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Effect of resistance training on the biomechanics and accuracy of serve receiving skills in volleyball

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ABSTRACT

This study aimed to identify the effect of resistance training on the biomechanics and accuracy of serve receiving skills in volleyball. The research community was composed of 26 young volleyball players of Baghdad volleyball clubs. A total of 4 players were selected for the preliminary experiment, while 14 participants were recruited as the main sample for the study. In the present study, a set of resistance exercises were designed by the researchers for the volleyball players of the sample. Exercises were performed by the sample participants during the course of study. The biomechanical variables considered in the present study were: Preparation moment (shoulder joint angle, hip angle, knee joint angle), moment of propulsion (shoulder joint angle, hip angle, knee joint angle). Based on the findings of the present study, the researchers concluded that the resistance exercises had a positive impact on the biomechanics and accuracy of serve receiving skills in the participants.

KEYWORDS

Technical performance; Biomechanics; Volleyball

1. INTRODUCTION

In the past decade, a lot of development has been observed in terms of techniques and skills of players in their respective games. This is due to the consistent work of sports authorities and researchers for creating a better learning environment by provision of training to the players using modern methods using scientific methods. Among the variety of sports, volleyball is one of the

games that can attain a good level of technical performance simply by the developing some biomechanical variables. An Athlete's complete performance depend upon many factors which include; playing efficiency of the player, validity, and characteristics of the tools and equipment used for the training, the method of training opted by the training coaches etc. (Abd al-Rahman & Al-Din, 1997).

Biomechanics is the noblest sciences because by means of it, living bodies with movement are performed and their efficiency is achieved (Simon, 2001). Teaching and training various mathematical skills depends on a set of basic principles of certain theories and scientific laws related to the physical abilities of the body. It also depends on the phenomenon of the momentum transfer and the consequent understanding of the effect of the forces in motion on the different parts of the body (Al-Fadhli, 2010). Technically the skill of defending the serving in volleyball requires a balance between stability and mobility. It helps in moving the knee up and down to obtain an appropriate force to push the ball in the right place(Asmail, 2003).Each player works to best of their efficiency, making constant efforts in raising the level of their skill performance in the game especially in competitions. Hence, it is very important for very training coach to have thorough information regarding the biomechanical variables and kinetics and kinematics by following the player's movement during his performance of the skill and its biomechanical analysis.

One of the fundamentals of developing the skill of defending the serving in volleyball is to focus on the special variables associated with the skill of defense serving by implementing a new set of resistance exercises based on the modern methods, simultaneously taking into account the basic abilities of the players. Hence, the primary aim of the study was to find out the effect of various resistance exercises to develop some biomechanical variables and the accuracy of the skill of defense in the volleyball players.

Technically the skill of defending the serving in volleyball requires a balance between stability and mobility. Hence, it is very important for very training coach to have thorough information regarding the biomechanical variables and kinetics and kinematics by following the player's movement during his performance of the skill and its biomechanical analysis. Researchers observed that there was heavy reliance of trainers on using old training methods for basketball players neglecting the, physical and functional abilities of the players. Hence, the researcher identified the need and formulated a resistance exercise protocol for training sessions of players of volleyball, based on the modern methods, simultaneously taking into account the basic abilities of the players

This study aimed to identify the effect of resistance training on the biomechanics and accuracy of serve receiving skills in volleyball. The hypothesis was that the resistance training would have a

significant positive effect on the biomechanics and accuracy of serve receiving skills of the participants.

2. METHODS

2.1. Participants

The research community was composed of 26 young volleyball players of Baghdad volleyball clubs. A total of 4 players were selected for the preliminary experiment, while 14 participants were recruited as the main sample for the study.

2.2. Instruments

In the present study, many tools and devices were used for the purpose of data collection with the aim to achieve the objectives of the research. The tools used in the present study included 20 legal volleyball balls, a stopwatch, a whistle, 2 metal measuring bands, a scale, adhesive tape, medical balls weighing 1-5 kg, dumbbells, overloads for the players, a video camera with a frequency of 25 p.m./tha, a Sony high-speed video camera with a frequency of 1200 p/sec (the speed was set at 210 p/sec), two triple carriers for camera and projector, a Lenovo Laptop with Kinovea software to analyze movements and identify biomechanical indicators, and a 1m long scale.

