) shows the results of the sample T-test to identify the rehabilitation program's effect on Achilles tendon injury among football players

N=3

Measurements	Normal range(degree)	Pre-test		Post-test		T Value	Sig
		Mean	Std. Deviation	Mean	Std. Deviation		
Planter flexion	50°	25.666	5.507	47.33	5.773	7.45	0.00
Dorsiflexion	20°	6.666	2.081	18.000	1.000	17.00	0.00
Inversion	35°	20.000	2.000	34.000	1.000	14.00	0.00
Eversion	25°	16.00	1.000	24.666	5.773	26.00	0.00

It is clear from Table No. (1) that there were statistically significant differences between pre-tests and the post- tests in the degrees of plantar flexion and dorsiflexion, favoring the post-measurements among the participants in this study.

The researcher believes the reduced range of motion in the ankle joint below normal levels to a loss of functional efficiency in the Achilles tendon following the injury. This decline is attributed to the severe pain, stiffness, and swelling that typically affects the tendon after such injuries.

The researcher attributed the reason for this change to the positive effect of the proposed rehabilitation program on Achilles tendinopathy in football players, as there was an increase in the degrees of ankle joint plantar flexion and

dorsiflexion after the end of the program, which helped the players increase variables related to the flexibility of the joint and the affected tendon, as it included various exercises and purposeful treatments, including stretching and strength and balance exercises. Also, a short-wave heat device and medical massage were used with the hands for the purpose of heating and to obtain the greatest amount of relaxation to activate the calf muscle and the muscles working on the ankle joint, thus obtaining greater flexibility.

The rehabilitation program and the application of exercises in a precise and gradual manner with loads and resistances also had a positive effect in improving the range of motion of the ankle joint angles, especially during flexion and extension of the foot.

An increase in the range of motion means an improvement in the elasticity of the tendons and ligaments surrounding the joint, as well as an improvement in neuromuscular work to control the work of the sensors responsible for providing services to the brain over this range (31).

This is consistent with what was indicated by Sumaiya Khalil Muhammad, Suad Abdel Hussein, and others (2010) (3) (2010) (7).

Flexibility exercises have an important role in developing the muscle lengthening component and increasing the elastic property of the muscles, ligaments, and tendons together, which leads to a clear increase or improvement in the range of motion.

Hayat Ayyad (2003) (193:4) also mentioned that there is a close relationship between the flexibility of the joints and the ability of the muscle fibers to elongate, and when there is a deficiency in the full range of motion, this causes a limitation to the extent of the elongation of the muscle fibers working on them. Therefore, the flexibility of joints must first be ensured before testing the ability of muscle fibers to elongate, and this is what the researcher worked on.



## Muscular strength

Table (2) shows the results of the sample t-test to identify the rehabilitation program's effect on Achilles tendon injury among football players.

N=3

Measurements	Pre-test		Post-test		T Value	Sig
	Mean	Std. Deviation	Mean	Std. Deviation		
Foot flexor muscle strength	7.333	4.041	35.666	4.041	32.123	0.00
Foot extensor muscle strength	14.333	4.163	46.333	2.081	15.372	0.00

Table No. (2) indicates that there were statistically significant differences between pre-tests and the post-tests in the extensor and flexor muscle strength of the foot in favor of the post-test among the research sample members.

The researcher attributes the differences in muscle strength between pre-tests and the post-tests as resulting from muscle weakness in the leg and ankle joint caused by the injury. The Achilles tendon disorder limited the ability of the calf muscle and other related muscles to produce sufficient force. This limitation was further exacerbated by pain, which hindered the player's ability to perform exercises effectively, particularly during the initial phase of rehabilitation.

The use of a rehabilitative treatment program speeds up recovery from these symptoms by lengthening and strengthening these muscles, especially the calf muscle, and by accompanying flexibility exercises to maintain the range of motion of the joint and quickly get rid of the symptoms of pain and inflammation. The rehabilitative program also includes fixed and mobile muscle strength exercises that affect the rehabilitation program relied on the requirements for developing muscle strength in terms of the type, intensity, size, and frequency of contractions, as well as the natural gradualism of the load, and finally the range of motion for each muscle.

This is consistent with the study of Khaled Ahmed Hussein (2015) (5) which indicated that the rehabilitative program includes exercises to train static muscle strength after injury and practicing them regularly and gradually is considered a necessary means of maintaining and developing muscle strength, and the researcher believes that applying these exercises with use Some Modern physical therapy methods have greatly contributed to alleviating pain and inflammation in the tendon and raising the level of functional performance of all types of fibers in the skeletal muscles and thus speeding recovery from injury.

