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The effectiveness of special endurance exercises on diminishing the angular kinetic energy of body parts when re-performing front and back shots in squash

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ABSTRACT

Squash is considered one of the games that require great physical effort through the continuous movement speed that the squash player needs while he moves to perform the front and back shots , the problem of research lies through a previous study in the use of an EMG device for working muscles when performing the front and back shots. During the previous study, the researcher recommended the use of special endurance exercises to develop players as a result of a decrease in the value of the electrical signal when the player performs large repetitions during play. The two researchers believe that this weakness in the player's own endurance abilities (endurance of speed and strength) led to that decline and directed in this study to knowing the effect of special endurance exercises on decreasing the angular kinetic energy of body parts when re-performing the front and back shots of the youth national squash team. The most important objectives of the research: To identify the effect of the decrease in the angular kinetic energy of some parts of the body, and its reflection on the speed of performing back and front straight shots in squash. The researchers concluded that special endurance exercises led to a delay in the decrease in the angular kinetic energy of body parts when repeated front and back strokes in squash.

Keywords: kinetic energy, EMG device, squash

I. Research Introduction and its importance:

Getting higher levels requires a concerted effort, a proper diagnosis of strengths and weaknesses, and work to develop what serves the event or skill in order to cope with the developed countries in sporting events and raise the country's flag high in international forums and meetings in the squash game.

Through the scientific and technological development, equipment and latest training methods that are achieved through the exercises used to develop the physical abilities associated with the game, analyzing and studying the effect of those exercises on the functions of the athlete’s body and thus on developing the level of

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achievement after it has become evident and known that it is not possible to reach the level of high achievement without functional adaptations events in the organs of the athlete's body, especially among squash players in particular as "the training process is based on scientific foundations and principles aimed at preparing the player from all physical, skill, planning, psychological and educational aspects, in order to reach the highest level of athletic achievement in a particular sport" (1). Of the sports is the game of squash, like most games, has general physical characteristics and abilities, special physical characteristics and abilities that distinguish it from other games.

1) Tariq Desouky: A proposed program for developing the special physical requirements of squash players and its effect on the level of performance, Master Thesis, Helwan University, 2001, p.2.

As each sport has its general and specific physical requirements that help improve the performance of its skills and create functional adaptations typical of the game and among these abilities (strength endurance and special speed endurance) as it is one of the special requirements of the game that plays a decisive role in the results of squash matches having special requirements by playing its runs. Thus special endurance is called performance that is characterized by strength and speed, since the both abilities withstand strength and endure speed play a prominent role in the player's ability to perform the repetitions that the player performs during the game. Thus the importance of research lies in knowing the effect of special exercises on developing the endurance of speed and strength on some performance of front and back strokes in squash.

Research problem:

The research problem is crystallized through accurate diagnosis and careful observation and analysis of many matches for the squash game for the national youth team. As the two researchers are working in the field of specialization as coaches and former players, their observations and diagnosis of the research problem were recorded through a previous study through the use of an EMG device for working muscles when performing front and back strikes (1), where the researchers recommended during that study the use of special endurance exercises to develop players as a result of a decrease in the value of the electrical signal when the player performs large repetitions during the game. The two researchers believe that this weakness in the player's own endurance abilities (endurance of speed and strength) led to that decline, and this study was initiated to know the effect of special endurance exercises on decreasing the angular kinetic energy of body parts when repeating the front and back shots of the national team youth players (Squash).

Research Goals :

- To recognize the effect of the decrease in the angular kinetic energy of some parts of the body.

- To recognize the reflection of energy deficiency in the speed and accuracy of performing front and back straight shots in squash.

- Learn about the effect of special exercises on the accuracy and speed of performing front and back straight shots in squash

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Research hypotheses :

- There are statistical differences between the pre- and post- tests in the decrease in the kinetic energy of the angular parts of the body of the national squash team players.

- There are statistical differences between the pre and post tests in the accuracy and speed of performing the front and back straight shots in squash.

Research areas:

The human field: Players of the national youth squash team registered with the Central Iraqi Federation.

The time frame: for the period from (6/7/2019) to (16/9/2019).

(1) Walid Ahmed, Yasser Wajih: The effect of muscle fatigue on motor transport in terms of an EMG device for muscles working in the performance of front and back shots in squash, published research, the Sixth International Conference of Sports Sciences, Basra University for the period from 25-27 / March 2017.

