

THE EFFECT OF RUBBER RESISTANCE EXERCISES ON BONE DENSITY AND SOME KINEMATIC VARIABLES OF THE FLAT SERVE SKILL IN TENNIS

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Abstract:

Through the researcher's follow-up of the sample of the study as she is specialist in kinetic biomechanical analysis, she found that sample members unable to endure training pressures during training, especially high training loads. The researcher thinks that the reason for this is due to muscular strength which may cause them deficiency in bone density. This, in turn, leads to a degradation of some biomechanical variables related to perform the flat serve skill in tennis, which in turn reflects on accuracy. That's why the researcher to include this kind of exercise using rubber and determine its effect on bone density and some kinematic variables related to flat serve in tennis in preparation and ball impact moments. The research was conducted on a sample of 8 players from Al Araby Club and their ages from 20 to 22 years old. After pre-tests, the prepared training was performed for 12 weeks in four training units (each unit is 90 minutes). After the end of the set period, post-tests were performed in the same conditions of pre-tests and with the same work team, and then the researcher analyzed players' movements using the Kenova program for kinetic analysis to extract the kinematic variables under study. Next, the researcher used Statistical Package for the Social Sciences (SPSS) program to show and analyze data in special tables. Finally, scientific result discussion with the aid of some references related to the topic of the study. The researcher reached a set of conclusions such as that rubber resistance exercises have a positive effect on increasing bone density of the arms which was reflected positively on some kinematic variables too.

Keywords: Rubber, Resistance, Skill, Tennis

1. INTRODUCTION & IMPORTANCE OF THE STUDY:

The base of raising performance in sports, including tennis, is the comprehensive physical preparation focusing on using correct and developed training methods that cope with the element which needs to be developed, whether it was physical, functional or a mechanical one. Exercise using rubber is one of the modern methods used to develop the performance. One of its qualities is security and safety that encourage us to use it with the junior and youth ages. They also can be benefited from anywhere for their easy operation. It is known that tennis players need a developed level of fitness as this game requires physical characteristics including special muscular strength that serve the continuous need for biomechanical physical and skilled performance in the playground and at various times and situations. Thus, the researcher tried to use rubber exercises to know the extent of their effect on bone density and some biomechanical variables of the flat serve skill in tennis.

Problem of the Study:

Tennis is one of the games which require high physical, skilled technical aspect like the rest of games. It even overcomes other games in that it needs certain requirements such as muscular strength. As a specialist in kinetic biomechanical analysis, the researcher followed-up the sample of the study and found that its members are unable to endure training pressures during training, especially high training loads. She found that the reason for that is muscular strength deficiency which may cause lack in bone density too, so deficiency in muscular strength and bone density may lead to a decrease in some biomechanical variables related to perform the flat serve skill in tennis, which in turn reflects on accuracy. That's why the researcher to include this kind of exercise in order to try to solve physical and skilled problems resulting from performance through determining its effect on bone density and some biomechanical variables related to flat serve in tennis in for the close link between player's physical and mechanical aspects.

Goals of the Study:

- 1- Preparing training using rubber for the sample of the study.
- 2- Determining the effect of rubber exercise on arms' bone density for the sample of the study.
- 3- Determining the effect of rubber exercise on some kinematic variables of flat serve in tennis.

Hypotheses of the Study:

- 1- There are statistically significant differences between pre and post tests in arm bone density of the sample of the study.

- 2- There are statistically significant differences between pre and post tests in some kinematic variables of flat serve skill in tennis for the sample of the study.

2. METHODOLOGY:

The researcher used empirical method as it was proper for results of the study and achieving its goals and hypotheses.

Sample of the Study:

The sample was chosen purposefully to include 8 tennis players from Al Araby Club and their ages from 20 to 22 years old in a single empirical group as in table (1) which was the most proper to achieve the purpose of the study and represent 100% of the original population with the following properties in table (1):

Table (1): Anthropometric measurements, arithmetic mean and standard deviation for the sample of the study:

Anthropometric measurements	Arithmetic mean	Standard deviation
Weight (kg)	77	6.4
Total length	175	2.6
Arm length	65	1.9
Trunk length	50	1.6
Leg length	104	1.4

The Applied Tests:

The researcher used mineral bone density through the use of Bone mineral densitometry which is a device connected through an electric network in a computer which works as an automatically programmed unit. It enables access the report (rays) of the examined automatically via laser printing to extract colored rays and connect the printer to a computer. This process is made under the supervision of a specialist doctor as the examined is required to be laid on the bed while the x-rays are performed for (5-15 minutes) using surveying photography. This is a color test that is not harmful nor needs needles in the body, so medical examination was conducted for players in the medical campus hospital and bone density tests were made by x-rays with direct supervision of the doctor.

Field procedures of the Study

Pre-tests

- Bone density measurement test for the sample of the study on Tuesday 02/09/2014.
- Skilled performance test of flat serve in tennis on Thursday 04/09/2014 at ten o'clock in the tennis playground at Al Araby Club with pre-test and pre-vidiotaping. Each player was given two serving attempts. If a player misses the first attempt, he shall perform another one, but if he missed both attempts he will be given another serve and record the number of successful attempts to be analyzed.