2.3. Procedures

The key biomechanical variables for the field defense test were identified by the researchers and the team of the biomechanical experts. First, the body weight of the participants was measured. Then, the arm mass was measured in relation to body mass with the equation of Rolf (1984): *Arm mass = (Body mass x 6.5) / 100.* The accuracy of serve receiving skills in volleyball was measured with the test of Mohamed & Hamdi (1997).

Exploratory experience

The researchers conducted a preliminary experiment on a sample outside the sample participants recruited for the study. The preliminary experiment (survey) was conducted on 4 volleyball players, recruited from the Police Sports Club. This experiment was conducted in the month of January 2019 in the hall of the Police Sports Club. The preliminary experiment was conducted with the aim to verify the validity of the tools used in terms of positive assistance, to verify the fitness of the tests for the tester members and the ease of their application, to know the time required to conduct the tests, to verify the understanding and efficiency of the assistant work

team in conducting measurements and tests and recording the results, to know the difficulties that the researchers may encounter during the course of the study and to provide appropriate solutions to them. The second reconnaissance experiment was conducted on 12 players, in the month of January 2019 after completing the preliminary experiment. The main experiment was conducted in the weightlifting hall and the hall of the sports club. A trial of the exercises was conducted on the players to find out the maximum value, frequency and intensity of the exercises. The camera was placed on a tripod; the focus was kept vertical on the middle of the player's motion path when performing the skill of defense transmission. The camera was 7.20 meters from the side line. For the stadium, the focus of the camera lens was kept 1.70 meters above ground level, and the scale (1m) was filmed as a reference for measurement

Pre tests

The research team conducted the initial tests on the research community players selected as the participants for the study, in the month of January 2019. The initial tests were performed in the closed hall of the volleyball stadium.

Intervention

In the present study, a set of resistance exercises were designed by the researchers for the volleyball players. Exercises were performed by the sample participants during the course of study i.e. in the month of January 2019 till March 2019. A total of 27 training sessions were given i.e. three sessions per week for total of six weeks. Each training session was completed in 35-40 minutes. The exercises were given in mode of medium and low-intensity with higher number of repetitions. The intensity of the exercises ranged between 80-95 of maximum intensity, but the intensity used in weightlifting exercises ranged between 40-85 as per the physical abilities of the participant players. The frequency of increasing intensity of the exercises was done by adding weights to the arms during the performance of the defense skill, with a range between 3-8 % of the arm mass of each player to 6-10 % of the mass of each player.

The training unit included special exercises, based on the physical abilities of the sample participants. The frequency of exercises was decided taking into account the ratio of work to comfort between repetitions (1:2) or (3:1). In the present study, the various parameters of the exercises were subject to variation according to the physical characteristics and abilities of the participants.

Post Tests

After training sessions of qualitative exercises to the sample participants, the final tests were accomplished by the researcher and his fellow teammates in the month of March 2019, under the same conditions in which the pre-tests were conducted in terms of time, location, equipment and tools, method of execution, and staff.

2.4. Data analyses

The Kinovea analysis software was used in AVI format and biomechanical variables were extracted directly from the film taken by the player while performing the test of the accuracy of the defense. The biomechanical variables considered in the present study were: Preparation moment (shoulder joint angle, hip angle, knee joint angle), moment of propulsion (shoulder joint angle, hip angle, knee joint angle). In the present study, statistical analysis was done with the Statistical Package for the Social Sciences (SPSS) by computing arithmetic means and standard deviations.

3. RESULTS AND DISCUSSION

The results of the study are presented in Table 1, comparing the pre-tests and post-tests of the variables analysed. This table presents means and standard deviations of all the variables measured in the study, showing that the players improved their biomechanics and accuracy of serve receiving skills in volleyball (Table 1).

The results of the present study revealed that significant variations were observed in the pre-test and post-test, in favor of post-test. The significant findings were attributed to the implementation of the resistance exercises among the sample participants, which relied on the development of strength. and appropriate speed. The strength was developed by adding the weights to the body of the participants in a gradual manner during the training sessions. This leads to a tangible development and helps the player to perform the skills with ease in their competitions. A similar study was conducted by Ricci, in which the authors pointed out that using the overload is a training principle that eventually prepares the muscles and develop control muscle work during the performance (Ricci, 1967).