Spatial domain: Squash playgrounds in the College of Physical Education and Sports Sciences - University of Baghdad - Al-Jadriya.

II. Research Methodology:

The researchers have used the experimental method in one of the basic limitations called (determining one group with a pre-test and a post-test) due to the relevance of this determination to the nature of the research problem, as "experimental research is the most accurate type of scientific research that can affect the relationship between the independent variable and the dependent variable in the experiment." (1), as (Wajih Mahjoub) confirms ʿthat the experimental method is" a deliberate and controlled change of the specific conditions for an accident and the observation and interpretation of changes resulted in the event itself "(2).

The research sample : “The goals that the researcher sets for his research and procedures he will use will determine the sample he will choose.” (2) The researcher must choose his research sample so that it is representative of the original community and contains all its features and properties. The size of the research sample depends on a number of considerations such as the researcher's capabilities and also the degree of variation or homogeneity of the units of the research community. The two researchers have deliberately selected the research sample, which included (8) players from the Iraqi national youth squash team registered with the Iraqi Central Squash Federation listings and who represent 100% of the community of origin for the national team.

Devices and tools that have been used in the research:

(Arab and foreign sources and research related to research and the information network. Metal tape measure. A legal squash playground , number (6), (16) Dunlop squash balls, (16) modern type (Dunlop) squash

rackets, (16) adhesive tape for planning test areas. (4) electronic stopwatch (Casio) type. (4) sirens. Signs and flags of different heights, (16) signs. Fast camera with speed (1200) frames per second, (3) Japanese Casio type. kinovia) for analysis.

Field research actions

The research needs to choose or define capabilities, variables, or multiple tests to measure some of the variables that are related to the phenomenon to be measured, and it has to select a group of tests to evaluate the vocabulary of the independent variable that was adopted in the research.

Determine the tests and variables for the search:

In order to determine the group of special abilities in order to put it under research and study, and then take a step to determine the group of tests, and appropriate standardized tests have been determined through scientific sources and modern references

(1) Ikhlas Abdul Hafeez and Mustafa Hussain Bahi. Methods of scientific research and statistical analysis in the educational, psychological and sports fields, Cairo: Al-Kitab Center for Publishing, 2000 AD, p. 107.

(2) Wajih Mahjoub. The origins of scientific research and its methods. First Edition, Jordan: House of Curriculum, 2001, p. 289.

(3) Raysan Khuraibet Majeed, Research Methods in Physical Education, Mosul: Directorate of Dar Al Kutub for Printing and Publishing, 1988, p. 41.

in the field of tests and measurement and in the field of precise specialization, which is a squash game, which can actually measure these abilities, including the following: -

The first test: the front ground hit in the direction of the opposite angle.

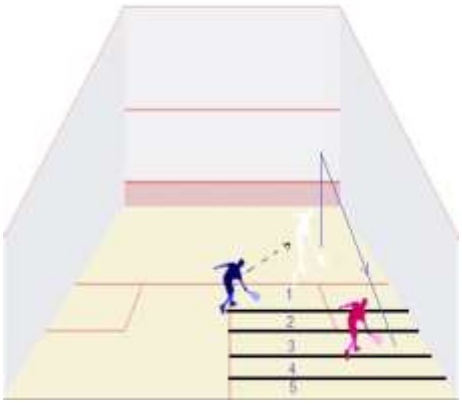


Figure (1) the accuracy of the forward blow

The purpose of the test: To measure the accuracy of the performance of the straight front ground strike.

Test procedures: The test is conducted in a regular squash playground using squash rackets, squash balls and a registration form. The back part of the right side of the playground is divided into 5 equal areas, and the distance between one field and another is (86.2 cm).

Performance specifications: The test is done by standing the player to be tested in the midfield court area (T), where the player stands in the correct position in preparation for hitting the ball, and the player is given (5) trial attempts after a warm-up to find out how to perform the test, and the ball is hit by one of the assistants and standing behind the right transmission area , on the condition that it reaches the front wall below the transmission line, and the tested player begins to move to the position of the ball and stand to execute the front ground hit , between the transmission line and the resonant plate line (Figure 1), and the player is given (10) attempts.

