SPORT TK-EuroAmerican Journal of Sport Sciences

https://revistas.um.es/sportk Online ISSN: 2340-8812

Received: **11/09/2021.** Accepted: **27/11/2021.** Published: **30/04/2022**

The effect of biomechanical feedback on the accuracy of the long serve in badminton

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ABSTRACT

The primary aim of the study was to find out the values of some biomechanical variables for the long serve skill in badminton and to identify the effect of biomechanical feedback on the performance of long serve. The present study had a single group, pre-post experimental study design. The research community was determined by the intentional method of one group with a pre-and post-test. The players of the Assyrian badminton club constituted the research community. A total of 12 players were present in the research community. The badminton players falling within the age group of 15-17 years for the season 2020-2021 were recruited as the participants for the study. A total of five players were selected as the participants of the study. Based on the findings of the present study, the researchers concluded that the biomechanical feedback effectively contributed through the educational curriculum in influencing the biomechanical variables and in improving the performance of the long-serve.

KEYWORDS

Biomechanics; Serve; Badminton

1. INTRODUCTION

Several empirical studies have established sports as a beneficial activity having a positive impact on the state of health, education and the economy. The goal of sports training is to train a sportsperson or team to achieve their full potential and perform optimally in a particular competition. Training of the players is the guiding force for training coaches. Hence it should be effectively planned and implemented by adopting new strategies and modern methods based on the individual characteristics of the players.

The development in the modern methods of learning and training has effectively contributed in raising the level of performance of the players in order to maintain the global standards of the players of different games. Feedback is one of the most important methods that correct the mistakes in the playing technique of the players in an effective way. Additional corrective information helps the players in serving the skilled work. The feedback has many types and each type serves a specific stage of learning and training stages. Out of all the types, the biomechanical feedback is one of the most important types that the coach or the teacher presents a model to the learner or player. This model contains a set of biomechanical variables that contribute to achieve highest level of performance.

The present study is conducted to find the impact of biomechanical feedback and the participation of the learner to analyze his or her motor performance and identify their mistakes in the playing techniques. Followed by this, the model helps in modifying their performance of the skill of long serve in badminton, which is one of the basic skills on which learning many other skills. Hence the present study holds the importance in opening new horizons for the development of learners' practical abilities in analyzing their motor performance and discovering errors to modify performance with biomechanical feedback.

The problem of the research lies in the difficulty of finding mistakes in the playing technique of the players and their reliance primarily on the training coach, in addition to not activating the work of sensory receptors and studying the condition or position of the body and limbs and comparing it with the long performance of this skill. Training coaches give feedback to the players by showing them a model performance. They ask the players to match the model performance. Most often the wrong technique gets included in their schedule of training which leads to poor performance in their final game. In addition to this, through the analysis and watching the players of the national team, it was found that the players lack this kind of behavior, the researcher’s team decided to give biomechanical feedback to correct the performance of the long serve and know the extent of its impact on improving the performance of the players in this skill.

The primary aim of the study was to find out the values of some biomechanical variables for the long serve skill in badminton and to identify the effect of biomechanical feedback on the performance of long serve. The researcher hypothesized that statistically significant differences would be found between the pre and post-tests in the performance of the long serve skill in the badminton players.

2. METHODS

2.1. Design and participants

The present study had a single group, pre-post experimental study design. The research community was determined by the intentional method of one group with a pre-test and post-test. The players of the Assyrian badminton club constituted the research community. A total of 12 players were present in the research community. Badminton players falling within the age group of 15-17 years for the season 2020-2021 were recruited as the participants for the study. A total of five players were selected as the participants of the study. The study was conducted within the time frame of June 2021 to August 2021 in the Assyrian Club Hall in Baghdad. The total number of attempts was 8 for each test (pre - post). The table 1 shows the characteristics of the research sample.

Table 1. Characteristics of the research sample.

	Weight	Height	Age	Arm length	Humerus length	Forearm length
Player 1	65	160	16	63	29	31
Player 2	60	159	15	64	31	29
Player 3	63	163	17	65	30	28
Player 4	70	165	16	70	33	33
Player 5	72	167	15	75	33	31

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 various tools used in the present study included: Kinovea Kinetic Analysis Program, calculator, HP laptop, Casio-type camera with a speed of 240 images/sec, camera holder, badminton rackets, and a scale.

Various biomechanical variables were identified by the researchers. These variables were: elbow joint angle at the moment of hitting, forearm angle at the moment of hitting, shoulder joint angle at the moment of hitting, and wrist joint angle at the moment of hitting.

Elbow joint angle: This is defined as the angle between the humeral line, i.e. from the point of the shoulder joint to the point of the elbow joint, with the forearm line, i.e. from the point of the elbow joint to the point of the wrist joint (Hindawi, 2010).

Forearm angle: This angle is measured by limiting it between the forearm and the wrist joint on one side and between the racket and the wrist joint on the other side.

Shoulder joint angle: It is the angle between the line from the shoulder to the elbow on one side and the line from the shoulder to the torso on the other side (Hindawi, 2010).

Wrist joint angle: It is the angle between the line joining the forearm bone and the horizontal line.