Videotaping

The researcher used videotaping using to video cameras (NATIONAL and SAMSUNG) made in Japan. The first camera was put at the right side of the server on 1.30 m high and 9 meters distance overhead. The second camera was on a height of 330 cm and a distance of 16 m to the left side with an angle of 100 degrees at the end of the playground. The aim of the first camera is to show serving performance, body joints movement, muscular work angles and angular speed in kinematic transport of the server's performance. The goal of the second camera is to extract ball speed rate in tennis serving. The same procedure was used in pre and post tests with the same measurements and under the same conditions and possibilities.

Rubber Exercises:

After determining one of the reasons of weakness in not investing the performance of tennis serving with the player's automatic power of movement correctly, the researcher prepared exercises using rubber to treat the weakness noticed at students of physical education department tennis team. The course was conducted along twelve weeks (4 training unit each of which is 90 minutes) starting from Saturday 06/09/2014 to 28/11/2014. Rubber exercises were used including arm muscles training, trunk and its sides, the training on the rubber ropes device RUBB MULTI GYM. The training course included a set of exercises through pulling rubber ropes with three levels of strength, resistance and pulling (3kg, 7kg, 9kg, 13 kg and 15 kg). These ropes were fixed on the device from all directions and from different positions and angles. The circular training method was used using rubber ropes as a direct training method to develop muscular strength of players as it is performed in a circular style and in stations. In each station, the player performs certain exercises due to the course and then move to another exercise with (5-6) total exercise average in the single group and this may increase due to goals. There

were 15 exercises on different positions, while load was 1/3. The researcher conducted training gradually and in time as it is difficult to perform with degrees of training load to cope with sample level. The researcher also considered requirements of the skill, temporary and permanent variables, administrative and organizational aspects.

Post-Test:

Post-test of measuring bone density of arms was conducted on 30/11/2014 in the medical campus' hospital on the same device with the same specialist doctor. Post-test was conducted on Monday 01/12/2014 at 10 am in the tennis playground of Al Araby Club. The researcher considered that the test shall be under the same conditions of pre-test.

Kinematic Analysis Program:

The researcher used Kenove program or kinetic analysis to show the studied mechanical variables and approve suitable mechanical rules to show results.

3. DISCUSSING AND ANALYZING RESULTS:

Results of Arm Bone Density Test for the Sample of the Study

Table (2) shows arithmetic mean, standard deviation, the T counted and scheduled value of the variable of arm bone density:

Variable	Pre-test		Post-test		T counted value	T scheduled value	Significance
	Mean	S.D	Mean	S.D			
Arm bone density	1.16	0.23	1.23	0.51	2.90	2.365	Significant

From the above statistical data, we notice that the arithmetic mean in pre-test of arm one density is 1.16 and a standard deviation of 0.23,

while arithmetic mean in post-test is 1.23 and a standard deviation of 0.51. When comparing the T counted and scheduled values, we find that there are significant differences for the sake of post-tests which assert the effectiveness of rubber exercises. It became clear that using resistance exercises is important in building muscles and increasing their strength. Diaa Rashad says that “strength training has a positive effect on muscular strength and ability growth”, so it is important to develop muscular strength as a basic component to show a lot of other body elements as well as showing good skilled performance. In addition, continuous and regular training using rubber ropes leads to substances exchange and interaction in the working muscles. This case is more noticeable while performing strength exercises, and then the increase of muscular size and mass which increase bone density, especially in places of bone and muscle connection. Bone mineral density refers to mineral concentration in forms of bones in two or three dimensions or the section indicating bones. It also refers to all types of measurements that the amount of mineral contents for bones measured in a certain section of bones and skeletal mineral contents.

Density means relation between mass and size and can be expressed with the density = mass / size formula and measured by weight to size such as 1 gm for each 1 cm³. Suzan Hill says that bones are kinetic fibers whose mechanical functions are to support and protect body fibers. Bone resistance power is based on its material and regular components. Minerals contribute to bone durability and strength. The collagen also gives flexibility and strength to joints. Although ones through the use of rubber resistance exercises which agrees with what was mentioned by Abdelrahman while showing the importance of using rubber in training as it is the quickest way to acquire muscular strength in case of movement and static stances, so muscles and bones acquire a lot of physiological characteristics that may not be achieved by other methods.

Moreover, rubber resistance training using gravity and devices based on hydraulic or rubber strength in training muscles correctly which leads to clear benefits of strength training including enhancement of public health such as increasing bone strength, muscle and ligaments, enhancing joint work, reducing the possibility of injury, increasing bone density, temporary metabolism increase, improving heart and blood circulation and cholesterol percentage increase.