### **Pain**

Table (3) shows the results of the sample t-test to identify the effect of the rehabilitation program on Achilles tendon injury among football players,

N=3

Tests	Measurements Unit )	Pre-test		Post-test		T Value Calculated	Sig	Indication
		Mean	Std. Deviation	Mean	Std. Deviation			
Degree of pain on plantar flexion	Degree	7.333	5.77	6.66	5.773	20.000	0.000	Morale
Degree of pain when dorsiflexion	Degree	8.000	1.000	6.667	5.773	22.000	0.000	Morale
Degree of pain during internal inversion	Degree	6.000	1.000	3.333	5.77	6.425	0.000	Morale
Degree of pain during external inversion	Degree	6.000	1.000	3.33	5.77	17.000	0.000	Morale

Table No. (3) indicated that there were statistically significant differences between the pre-measurements and the post-measurements in the degree of feeling the intensity of pain in favor of the post-measurement among members of the research sample.

The researcher attributes these differences in the degree of pain sensation before and after applying the proposed rehabilitation program using some exercises developed in terms of volume, intensity, repetition, and auxiliary means to the efficiency of the rehabilitation program that was applied, which included stretching and flexibility exercises, which are of great importance in increasing the range of motion, as this leads to increasing the blood capillaries, the site of the injury is supplied with the necessary oxygen to help it work efficiently, which in turn causes the pain to disappear completely.

Muhammad Qadri (2000) (6) indicated that integrated rehabilitation treatment has a positive effect on strengthening and relaxing tense muscles, stimulating blood circulation, improving muscle tone, and alleviating pain (11:2).

This is consistent with the study of Suad Abdel Hussein et al. (2010) (7) that applying a rehabilitation program that includes flexibility and stretching exercises that work to increase the range of motion has a positive effect on the disappearance of pain.

The researcher's focus in this study was on alleviating or eliminating pain completely because of its great importance in the success of the rehabilitation program and the treatment of Achilles tendinopathy.

This is what Prosester (2003) confirmed that the most important goal of the rehabilitation program is the decline in pain symptoms because pain causes obstruction of the basic functions of the joint, which prevents the injured person from practicing physical activities and staying away from the field for quite a while (32).

From the above, the researcher believes that the proposed program for the rehabilitation of Achilles tendonitis, which contains a group of varied, gradual exercises (with a focus on exercises) and in a way that is consistent with the nature of the player's muscular work and the degree of injury, has led to an increase in the variable of muscle strength and muscle lengthening, and thus an

increase in the range movement of the joint, and a decrease in the level of pain sensation at the site of the injury, resulting from the tendon's recovery and its return to performing its functions fully efficiently. The good application of the program with the direct supervision of the researcher played an important role in obtaining these results.

### **Conclusions**

There is a positive effect of the proposed rehabilitation program using therapeutic exercises and some physical therapy methods to rehabilitate players with Achilles tendinopathy.

The therapeutic rehabilitative exercises that were developed according to scientific principles, taking into account the principle of gradation in terms of intensity and appropriate timing, contributed significantly to increasing strength, muscle lengthening, and tendon flexibility, as well as alleviating the severity of pain and improving the range of motion of the foot joint.

### **Recommendations**

- To be Guided by the proposed therapeutic rehabilitation program when rehabilitating Achilles tendinopathy or Achilles tendinitis, because of its major role in improving the range of motion and reducing the severity of pain, as well as muscle strength and lengthening in players.
- Conduct other similar studies for tendinopathy injuries in other parts of the body.

### **References**

1. Riad Osama (2006): Sports medicine and sports injuries.: Dar Al-Fikr Al-Arabi, Cairo
2. A study by Al-Shalkamy, Ahmed Atef Ahmed, entitled: A proposed rehabilitative exercise program for Achilles tendon rupture injury. (2011)