Scoring points: points are calculated for each correct hit:

5 points if the ball hits field 5. 4 points if the ball touches field 4. 3 points if the ball touches field No. 3. Two points if the ball touches field No. 2. One point if the ball touches field No. 1. Zero if the ball is outside the drawn boundaries. The maximum score that can be obtained is (50) points.

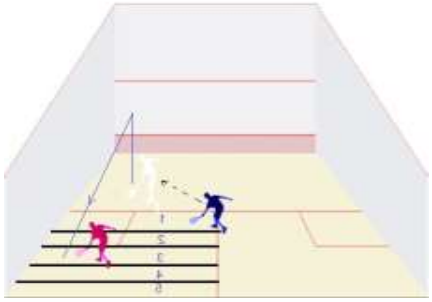


Figure (2) Accuracy of the back kick

The second test: the back ground hit towards the opposite angle.

The purpose of the test: To measure the accuracy of the performance of the rear kick

Straight

Test procedures: the same procedures as the previous test, but the test is performed from the left side of the court (Figure 2).

(1) Ali Jihad Ramadan: The Impact of a Suggested Training Curriculum on Developing Some Basic Skills in the Game of Squash, Master Thesis, College of Physical Education - University of Baghdad, 2000, p. 55.

(2) Ali Jihad Ramadan: A previously mentioned source, 2000, p. 56.

Figure (3) the speed of performing the front hit

The third test: test the speed of the front straight ground strikes (1)

The purpose of the test: to measure the velocity of the forward strikes.

Tools used: squash racket, squash ball, stopwatch.

Performance description: The tester stands behind the rear right transmitter box, which is about 7.9 meters from the front wall. When giving the start signal, the tester drops the ball and then hits it against the front wall below the transmission line, and after it bounces, from the front wall to the ground, the tester hits it again for 30 seconds. (3).

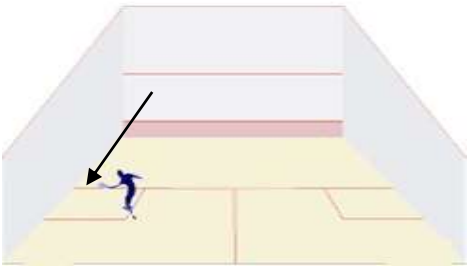
Test conditions: The tester is given 3 attempts. The hit above the transmission line does not count.

The hit that hits the resonant plate does not count. A hit that falls in front of the ground line is not counted. The hit taken by the tester in front of the line behind it does not count. The ball is allowed to be hit after bouncing from the back wall.

Scoring: The tester records the number of correct forwards in 30 seconds for the best out of (3) attempts

Fourth test: test the speed of performing back straight ground strikes (2)

Performance description: The same specifications as the previous test, but it is performed from the left side of the field.



Calculate the angular kinetic energy of body parts

After the members of the research sample are photographed when performing the accuracy test of the front and back stroke in squash and the velocity at which the shooting is (240) images / s. To perform a skill analysis using the (Kinovia) program and extract the results:

It is done through the following steps:

Knowing the player's total weight.

Determining the ratio of the weight of body parts in relation to the body:

We extract the real portion weight by:

(Player Weight x Part Weight Ratio in Relation to Body)

- Extraction of the angular velocity of body parts (legs + torso + arms).

- Calculate the turning radius of the body parts.

1) Tariq Dasoufi Kamel: A proposed program for developing the special physical requirements of squash players and its impact on the level of performance, Master Thesis, Helwan University, College of Physical Education, 2000, p. 111.

2) Tariq Dasoufi Kamel: Previous source, 2000, p. 113.

The application of the law of angular kinetic energy for parts of the body can be extracted through the following law :(1)

Kinetic energy = 1/2 mass x velocity 2

Since peripheral velocity = min x angular velocity

So angular kinetic energy = 1/2 mass (min 2 x angular velocity 2)

As in Figure (5) a model of the extraction of the kinetic energy of the corner

Figure (5) an angular kinetic energy extraction model

Exploratory experience:

The aim of this experiment is to identify the difficulties and problems that the researchers may face during the implementation of their main experiment, especially those related to the administrative and organizational aspects, as well as to identify the time it takes for each test and the logical sequence to perform the tests. The extent of the players' response and interaction with those tests and their suitability in terms of age and training level.

The experiment was conducted on Tuesday, 7/6/2019.