2.3. Procedures

Exploratory experience: The researchers conducted a preliminary experiment to test in the month of June 2021 on 5 Al-Assyrian Club players. The preliminary experiment was conducted with the aim to determine the dimensions of the location of the camera (height + distance from the student)**,** to know the distance of the camera from the player's performance location, to recognize the validity of the camera and determine the appropriate speed for imaging and analysis. , 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 researcher may encounter during the course of the study and providing appropriate solutions to them.

Pre-test: Standard tests for the research sample were carried out in the month of June 2021 in the badminton court of the Al-Athawy Club, using two Casio video cameras at a frequency of 120 images/second. The first camera set at a distance of 600 cm from the player, was placed on the right side in which the player performs the skill. The center of the camera lens was 150 cm above the surface of the canned ground for the imaging ray to completely cover the player and the racket's body. The second camera was kept behind the player at a frequency of 120 images/sec. The second camera was set at a distance of 600 cm from the player, and the height of the center of the camera lens from the surface of the playing field was 150 cm to ensure that the skill was fully photographed.

Main experience (feedback approach): The primary experiment was initiated by the researchers in the month of June 2021 in the stadium of the Assyrian Club. The kinetic analysis program (Kenova), enabled the researchers to observe more than one film for establishing the comparison between the attempts of the national team players with the global model and presenting the findings to the training coaches. The training coaches evaluated the performance of the players. Biomechanical feedback helped the researcher to identify the mistakes of the players in their playing technique which often lead to the poor performance of the long serve skill. Followed by this, each participant was provided with the feedback in a phased manner using the video presentation (late feedback). Simultaneously,

each player was directed to work on these mistakes by putting efforts in correcting their techniques during the training sessions. On field feedback was also given to the players (direct feedback). Players were directed to move to the next phase of the technique until it has been followed by the assessment and evaluation done by the training coach. Stage wise division of the feedback batches allows the players to achieve interdependence between two corrective stages.

Post-test: After accomplishment of the main research experiment, the final tests were accomplished by the researchers and fellow teammates in the month of August 2021 with the same conditions and under the same spatial and temporal conditions.

2.4. Statistical analyses

In the present study, statistical analysis was carried out using the Statistical Package for the Social Sciences (SPSS) by computing arithmetic means, standard deviations, and t tests, at 0.05 level of significance.

3. RESULTS AND DISCUSSION

Table 2 shows the comparison between the results of the pre and post-tests of the research sample. There were statistically significant differences between pre-tests and post-tests in the four angles analysed: elbow joint angle, forearm angle, shoulder joint angle, and wrist joint angle.

Table 2. Comparison between the pre and post-tests of the research sample

Variables	Measuring unit	Pre-test		Post-test		t	p
		Mean	SD	Mean	SD		
Elbow joint angle	Degree	10.20	0.44	12.40	0.54	3.50	0.02
Forearm angle	Degree	12.60	0.54	14.00	1.00	5.715	0.05
Shoulder joint angle	Degree	50	3.74	62	4.07	5.66	0.01
Wrist joint angle	Degree	81.7	4.47	87.21	5.91	2.78	0.04

In the present study, the wrist angle and shoulder angle had significant and clear effect along with the use of feedback to modify the biomechanical path adjustment and knowledge performance of the long serve skill of the badminton players. In the present study, biomechanical feedback was given emphasizing these angles during the training sessions at different stages of the game. The players were directed to get the racket closest to the axis of rotation during the rotation in order to get the largest possible circular speed and then move the racket away from the axis of rotation in order to

exploit the circular velocity that is from the rounding of the racket towards the axis of rotation (Nizar, 1976). This leads to an increase in the angle of the shoulder.

In the current study, interval training was given to the participants of the experimental group as the standardized training according to the scientific foundations. The graduation and the change in degrees of intensity was done by putting the muscle under training loads below the extremity. It leads to the excitement of the largest number of muscle fibers and then increased the strength produced.

In the present study, significant difference was observed in the elbow angle, which indicated that the elbow angle has a significant impact on the performance of the skill of the long serve of badminton players in terms of reduction in the angular velocity and increase in the circumferential velocity (El Din, 1998). The increase in peripheral velocity results in a high increase in linear velocity (Jasm et al., 2021).

A significant difference was also observed in the angle of the forearm, which indicated that the angle of the forearm had a significant and clear effect on the performance of the skill of the long serve of the badminton players. The use of biomechanical feedback has an effect on modifying the motor path of the wrist angle. It can be thrown or hit through curved paths by prolonging the turning radius of the limbs used and increasing the turning radius, the required collision acceleration, which increases the muscle torque to produce the appropriate angular velocity of the tool like in the game of tennis (Colhrun & Catarin, 1982).

4. CONCLUSIONS

Based on the findings of the present study, the researchers concluded that the biomechanical feedback effectively contributed through the educational curriculum in influencing the biomechanical variables and in improving the performance of the long-serve, which contributed to raise the level of the badminton players. Therefore, providing the learners with experience in diagnosing some variables increases their learning speed. The authors recommend that badminton coaches use the biomechanical feedback to rectify the mistakes in the playing techniques, especially the long serve. The researchers also recommended conducting large sample trials on the importance of biomechanical feedback in different games and on different populations of players of different age groups.

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AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct and intellectual contribution to the work, and approved it for publication.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

FUNDING

This research received no external funding.