3. Samia Khalil Muhammad: Physical Therapy, Means and Techniques, Cairo, Nass Printing Company, 2010. 3.
4. Hayat Ayyad Rafael: Sports Injuries Egypt, Manshaet Al Maaref, Alexandria, PT, 2003
5. Khalid Ahmed Hussein Omar: The effect of a proposed training program using exercises and physical therapy methods for athletes with external ankle joint sprains in Khartoum State, Master's thesis, unpublished, College of Postgraduate Studies and Scientific Research, Sudan University of Science and Technology, 2015.
6. Muhammad Qadri Bakri: Sports rehabilitation, sports injuries, and first aid, Cairo, 2000
7. Suad Abdel Hussein and others: The use of different rehabilitation methods according to some biomechanical variables and their effect in increasing the range of motion for people with shoulder joint injuries, purely published, Journal of Physical Education Sciences, Issue (2), Volume (3). 2010.
8. Ahmed Atef Ahmed (2012): A proposed rehabilitation program for Achilles tendon tear injury after surgery, master's thesis, College of Physical Education, Mansoura University.
9. Fridén, C., Saartok, T., Bäckström, C., Leanderson, J. & Renström, P. (2003). The influence of premenstrual symptoms on postural balance and kinesthesia during the menstrual cycle, *Gynecological Endocrinology*.17:6:433-440.
10. Anthony, A., Schepesis, M. D., Hugh Jones, M. D., Andrew L. and Haas, M. D. (2002). Achilles Tendon Disorders in Athletes. *Am J Sports Med* Mar-Apr; 30(2):287-305.
11. De Jonge, S., Van Den Berg, C., De Vos, R. J., et al., (2011). "Incidence of midportion Achilles tendinopathy in the general population," *British Journal of Sports Medicine*, vol. 45, no. 13, pp. 1026–1028.

12. Parekh, S. G., Wray, W. H., Brimmo, O, et al. (2006). Epidemiology and outcomes of Achilles tendon rupture in the National Football League. Presented at American Academy of Orthopaedic Surgeons 73rd Annual Meeting, Chicago, March.
13. Maffulli, N. (1999). Rupture of the Achilles tendon. *J Bone Joint Surg Am.* 81:1019–36.
14. Khan, K. M., Cook, J. (2000) Overuse tendon injuries: where does the pain come from? *Sports Med Arthrosc Rev.* 8: 17–31.
15. Hubbar, M. J., Hildebrand, B. A., Battafarano, M. M. Battafarano, D. F. (2018). "Common Soft Tissue Musculoskeletal Pain Disorders". *Primary Care.* 45 (2): 289–303.
16. Dhinu, J., Jayaseelan, John. J. Mischke, Raymond L. Strazzulla. 2019. Eccentric Exercise for Achilles Tendinopathy: ANarrative Review and Clinical Decision-Making Considerations. *Journal of Functional Morphology and Kinesiology*4:2, 34.
17. Maffulli, N., Sharma, P. and Luscombe, K. L. (2004). "Achilles tendinopathy: aetiology and management". *Journal of the Royal Society of Medicine.* 97 (10): 472–476.
18. Huttunen, T. T., Kannus, P., Rolf, C., Fellander-Tsai, L. and Mattila, V. M. (2014). Acute Achilles tendon ruptures: incidence of injury and surgery in Sweden between 2001 and 2012. *American Journal of Sports Medicine.* 42 2419–2423.
19. Ochen, Y., Beks, R. B., Van Heijl, M., Hietbrink, F., Leenen, L.P. H, Van der Velde, D., Heng, M., Van der Meijden, O., Groenwold, R. H. H. and Houwert, R. M. (2019). Operative treatment versus nonoperative treatment of Achilles tendon ruptures. Systematic review and meta-analysis. *BMJ*; 364 k5120.

20. Youichi, Y., Ichiro, T., Andrew J. R., Yoshiharu S., Hirotaka, K. and John G. K. (2017). The Risk of Achilles Tendon Rupture in the Patients with Achilles Tendinopathy: Healthcare Database Analysis in the United States, Hindawi BioMed Research International Volume, Article ID 7021862, 4 pages.
21. Peter, M. (2022). Physiotherapy management of Achilles tendinopathy. *Journal of Physiotherapy* 68:221–237.
22. Ohberg, L., Lorentzon, R. and Alfredson, H. (2004). Eccentric training in patients with chronic Achilles tendinosis: normalized tendon structure and decreased thickness at follow-up. *Br J Sports Med* 388–11.
23. Magnussen, R. A., Dunn, W. R., Thomson, A. B., Nonweiler, B. F. & Mccarty, E. C. (2009). Nonoperative treatment of midportion Achilles tendinopathy: a systematic review. *Clinical Journal of Sports Medicine*, 19(1), 54-64.
24. Hunter, G.(2000). The conservative management of Achilles tendinopathy. *Phys Ther Sport*, 16–14.
25. Davidson, C., Ganion, L. R., Gehlsen, G.et al. (1997). Rat tendon morphological and functional changes resulting from soft tissue mobilization. *Med Sci Sports Exerc*, 29313–319.
26. Shalabi, A., Kristoffersen-W. M., Svensson, L.et al Kader, D., Saxena, A., Movin, T.et al.(2023) Achilles tendinopathy: some aspects of basic science and clinical management. *Br J Sports Med*, 6239–249.
27. Cacchio, A., Paoloni, M., Barile, A., Don, R., de Paulis, F., Calvisi, V., & Santilli, V. (2015). Effectiveness of radial shock-wave therapy for calcific tendinitis of the shoulder: single-blind, randomized clinical study. *Physical therapy*, 95(5), 638-648.
28. Ian Fyfe, M. D., William, D., Stanish, M. D. (1992).The Use of Eccentric Training and Stretching in the Treatment and Prevention of Tendon Injuries *FACSClinics in Sports Medicine*Volume 11, Issue 3, Pages 601-624.

