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**THE EFFICIENCY OF SPIKING IN VOLLEYBALL ACCORDING
TO THE BODY'S LATERALITY**

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Abstract

Most volleyball players have certain hand-preference. The existence of the morpho-functional lateralization makes itself present during several stages of the game: serving, attacking, performing the fundamental posture in the court, or jumping to serve. The goal of the research is to determine the preference for areas in line II in the case of performing a spike-player, and if the performance of the spike-player depends on this. The study attempts to determine the preference for areas in the second line. Here an attack can be done in the case of performing a spike-player, according to the side from which the ball is set in order to hit it (left or right), and whether the performance of a spike-player depends on this preference. For the parameters recorded during training and games, has been calculated statistical difference. We used independent samples “t” test and Pearson correlation coefficient. Thus, among the preferences for the areas of attack on training and official games, there are a direct connection, namely these preferences evolve in the same manner. Results suggest that preferences for the area of attack in the second line, depend on the section from which the ball is set to be hit.

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1. Introduction

Laterality is a morphological and/or functional asymmetry in developing pair members and bodies (Dumitru, 1986). Functional laterality existent between the handy part and the lubberly one is due to the slow stage of performing nerve and biochemical processes at the level of the cortex and muscles, as an effect of some reflexes, most of them are conditioned (Harris, 2010).



At the point when there is any anatomical structure or functional physiological and biomechanical requirements (Löffing, Schorer, Hagemann & Baker, 2012), Match situation on the human body that weighs more on either with regard to game rules and structure, includes the time right or left side, it is called lateralization. (Beratis, Rabavilas, Kyprianou, Papadimitriou & Papageorgiou, 2013).

Concerns about the phenomenon of laterality in the volleyball game are restricted and address in particular the phenomenon of ambidextrous development (Rogers, Vallortigara, & Andrew, 2013). Ambidexterity is the state of being equally adept in the use of both right and left body sides. Individuals who are naturally ambidextrous are extremely rare (Schorer, Löffing, Hagemann, & Baker, 2012). Athletes can become ambidextrous, by practicing equally with both hands and legs while their movement versatility with each body side is generally the qualitative factor in determining a person's ambidexterity. (Ilnicka, Trzaskoma, Wiszomirska, Wit, & Wychowański, 2013).

The main cause of athletes' laterality is the exaggerated, unilateral orientation towards the right arm during beginners' instructive period, and also the coaches' race for immediate results (Cojocaru, 2015). Therefore, given the unilateral specialization, the perform national laterality indistinguishable to the particular one (Abrams & Panaggio, 2012). The existence of the morpho-functional lateralization makes itself present during several stages of the game: when serving, attacking, when performing the fundamental posture in the court, when performing a jump serve (Bădău, 2012). Lateral dominance has been studied throughout history; however, the idea that lateral dominance can affect sports performance is a concept with little scholarly research (Baker & Schorer, 2013). According to Cular, Miletic & Miletic (2010), "the fact that left-handed and right-handed individual are able to develop motor skills in their non-dominant side should be considered an advantage in the training process in order to achieve better sports results".

The findings of a questionnaire, conceived with the purpose of knowing the volleyball players' opinion about the change of some asymmetrical technical actions into symmetrical actions, have been the following: 79.9% of them have stated that they feel insecure when the gaming posture confines them to make use of the non-dominant hand. All subjects have addressed that the possibility of performing fundamental technical actions, either with the right or left arm, allows them to play with a much greater confidence, especially in difficult situations, while 82.9% of the questioned subjects have agreed to the necessity of symmetrical training, since during the unilateral training they have suffered serious injuries at the shoulder and back levels, due to the excess of effort for the dominant limb, especially in the case of spiking (Wiodzimierz, 1996).

Consequently, the research so far has proven that the perform national laterality depends on the preferred hand and on its level of exercise, on certain spatial characteristics of the performed tasks. For the moment, it is not known if in volleyball performnational laterality depends, on the posture adopted by the player at the time of performing a spike-player (Croitoru, 2014).