1) Sarih Abdel Karim and Wehbi Alwan: Biomechanics and Mathematical Biomechanics, 1st Edition (Al-Ghadeer Printing Company, Beirut, Lebanon 2012) pg. 217.

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Hamza Farman / age groups coach at the Iraqi Squash Federation.

Pre-tests:

The pre-tests have been applied to the members of the research sample after the completion of the identification of the most important tests and the mechanical variables adopted in the research on Monday, 7/8/2019 and at 3:30 afternoon on the squash courts at the College of Physical Education and Sports Sciences / University of Baghdad.

The main experience

The two researchers have prepared a set of exercises for endurance of strength and endurance of speed, depending on scientific sources and references specialized in the field of sports training science, as follows: - A period of (8) weeks was determined to train the two abilities over a period of two months, meaning (24 daily training units). Three training units were determined per week, according to the agreement with the coach of the national team and the approval of the Central Union for this period. Training days were determined on (Saturday, Monday and Wednesday of each week). The training time in each daily training unit was set at a rate of 35 to 45 minutes from the main part of the training unit whose actual time is (120 minutes) taking into account the rules of the daily, weekly and monthly training loads for the intermediate training course for the main experience of the researcher. The implementation of the exercises continued for a period of two months from Wednesday 7/10/2019 and ended on Wednesday 4/9/2019, where the most important modern training methods were identified to implement the vocabulary of these exercises and their approval in order to contribute to the development of these two capabilities, and these methods are: - Interval Training Method is high intensity and Repetitive Training Method.

Dimensional tests:

All the conditions for the pre-tests have been set, taking into account all the procedures carried out by the researchers in carrying out the pre-tests and determining the same period and the same auxiliary staff to carry out the procedures of the post-tests to move away from the circumstances of chance affecting the results of the post-tests after the completion of the main experiment of training for the individuals of the research sample on Saturday 7/9/2019 to carry out these tests at 3:30 pm on the squash courts in the College of Physical Education and Sports Sciences / University of Baghdad. .

Statistical means:

The statistical bag ((spss)) was adopted in extracting the statistical results.

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View and analyze the results of tests for the accuracy and speed of front and back strokes in squash

Table (1)

The table shows the arithmetic mean, standard deviations, and the value (T) calculated between the pre and post tests for tests of accuracy and speed of performing the front and back straight strokes in squash:

Variables	Pre-test		Post-test		F-	F H	Calculated value of T	Level of error	Significance
	S-	H+	S-	H+					
Accuracy of a straight kick	**40.25**	**1.03**	**42.37**	**1.59**	**2.12**	**0.35**	**6.06**	**0.001**	Significance
Accuracy of a straight backhand	**38.50**	**0.53**	**40.12**	**0.91**	**1.62**	**0.26**	**6.17**	**0.000**	Significance
The speed of the straight hit forward	**29.37**	**1.06**	**31.00**	**1.51**	**1.63**	**0.32**	**5.01**	**0.002**	Significance
The speed of the straight strike back	**25.50**	**0.92**	**27.25**	**1.38**	**1.75**	**0.25**	**7.00**	**0.000**	Significance

- At a kinematic level (1-8 = 7) and a significance level <(0.05)

4-2 Presentation and analysis of the results of tests of accuracy and speed of performance of front and back strokes in squash

Table (2)

The table shows the arithmetic mean, standard deviations, and (T) value calculated between the pre and post tests of the kinetic angular energy variable for the parts of the body (for the arm, the trunk, the front focal foot)

Variables	Pre-test		Post-test		F-	F H	Calculated value of T	Level of error	Significance
	S-	H+	S-	H+					

Kinetic energy for the front striking arm in squash	**157.40**	**6.38**	**167.11**	**5.87**	**9.71**	**1.89**	**5.12**	**0.001**	Significance
Kinetic energy of forehand strike in squash	**29.71**	**0.32**	**30.77**	**0.64**	**1.05**	**0.21**	**4.81**	**0.002**	Significance
Kinetic energy for the focal foot forehand stroke in squash	**5.32**	**0.24**	**5.81**	**0.37**	**0.49**	**0.12**	**3.96**	**0.005**	Significance

Table (1) and (2) show the results of the pre and post tests for the research variables, as it appears that there are statistically significant differences between the results of the pre and post tests and in favor of the post tests for tests of accuracy and speed of performing the front and back straight strokes in squash. The researchers attribute that to the exercises used that focused on developing aspects of endurance capabilities. Speed and endurance of strength were effective as they include exercises that move inside the stadium at different times and included exercises with one player and then introduce competition with two players in order to make the exercises similar to the conditions of the match . (Abu Al-Ula Ahmed 1997) confirmed that "the high level of the physical activity of the athlete depends on competition and special exercises related to the type of activity of the specialized athlete. ”(1)

The researchers attribute the reason for this to the use of special physical vocabulary that has a clear and effective effect on improving the speed-tolerance characteristic of the research sample through their adaptation to the approach that relied on organizing training periods.

