

Muscular strength training and its effect on strength endurance and speed in wheelchair tennis players

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ABSTRACT

The primary aim of this study was to prepare muscular strength exercises to develop the endurance of the arms and the speed for wheelchair tennis players. The players of the Iraqi national team of wheelchair tennis constituted the research community for the present study. A total of 5 players registered in the records of the Iraqi Federation of Racquet Games, who were training and competing in the sports season 2020/2021, were recruited as the participants of the study. A total of 24 training units were included in the study with two units/week for total of 12 weeks. The researchers concluded that the muscular strength training significantly improved the strength endurance and the speed of the wheelchair tennis players.

KEYWORDS

Strength training; Strength endurance; Speed; Wheelchair tennis

1. INTRODUCTION

Nation-building and progress greatly depend upon the economic, educational, and scientific development of a country. Before the 20th century, individuals with disabilities often were viewed as nonproductive members and burden on society. Integration and inclusion of people with disabilities in mainstream sport have been a key focus in recent decades and has created new opportunities for participation and competition (Parra Proaño, 2022). There are many sports practiced by the disabled (Marín et al, 2010). Among these sports, wheelchair tennis is one of the individual games that are distinguished by its specificity in performance in different and multiple directions depending on the

direction of the ball and this effort continues until the end of the game, so the player must maintain his/her ability throughout that period to resist fatigue (Zhanel et al, 2015).

Wheelchair tennis is one of the games whose performance is very difficult for the player through the movement of the chair and holding the racket with the same hand and moving on the court while exerting strength and accuracy in hitting the balls to the opponent's yard (Jihad Al-Rubaye & Hussein, 2022). In the Arab Paralympic Games, one of the key obstacles is the lack of use of modern training methods in the training process that works to develop the player's performance and results. Furthermore, the researchers identified a weakness in the endurance of the arms and the speed of wheelchair tennis players.

Therefore, the primary aim of this study was to prepare muscular strength exercises to develop the endurance of the arms and the speed of wheelchair tennis players, and to identify the effect of muscular strength training on developing the endurance of the arms and the speed of wheelchair tennis players.

2. METHODS

2.1. Design and participants

The present study had a single group experimental design, with pre and post-tests to suit the nature of the problem for the purpose of arriving at the research results. The players of the Iraqi national team of wheelchair tennis constituted the research community for the present study. A total of 5 players registered in the records of the Iraqi Federation of Racquet Games, who were training and competing in the sports season 2020/2021, were recruited as the participants of the study.

2.2. Instruments

Strength endurance test. The test was conducted with the intent to measure the strength endurance of the two arms. Prior to the start of test, the wheelchair was fixed well on the ground by placing anchors on the rear wheels of the chair to prevent the chair from moving during the performance of the test. From the seated position on the wheelchair, the participant was asked to lean on both sides of the chair in a position where the arms were fully extended. After hearing the start signal, the participant was asked to bend the arms, and extend the arms to the fullest range of motion and continue with the same until the fatigue occurs. A single attempt was given to each participant. The number of times the correct performance was repeated during the attempt was recorded (Al-Khasawneh, 2003).

Speed test. The test was conducted with the intent to measure the speed and the performance of the forehand and backhand. The tools required to conduct the test included wheelchairs, signs, and a stopwatch. After hearing the start signal, the participant was asked to move from the starting point to point 1 and to rotate around it, return to the starting point, then move to point 2, return to the starting point, then move to point 3 in the front near to the net and hit the ball with a flying forehand diagonally, and return to the starting point and move to point 4 and hit the ball with a flying backhand diagonally, and return to the starting point. The performance time was calculated from the beginning of the test implementation until the end. In the event of a failure in one of the attempts, two seconds were added to the total performance time (Al-Khasawneh, 2003).

