

Investigation of the Effect of Fatigue on Service Shots' Hit Ratio for Volleyball Players

Mehmet Çebi

School of Physical Education and Sports,
Ondokuzmayis University, Samsun, Turkiye

Abstract: This study was done on the under armour elite volleyball players, with an age range of 18-25, in order to examine whether the players' fatigue status during the match can cause any deflection on the service shots that hit and miss the target towards left and right. The right hand dominant 30 elite volleyball players with mean age of 20.70 ± 1.68 years, mean height 181.93 ± 5.40 cm and with a mean of 74.03 ± 6.97 kg body weight had participated to this study voluntarily. The participated players made 10 service shots to the target after a 20-minute warm-up and 3 sets and then the measurements were taken. The first set of measurements taken after warm-up and the final measurements taken after 3 sets were compared, SPSS program was used to compare the difference between the measurements. As a result of the study it was determined that the services that hit the target, glided to the right and to went to the out decreased numerically but they were statistically no meaningful, but the services glided to the left increased statistically ($p < 0.05$). In conclusion, it was considered that the service shots' deviation to the left has been associated with fatigue and laterality.

Key words: Volleyball • Service • Fatigue

INTRODUCTION

When there is any anatomical structure or functional situation on the human body that weighs more on either right or left side, it is called lateralization [1]. Cerebral lateralization means there are morphological and functional differences between the two hemispheres of the brain [2]. One of the hemispheres being heavier than the other one is anatomical cerebral lateralization, but the hand preference is considered as a functional cerebral lateralization. In humans the left hemisphere is dominant for verbal functions and the right hemisphere is dominant for non-verbal and spatial functions. The left hemisphere is specialized for speech, literature, oratory skills and the right hemisphere is specialized for the painting, architecture, geometry and the visual qualities. For the vast majority of people motor control areas, sensual speech center (Wernicke's area) and the motor speech center (Broca's area) are usually more developed in one cerebral hemisphere compared to the other one. The better developed hemisphere is called the dominant hemisphere. About 95% of people's left hemisphere is more dominant over right hemisphere [3].

As with many sports disciplines in the sport 1, in order to be successful in volleyball there are both physiological and biomechanical requirements. Match, with regard to game rules and structure, includes the time of repeated intense exercises periods and recovery times between those periods for the athletes. Volleyball athletes are required to be fast, agile, durable, strong and have both anaerobic and aerobic endurance [4].

Fatigue is classically defined as reduction of skeletal muscle strength or its power generating capacity [5, 6]. Fatigue may occur in the human body, muscle or muscle group as a result of the loss of the effectiveness of some or all of the different neuromuscular mechanisms. It has emphasized that voluntary muscle contractility fatigue is caused by the motor nerves that are contained in motor unit which transmits nervous warnings, the motor endplate that motor nerve muscle fiber transmits the warning neural, the mechanism which generates force and the inadequacies in the central nervous system that is responsible for sending nerve stimulation [7].

One of the most important causes of physical activity related fatigue in a lot of sports branches is the repetitive contractions caused by maximal intensity sprint, jump and

change direction movements during the match. It was thought that trainings that based on the motion pattern of the actual match may cause muscle damage and this may cause performance degradation and therefore may lead to long term fatigue [2].

Cerebral lateralization means morphological and functional differences between the two hemispheres of the brain. Handedness is regarded as a functional cerebral laterality [8]. It is considered that on both sides human brain typically contains regions that are different in size. Left brain manages right hands; right brain manages left hands [9 - 11]. Then, left brain is dominant in right handed; right brain is dominant in left handed. Therefore, it can easily be said that the right-brain skills in the left handed is superior to the right handed and the left -brain skills in the right handed is superior to the left handed. Yakovlev *et al* determined that the pyramidal fiber numbers come to alpha motor neurons with regard to the right hand are higher than the pyramidal fiber numbers that come to alpha motor neurons with regard to the left hand.

This study was performed on the under armour elite volleyball players, with an age range of 18-25, in order to determine whether the players' fatigue status during the match has caused any deflection on the shots that hit and miss the target towards left and right.

MATERIALS AND METHODS

The right hand dominant 30 elite volleyball players who are studying in the Academy of Physical Education and Sports in 19th May University, Samsun and had

training of over five years with mean age of 20.70 ± 1.68 years, mean height 181.93 ± 5.40 cm and with a mean of 74.03 ± 6.97 kg body weight had participated to this study voluntarily (Table 1). The subjects were measured after filling out and signing the voluntary participation information form.