(1) Abu Al-Ula Abdel Fattah. Sports Training, Physiological Foundations, (Cairo: Dar Al Fikr Al Arabi, 1997), p. 200.

Using appropriate intensity, appropriate rest and repetitions that are compatible with the development of endurance of speed and strength, and the use of training methods that are commensurate with the development of this physical characteristic lead to the ability of physical work in the research group to be high and thus led to an improvement in achievement The special exercises used were suitable for the sample of the research that includes the national youth team players , where training was for a period of 3 days a week, and the researchers believed that it was an opportunity to develop the strength endurance of the arms, and as that confirmed by (Hamdi Ahmed Al-Sayed) "Muscle groups must be trained regularly using special exercises to develop special strength endurance abilities and training for a period of (3) Days (Saturday, Monday, Wednesday) or (Sunday, Tuesday, Thursday) are sufficient for an improvement in performance. (1)

The two researchers also attribute the development of the accuracy of the front and back strike skill in the game of squash, which is one of the most frequent skills during play, as (Mufti Ibrahim 1998) states that "sport skill is the jewel in any sport and its achievement (development) depends on physical numbers on which planning , psychological and mental preparations depend. "(2), They also attributes this to the use of special physical vocabulary that has an effective impact, which contributed to the development and strengthening of the squash player's special muscles, especially the muscles of the arms working when performing hitting the ball, which works to" increase flexibility of the muscles as a result of the repeated movement of the muscles, ligaments and joints. " (3), (Talha Husam al-Din, on Bloomfield 1997) also states, "There is a high correlation between endurance, muscle strength, accuracy and speed of skillful performance." (4)

As the muscle performs a high contraction during the effort, whether in shortening its length or increasing its length for an external action, as this depends on the amount of resistance the muscle is trying to overcome and confront, as well as the strength of contraction or tension produced by the muscle. "(5) The curriculum also contained exercises multiple and varied, especially the development of speed endurance for the front kick from the middle of the field and the backcourt by training on forms of speed endurance and linking it to movement. This helped improve this characteristic when performing strikes, which in turn led to the development of the speed of performance of front and back strokes in squash. As "the organized and programmed training on speed and the use of types of standardized intensity in training and by using the types of optimal rest between the repetitions lead to development in the experimental research group "(6) and this is what the results showed in the post-tests. As for the results of the variables (kinetic energy of the arm, the kinetic energy of the trunk, the kinetic energy of the front foot) shown by Table (2) The results showed a decrease in the kinetic energy between the body parts, as it showed the lowest value for the kinetic energy of the front foot and then the torso and the highest kinetic energy value was the striking arm.

(1) Hamdi Ahmed Al-Sayed: Muscular Strength and Working Muscles Exercises, 1st Edition, Al Kitab Center for Publishing, Cairo, 2011, p.33.

(2) Mufti Ibrahim. Modern Sports Training, 1st Edition, (Cairo: Arab Thought House, 1998), p. 180.

(3) Qasim Hasan Hussein and Abd Ali Nassif. The Science of Sports Training, 1st Edition, (Mosul: Dar Al-Kutub Foundation for Printing and Publishing, 1990), p.57.

(4) Talha Hussam El-Din and (others). The Scientific Encyclopedia of Sports Training, 1st Edition, (Cairo: The Book Center for Publishing, 1997), p.16.

(5) Rander A., Sherman J. and Luciane D .; Muscle inhuman Physiology the Mechanisms of Hody Function, Chpter 11, 7th ed., Imc. Crow ltill, 1998, P. 313.