Speed and accuracy test. The test was conducted with the intent to measure the speed and accuracy of the forehand and backhand. Two circles were drawn at a distance of 1 m from the meeting point of the sideline of the single court and the baseline, and two circles on the meeting point of the sideline with the transmission line, and two circles on the side line at a distance of 1 m from the net and another circle at a distance of 1 m from the net and on the middle transmission line. The starting point was determined by the median sign on the baseline. The tools required for conducting this test included tennis balls, tennis rackets, chalk, tape measure, signs, timer, collection basket, stopwatch, and a whistle. The recorder stood in the square opposite to the participant to observe the area of the ball's fall. The ball was thrown to the participant by the assistant, who directed the movement of the participant during the performance. The time was calculated by the timekeeper from the moment of start to finish. A warm up session was given to each participant for adaptation to the test. After hearing the start signal, the participant was asked to run quickly towards the first barrier on the right, to revolve around it and return to the starting point, then move to the second barrier, rotate around it and return to the starting point. One attempt was given to each participant. The performance time was calculated from the moment of the start until the end (Al-Khasawneh, 2003).

2.3. Exercise protocol

In the present study, the researchers conducted an extensive review of the scientific resources and prepared performance-specific exercises within the training curriculum of the players. The exercises were implemented by the use of various tools. The researchers presented the exercises to a group of five experts and specialists. Comments and opinions were taken to avoid errors. The training curriculum of the experimental group was applied in the special preparation stage and in the main section of the training unit at the Tennis Training Center at Al Shaab International Stadium. A

total of 24 training units were included in the study, with two units/week for a total of 12 weeks. The method of low- and high-intensity interval training was used in the curriculum units to develop strength endurance. The duration of the exercises ranged between 20-30 minutes, interspersed with rest periods suitable for the type of exercise and the intensity used.

2.4. Statistical analyses

The statistical analyses were carried out with the Statistical Package for the Social Sciences (SPSS) version 23. In order to analyze the data, the researchers calculated means, standard deviations and t tests.

3. RESULTS AND DISCUSSION

The results are presented in Table 1, which compares the results of the pre-tests and the post-tests. The statistical analysis of the present study revealed significant differences in pre-post comparison of the parameters related to the physical and skill tests conducted in the wheelchair tennis players of the sample, in favor of post-tests. The researchers attributed this difference to the use of special strength training, which included physical exercises similar to the performance of the skill in terms of muscular contraction and its direction. The results of this study also indicated significant development of strength and speed in the wheelchair players. The speed of movement had an effect on the transitional speed in the chair, which brings out this skill and controls the appropriate muscle contractions to increase the speed and direct the tennis ball.

Table 1. Comparison of the results of the pre-tests and the post-tests

Test	Unit	Pre-test		Post-test		Mean difference	T	p
		Mean	SD	Mean	SD			
Strength endurance of the arms	Count	44.000	13.172	61.000	15.166	17.000	5.787	0.004
Speed	Second	22.024	2.629	19.558	3.218	2.466	5.360	0.006
Speed and accuracy	Second	31.022	2.998	26.686	1.514	4.336	4.857	0.008

In the present study, the researchers focused on the exercise training of the players using various tools, which included medical balls, weights discs, weights, and heavy kits. Exercises with the various tools helped to maintain the interest of the players and it also helped to avoid fatigue and boredom among the players.

Lerner & Lerner (2005) stated that tools and devices are a set of materials that take multiple shapes and different sizes and serve different goals. The percentage of their contribution in learning motor skills varies from simple to complex (Al-Sheikhly, 2000). The authors also stated that the sequence of exercises strengthens the relationship between the brain and the muscles. Finally, the repetition of the exercises helped to avoid the external factors or stimuli that may distract the players during the performance.

4. CONCLUSIONS

Based on the findings of this study, the researchers concluded that the muscular strength training using various tools significantly improved the strength endurance of the arms and the speed of the wheelchair tennis players, which led to the successful performance of the basic skills of the wheelchair tennis players.

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CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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