Analysis and Discussion of Results of Kinematic Variables of Flat Serve in Tennis at Preparing Study Sample

Table (3) shows arithmetic mean, standard deviation, the T counted and scheduled value of the variables of the study in flat serve of the study sample in pre and post tests during preparation moment:

Variable	Pre-test		Post-test		T counted value	T scheduled value	Significance
	Mean	S.D	Mean	S.D			

Ball height	238.19	3.79	261	2	58.212	2.365	Significant
Elbow angle	65.25	3.57	57.90	3.37	0.069		Insignificant
Shoulder angle	163.75	3.57	173.37	4.80	3.42		Significant
Trunk skewness angle	8.37	1.06	11.50	1.68	13.09		Significant
Knee angle	153.76	2.51	163.87	6.58	3.51		Significant

Significance level (0.05) and freedom degree (7)

High value of arithmetic mean in post-test in the variable of ball height is due to the effect of rubber exercises applied on the sample of the study which led to make the players identify the great benefit of ball height and on the correct performance mechanism as well as the increase in knee joint angle (it is the angle between thigh line from the hip joint point till the knee joint and from the leg line from the point of knee joint till the tendon joint point and it is measured from inside only because it is closed). This led to increasing ball height. As for not finding significant differences between pre and post tests in elbow angle variable, (the angle between the elbow line from the point of wrist joint and humerus line from the point of elbow joint to the shoulder joint point and it is measured from inside as it is closed) the researcher found that this angle was at a good level before applying training and it was slightly developed through noticing the difference in arithmetic mean which was (65.25) in pre-test and increased to (57.90) in post-test. As for the increase in shoulder angle, it shows that rubber exercises were beneficial and contributed to develop general level of the players and raised his physical and skilled abilities through his good mastering of kinematic variables for the whole body during serving. Flat serve, which requires the ball to be in front of the face and with good height with the increase in bending knee joint, trunk skewness angle and consistent kinetic performance to put the ball in the correct areas. (the preparation section contains muscle extension with maximum cramp or close while starting the main section to use power in an optimal way in the main section). The researcher found that this development is due to the used of rubber exercises that increased shoulder angle as well as bending and extending repetitiveness using rubber which contributed to develop shoulder muscles. On the other hand, the rubber exercises made players benefit from trunk skewness angle due to the type of the used serve. The increase in trunk skewness angle led to more benefit from serve movement to make players reach a connected and flexible movement as if it is a single section. Training on this type of movements requires learning the three sections well with linking them as to form a permanent relation among sections. In addition, the used exercises are related to mechanical rules such as levers that can be utilized to produce the biggest amount of muscular strength in addition to pulling angle used in muscular work.

Results of results of kinematic variables of flat serve of pre and post tests in ball impact

Table (4) shows arithmetic mean, standard deviation, the T counted and scheduled value of the variables of the study in flat serve for the study sample in pre and post tests in ball impact:

Variable	Pre-test		Post-test		T counted value	T scheduled value	Significance
	Mean	S.D	Mean	S.D			
Ball height	213.75	4.46	247.60	2.25	44.31	2.365	Significant
Elbow angle	142.88	3.13	170.12	6.33	6.10		Significant
Shoulder angle	156.99	6.84	152.01	2.26	2.36		Significant
Trunk skewness angle	8.00	3.11	6	2.38	4.96		Significant
Knee angle	9.73	1.56	172.75	2.54	161.85		Significant

Significance level (0.05) and freedom degree (7)

The researcher found that ball height development is due to bending and extending body joints as well as making players aware of benefiting from free arms and the way of throwing the ball in a way that is consistent with the path of accompanying movement of hitting the ball. This height development helped in developing serving in general which was asserted by Deson Geoffrey who said: “the higher the ball is, the more correct is ball position which means achieving speed and accuracy based on suitable height for hitting”. The table also shows that differences were significant concerning elbow, shoulder angles, trunk skewness angle and knee angle between pre and post tests for the sake of the post test as a result of increased arithmetic means’ values. The researcher found that this development is due to the player who started to realize the benefit from ball height while hitting it to enhance his serve’s accuracy through explaining all details of the skill and mechanic analysis. Nahida Abd Zaid asserts that: “skills are acquired and develop by training and practice and can be changed. A skill is analyzed from its superficial form, anatomic aspects and mechanical analysis”. The researcher also explains significant results as due to the development of physical aspect through various trainings and developing physical aspects related to skilled performance such as shoulder and shoulder muscles exercises as well as exercises of contracting and extending muscles of

forearm and side back muscles approved by scientific references. We can add the approval of principles of developing aspects of muscular strength in references.

4. CONCLUSIONS:

- 1- Rubber training exercises have a positive effect on increasing bone density of arms.
- 2- Rubber training exercises have a positive effect on some kinematic variables at preparing for flat serve in tennis.
- 3- Rubber training exercises have a positive effect on some kinematic variables at ball impact in flat serve in tennis.

5. RECOMMENDATIONS:

- 1- It is necessary to approve rubber exercises to develop muscular strength and bone density of players.
- 2- The use of rubber exercises to improve kinematic variables of flat serve in tennis.
- 3- It is necessary to apply this type of training for various sort teams in terms of single and team games.
- 4- Conducting other similar studies tackling the use of rubber exercises and identify their effect on bone density for different sections of the body such as trunk and legs.
- 5- Conducting similar researches tackling the effect of these exercises on kinematic variables of various tennis skills as well as other single or team games.

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