(6) Hamdan Rahim Raja. The effect of special endurance on the performance of some throwing grips (jerk) of the wrestlers, PhD thesis, University of Baghdad, College of Physical Education, 1994, p. 100

The researchers attribute this to the great speed of the arm that the player must exert to quickly shot the ball to areas far from the opponent's presence and that the occurrence of this decrease in the kinetic energy of the body parts performing the skill is an indicator of obtaining the highest value of the kinetic transmission. The rate of kinetic energy decrease should be the least possible to ensure obtaining the highest indicator of kinetic

transmission "(1), as well as that the components of the training load for the exercises used have proven their effectiveness in reducing the decrease in the kinetic energy of the parts of the body when performing the movement, which gave the player the ability to perform harmonic and ease of movement, lack of errors , using less effort and increase the return Of movement as well as the ability to cope with fatigue,. This is confirmed by the results, as the exchange of front and back balls during play throughout the game and that the preservation of the kinetic energy at the highest value is a good indication that the player has high endurance (functional - physical) abilities with delaying fatigue. As that was confirmed by (Ahmed Nasreddin Sayed 2014) that the fatigue phase is associated and coordinated with the end of performance as a result of repetition of a large number of muscular nervous, and when the player's ability to endure strong and successive physical efforts, it clearly indicates the player's level and abilities to continue performing. (2) Also, confirmation of the compatibility of the angular positions of the working joints when performing the forehand skill, taking into account the appropriate area for the movement of the foot, gave angular momentum to the pivot foot as a result of the angular difference between the maximum extension and the maximum flexion, which led to the ability to hit effective strokes of stability with the ability to adapt and back to the initial situation. As this was confirmed by (Qasim Hassan Hussein 1998) that the pivot foot is affected by the vertical movement , which represents the weight of the body and the reaction of the earth , and the horizontal component that is represented by friction and the reaction of the earth to it. (3)

This logically explains to us the reason for the decrease in the velocity of the foot when grounding and thus the value of the kinetic energy to decrease if we know that the mass is fixed. The researchers attribute the morale of the kinetic energy of the arm to the great speed that the player must exert, by exploiting the moments of time using force (maximum force with the least time) during the implementation of the kinetic duty, to quickly shot the ball to areas far from the opponent’s presence and that this decrease in kinetic energy does not occur. The body performing the skill is an indication of obtaining the highest value of the kinetic transmission, from the moment of the push (the two legs) down to the striking arm, thus achieving a decrease in the total energy due to an increase in the potential energy of the player with a decrease in the kinetic energy. This is what was indicated by (Sarih Abd al-Karim 2007, p. 119), since kinetic energy = total energy x body mass / potential energy "and this is what should be the rate of kinetic energy diminution as low as possible to ensure the highest index of kinetic transmission" (4)

(1) Sarih Abdul Karim: Biomechanical Applications in Sports Training and Kinetic Performance, 2nd Edition, Baghdad, 2010, pg. 172.

(2) Ahmed Nasreddin Sayed; Principles of the Physiology of Sport: 2nd Edition (Cairo, Al Kitab Center for Publishing, 2014) pp. 352-353.

(3) Qasim Hassan Hussein; Short-distance field training: (Baghdad, Al-Adeeb Press, 1987) p. 6.

(4) Sarih Abd al-Karim and Wahbi Alwan al-Bayati: Anatomical analysis and its kinematic and mechanical applications, 1st Edition, Baghdad, Uday al-Aqili Press, 2007, p. 119.

III. Conclusions:

1. The exercises used have proven effective in developing the endurance of speed and endurance of strength for the national youth squash team.

2. The development of the physical aspects led to the development of the skill through early access to the ball as well as regaining control of the control area (T) faster than the opposing player.

3. The exercises used led to the development of the leg muscles and thus the movement of the players was faster in reaching the ball.

4. The exercises used led to the development of the arm muscles and thus increased the accuracy of the front and back strokes by controlling the racket while repeatedly hitting the ball.

5. That the development of the physical aspects led to a decrease in the angular kinetic energy when repeatedly hitting the ball by improving the speed of movement of body parts with the stability of mass.

IV. Recommendations:

1. Using early exercises on similar samples of non-age groups in a game of squash.

2. The use of continuous tests to measure speed and strength endurance and training on weaknesses and strengths in the game of squash.

4. Training the players on the mechanical conditions that serve the skillful performance of the squash player.

5. Take advantage of the analysis of motor skills to develop the training aspects because it is considered one of the objective means in detecting errors in skill performance.

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