After general and private warm-ups for 20 minutes and after 3 set games, 20 service shots were applied to the participating volleyball players. Players made service shots using the tennis service technique from their area to across where it was marked by the 20 cm wide tape. Between the service shots the interval working principle was observed to avoid throwing players to relax moderate jogging was applied. In this study the service shots were recorded with the camera and then the camera records were inspected and the numerical values were obtained.

SPSS program was used for statistical evaluation of data In order to determine whether there was a normal distribution of the data, One-Sample Kolmogorov-Smirnov test was used. It was found that there was no normal distribution of the data and the SPSS program was used for the statistical analysis of the data. When comparing the groups t test was used to compared depending groups and $P < 0.05$ was considered significant.

RESULTS

Physical properties such as age, height and weight averages of under armour elite volleyball players who participated in the study and their service shots deviations were detected by using in the pre and post test.

Table 1: Physical Properties of the Participating Volleyball Players

Variables	N	Min	Max	Mean	S _D
Age	30	18,00	25,00	20,7000	1,68462
Height	30	171,00	193,00	181,9333	5,40072
Weight	30	62,00	89,00	74,0333	6,97030

Table 2: Pre and Post Test Values of the Subjects who Participated to the Study

Variables		n	Mean	S _D	t	p
Service Shots that Hit the Target	Pre Test	30	1,60	0,93	,462	,647
	Post Test	30	1,50	1,07		
Service Shots Gliding to the Right (in laterality direction)	Pre Test	30	4,33	1,72	1,262	,217
	Post Test	30	3,80	1,42		
Service Shots Gliding to the Left (in opposite laterality direction)	Pre Test	30	3,36	1,75	-2,164	,039*
	Post Test	30	4,30	1,70		
Outgoing Service Shots	Pre Test	30	0,60	1,22	,817	,420
	Post Test	30	0,43	0,81		

* $P < 0.05$

It was seen that the shots to the target, the right dominant players' shots with fatigue inclined to go to in a statistically meaningful way to the left side, opposite of the laterality ($p < .05$). This shows that as a result that the fatigue occurred in the dominant side the opposite laterality side came into mandatory use. However, there was statistically significant difference for hitting the target, gliding to right.

DISCUSSION

This study was done in order to examine the deviation of the players' service shots due to fatigue occurred during the match. Pre-competition and post-competition service shots to the target showed that shots inclined to glide to the left with the fatigue. According to the study of Dangelmaier and Dangelmaier and Coward [13] it was found out that after 50 dunks women volleyball players', towards the end and due to fatigue, motion segments slow, the size of their movements is narrowed, the movement angles changed and the movement wideness is reduced. The ball speed and hitting accuracy were dropped. These changes can lead to errors in the match. It was also determined that the fatigue occurred during the match change the performance of Volleyball players.

With regard to Ziyagil *et al*, when their studies are compared in this area with the findings, similarities and differences were observed. According to the Ziyagil *et al* study which was done on the wrestlers the average time of different rounds of the game depend on the laterality factor that showed changing trends. Quarter-final round, the right and left hand techniques, the average time to close to each other, while other tours the average duration of time decreased when the techniques were committed from right and the average duration of time increased when the techniques were committed from left. While until the third round the games that were applied from the right side the average working hours were shortened, the games that were applied from the left side the average working hours increased in each progressive round.

Depending on the rate of recovery it was stated that until third and fourth running match the use of the techniques from right came forward. In general, from the first round of the championship until the final round, the techniques done from the left side were realized in less time. The techniques done from the right side, the average application of time was gradually decreased in the qualifying rounds. They reported that in Third and fourth place running game and in the final competition the use of

the left side was increased. Also Ziyagil *et al* reported that the average technical scores taken according to the left and right laterality are continued until semi-finals but after that round changes are happened in favor of the left laterality [13].

Ziyagil *et al*. [13] have suggested that the fatigue occur due to the intense use of their dominant side the wrestlers fore fronted their left side in technical applications in order to recovery in the following tours and in this way they would rest. Tan's study [14] in humans' spinal motor, for the first time, showed that in addition to supra spinal centers there was a spinal motor unbalance effect. Therefore, the functional implications of spinal motor asymmetry may arise.

In conclusion, according to our study, it was found out that the participating subjects' pre and post game service shots to the target are affected by the fatigue and the laterality occurred during the game and therefore right-handed volleyball players' service shots are gliding towards the left side in a significant way.

It was considered that the reason why the right-handed player's shots' are deviated to the left was the laterality and using the dominant hemispheres for a long time. So it would be appropriate managerial behavior to act accordingly by the trainers. In order to discover the exact role of the factor mechanisms further studies are needed.

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