Table 1. Comparison between pre-tests and post-tests of the variables analyzed

Variables		Unit	Test	Mean	Standard deviation
Moment of preparation	Shoulder joint angle	Degree	Pre	37.28	2.10
			Post	45.94	7.60
	Hip angle	Degree	Pre	71.35	7.31
			Post	88.84	6.52
	Knee angle	Degree	Pre	1.33	19.01
			Post	1.51	18.04
Moment of propulsion	Shoulder joint angle	Degree	Pre	88.24	4.50
			Post	96.63	3.90
	Hip angle	Degree	Pre	141.27	21.01
			Post	161.29	19.30
	Knee angle	Degree	Pre	165.13	22.60
			Post	171.46	18.46
Moments of preparation and propulsion	Moment of preparation	KgM^2/Tha	Pre	191.29	38.36
			Post	223.02	39.27
	Moment of propulsion	KgM^2/Tha	Pre	169.68	45.02
			Post	210.12	40.44
	Momentum change	KgM^2/Tha	Pre	21.98	28.18
			Post	25.20	23.91
Accuracy of serve receiving skills		Grade	Pre	25.65	2.10
			Post	32.23	1.95

A significant difference was also found between the two pre-tests and the distance between the joints of the shoulder, hip and knee during preparation and propulsion. The difference was attributed to result of achieving the required angular range which further increased the movements in different in the preparation mode as well as in the main propulsion phase. The specific training method used in the study included a dynamic match between the exercise, the structure, fluidity, degree of

compatibility with the physical abilities of the players and the integration of motor possibilities in muscular work in the skill of defending the serve in the volleyball game. Osam (2000) stated that physical exercises can affect the development of neuromuscular compatibility and strength, especially when these movements are similar to the movements of performance of skill and using the same muscle groups (Osam, 2000).

Researchers found significant differences for the first momentum indicator at the moment of preparation when performing the skill of defense transmission. The researchers attributed this to the fact that achieving the correct mechanical manifestations of performance angles at the moment of preparation, created good conditions to retain the momentum of the body that contributes the least gravitational resistance torque (weight torque) as these indicators are associated with achieving good tides of the corners of the body joints.

Through the analysis of the results of the second momentum index, at the moment of propulsion when performing the skill of defense of the serve, significant difference was found. The researchers attributed the difference to the fact that the variable of the push of force depends mainly on the variables of mass and speed in measuring the variable of momentum. The variable momentum relied entirely on the variable speed (primary and final). The change in the amount of movement of the angular body that is related to the amount of mass of the body or part of the body, its length, and its angular speed, which has to do with the push of the moment force exerted, is the cause of the change in the amount of movement of the body always (Khalil, 2015).

In any exercise form, strength and speed must correspond to muscle strength. Strength contributes to development of skilled performance in the players. Al-Fadhli (2010) in their study stated that the development of muscle strength can contribute to significantly increasing the effectiveness of training, leading to progress in the level of speed characterized by strength (Al-Fadhli, 2010). The perfection and accuracy in the skill of defense is necessary to pass the ball to the teammate in a way that would enable the player to score a point, but if the reception is not good it questions the quality of preparation. The proficiency of this skill depends primarily on the psychological aspect and the focus on physical and mechanical possibilities.

The trainers mainly focus on the defense and server skill of the players in the volleyball game. Both the skills are associated like two sides of a coin. Both the skills hold an equal importance in the volleyball game. The importance of this skill is demonstrated by the development of skill performance as a result of the diversity of serving. The players use the forearms for receiving the ball from the adjacent team player, which helps to receive the ball safely. This type of reception is used by 95% of the players (Aqil, 1987; Riad, 2002).

4. CONCLUSIONS

Based on the findings of the present study, the researchers concluded that the resistance exercises had a positive impact on the biomechanics and accuracy of serve receiving skills in the participants. According to these results, the authors recommend that volleyball coaches pay attention to serve receiving skills in order to obtain a successful attack and achieve a direct point. The authors also recommend that volleyball coaches use resistance exercises to improve the biomechanics and accuracy of serve receiving skills in their players.

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CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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