29. Halabchi, F. and Hassabi, M. (2020). Acute ankle sprain in athletes: Clinical aspects and algorithmic approach. *World J Orthop.* Dec18;11(12):534-558.
30. Delgado, D. A., Lambert, B. S., Boutris, N., McCulloch, P. C., Robbins, A. B., Moreno, M. R. and Harris, J. D. (2018). Validation of digital visual analog scale pain scoring with a traditional paper-based visual analog scale in adults. *Journal of the American Academy of Orthopaedic Surgeons.* Global research & reviews. Mar;2(3).
31. Ham, I., Joseph, K. and Kathleen, M. (2009). *Biomechanical Basis of Human Movement*, 3rd Ed, Copyright, Lippincott Williams & Wilkin.
32. Brewster, C. and Schwab, D. (2003). Rehabilitation of the shoulder following rotator cuff injury or surgery, formal orthopedic and sports physical therapy.
33. Maffulli, N., Ewen, S.W., Waterston, S.W., et al. (2000). Tenocytes from ruptured and tendinopathic Achilles tendons produce greater quantities of type III collagen than tenocytes from normal Achilles tendons. An in vitro model of human tendon healing. *Am J Sports Med*; 28:499–505.
34. Van Dijk, C. N., Van Sterkenburg M. N., Wiegerinck, J. I, et al. (2011). Terminology for Achilles tendon-related disorders. *Knee Surg Sports Traumatol Arthrosc.*; 19:835–41.
35. Li, H. Y. and Hua, Y. H. (2016). Achilles tendinopathy: current concepts about the basic science and clinical treatments. *Biomed Res Int.*; 2016:1–9.
36. Egger, A. C. and Berkowitz, M. J. (2017). Achilles tendon injuries. *Curr Rev Musculoskelet Med.*; 10:72–80.
37. Roos, E. M., Engström, M., Lagerquist, A. and Söderberg, B. (2004). Clinical improvement after 6 weeks of eccentric exercise in patients with mid-portion Achilles tendinopathy—a randomized trial with 1-year follow-up. *Scand J Med Sci Sports.*



38. Yu, J., Park, D. and Lee, G. (2013) Effect of eccentric strengthening on pain muscle strength, endurance, and functional fitness factors in male patients with Achilles tendinopathy. *Am J Phys Med Rehabil.*; 92:68–76.
39. **Norkin, C. C. and White, D. J.** (2016). *Measurement of Joint Motion. A Guide to Goniometry* (5th ed.). F.A. Davis Company.
40. [https://ar.wikipedia.org/wiki/Sports\\_injury](https://ar.wikipedia.org/wiki/Sports_injury).
41. Tendinopathy: Definition, Comparison to Tendonitis, and Treatment (healthline.com).
42. <https://www.bing.com/search>. Rehabilitation of Tendon Injuries in Sport.

## Appendices

**Appendix (1):** A sample of some exercises for the proposed rehabilitation program for Achilles tendinopathy

The first exercise: From a long sitting position, extend the injured leg forward, attaching the rubber band to the injured foot and holding both ends of the rubber band in the injured person's hand. The exercise begins by moving the ankle by bending the foot backwards and holding it for 30 seconds, then returning to the normal position, as in Figure No. (1). Be careful not to bend the affected knee during exercise

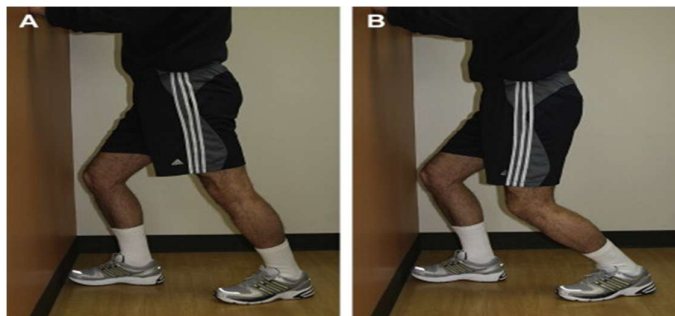


Figure No. (1)

The second exercise: From a standing position facing a wall while pushing or holding the wall with your hands, move the injured leg back, taking care not to

bend it at the knee while the heel is touching the ground. Bring the healthy leg forward, and bend it in front, then hold for 20-30 seconds. As in Figure (2).

Note: Repeat the same exercise with the bending of the affected leg, as in Figure No. (2).



A and B Figure No. (2)

The third exercise: From the standing position, raise the heels high, then return to the normal position for 10-12 repetitions, taking care not to bend the knee during the exercise, as in Figure No. (3).

Note: Repeat the same exercise on the injured leg while raising the healthy leg, as in Figure No. (4).



Figure No. 4



Figure No. (4)

The fourth exercise: from a standing position. The exercise begins by standing on a step with the tips of the toes or the front third of the feet, rising to the top with both feet, then moving the affected leg downward for 10-12 repetitions, as in Figure (5).

Note: You may go up and down on both feet at the beginning of the exercise and then on the injured leg.

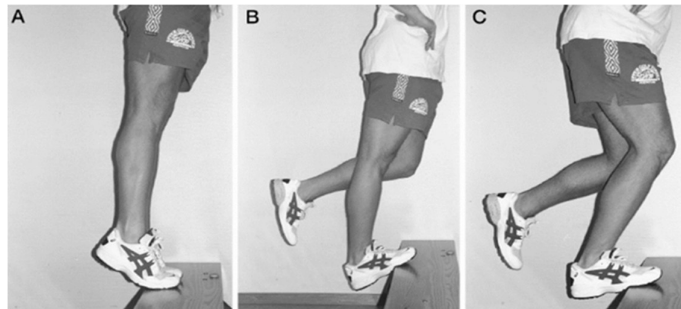


Figure No. 5

The fifth exercise: From a sitting position on a bench: The exercise begins by raising the heels to the top (with a weight) and then returning to the normal position for 10 repetitions, as in Figure No. (6).

Note: Repeat the same exercise, placing a disc under the tips of the toes or the front third of the foot, then rising and descending the heels downward as in Figure No. (7).



Figure No. 6



Figure No. 7

**Appendix (2):** Rehabilitation units/ Achilles tendinopathy

The objective of the unit Rehabilitation is to improve stretching, strength and balance.

- Date: 29/12/2021
- Unit time: 40-50 minutes
- Week: Fourth
- Unit/ Second

Unit division s	Time of every division	Unit components	Number of Frequencies	Time	Groups	Rest among frequencies	Rest among groups	Notes
Preparatory section (15 minutes)	15 minutes 5 minutes General warm-up  10 minutes/special warm-up	Light jogging at a low intensity and some exercises to raise the body temperature and prepare the functional systems. Special exercises for the calf muscle and tendon, as well as other muscles surrounding the leg and ankle joint, with a light	..... ..	..... .....	..... ...	..... ...	..... .....	Preparing the body and the affected joint

		massage of the tendon and calf to prepare them to perform therapeutic exercises.						
The main section (25) minutes	5 minutes 5 minutes 5 minutes 5 minutes	Exercise (1) from a long sitting position Exercise (2) from a standing position Exercise (3) from the standing position Exercise (4) from a standing position Exercise (5) from a sitting position on a bench	..... .... ..... .... 10 repetitions 10 repetitions 10 repetitions	30 seconds 30 s 40 s 50 s 50 s	4 4 3 3 3	..... .... ..... .... ..... .....	60s 60s 80s 80s 80s	The therapeutic exercises include psychological preparation to provide motivation
Concluding section	5 Minutes	stretching exercises, ice packs, recovery and relaxation	..... ...	..... .....	..... ...	..... .....	..... .....	Psychological preparation

**Appendix (3):** Names of experts and specialists in physiology, injuries, and football

Serial	Name	Workplace
1	Prof. Dr. Hamid Salih Mahdi	Specialist Professor in Physiology at the College of Physical Education and Sports Sciences/University of Baghdad
2	Prof. Dr. Hameed Abdulnabi	Specialist Professor in sports injuries and rehabilitation at the College of Physical Education and Sports Sciences/University of Baghdad
3	Prof. Dr. Dheyaa Naji Abbood	Specialist Professor in specializing in football coaching at the College of Physical Education and Sports Sciences/University of Baghdad

### Appendix (4): Visual Analog Scale form