2. Problem Statement

Most volleyball players have certain hand-preference. This is due to excessive training of the dominant part of their body when they are juniors mostly because the coaches run for immediate results.

3. Research Questions

We base our research on the following hypotheses:

- 3.1. Depending on which direction the ball comes from, what is the preference for the areas of line II to strike the ball: left or right, in the front of, or behind the setter?
- 3.2. Does the effectiveness of the attack depend on this preference?

4. Purpose of the Study

This study attempts to determine the preference for areas in line II in the case of performing a spike, according to the side from which the ball is set in order to hit it, namely from left or right, and whether the performance of a spike depends on this preference.

5. Research Methods

The subjects have been assessed in regards to the definition of preferential laterality for the three parameters: hand, foot, eye, using the HARRIS test, the Harris Test of Lateral dominance was designed to assess preferred and superior performance of one side of the body compared to the other. It measured eye and hand dominance, as well as directional confusion. It contained a total of 10: (1) knowledge of left and right, (2) hand preference, (3) simultaneous writing, (4) handwriting, (5) tapping, (6) card dealing ability, (7) strength of grip between hands, (8) monocular testing, (9) binocular testing, (10) stereoscopic testing, with the due specification that the actions have been modified for establishing the foot's dominance, as it follows: instead of the hopscotch's test, where subjects was questioned regarding the foot on which they perform the pass for the spike. The ocular prevalence has been determined by modifying two actions: instead of the test "pick the cardboard and look through its hole!" it has introduced the question "What eye did you use to look through the peephole?", while the test "Shoot with a toy gun" has been replaced with the question "What eye do you use while looking through a microscope?". The test has thus been turned into a questionnaire.

Laterality tests for procedures specific to the volleyball game was conducted in training and official game circumstances. The tests was conducted with the right arm by 10 subjects, while the other 2 conducted it with left arm.

The subjects are 12 players, volleyball team A division, average age 23.8 ± 7.11 years (the minimum age being 17.6 years, while the maximum one being 33.5 years), having an height average of 195.25 ± 6.08 cm, a weight of 82.41 ± 5.47 kg, a breadth of 198.45 ± 7.74 cm, with an experience in practising volleyball of 12.9 - 7.10 years. The athletes tested, six from the basic team and six from the second team during the competitive year. Following the tests for determining the preferential laterality were applied for the three parameters: hand, foot and eye, it resulted that 10 players were right-handed, while 2 of them had a cross laterality.

For the spike-player the tests have been conducted immediately after the general and specific warm-up. The spike-player's position is in the centre for area 3:

1. The ball is set: from the left (the player being right-handed) and it will be directed towards an area in the second line of the court, but the subject must specify in advance where he or she wishes to set the ball, while for the right side the same procedure is to be followed.

2. Ten spike-players from the central area in the imposed position 5 with rightward pass.

3. Ten spike-players in the imposed position 1 with rightward pass.

Areas 1 and 5 are areas of defence of the opponent's court, arranged diagonally to the attacker. Area 5 is in front-right for the attacker, while area 1 is in front-left.

The tests have been conducted as follows: on trainings during the tournaments.

For the parameters recorded during the tests conducted while training and playing the official games, it has been calculated that the significance of the difference is between averages. For this purpose, the test "t", meant to compare the arithmetical averages has been used. Pearson correlation coefficient for calculating the correlations among the parameters from training and those from the game has also been used. Throughout this study the data are presented as averages and standard deviations.

6. Findings

The results are included in tables and statistically processed.

The players' preferences for the attack areas in the second line, according to the side from where the ball is set in order to be hit, in training and official game circumstances.

Table 01. Preferences for the areas in the second line according to the side from where the ball is set

Attack hit	Preference for			Attack zones
	Zone 1 (%)	Zone 5 (%)	Zone 6 (%)	Out of total feats (%)
Leftward pass	47.50±20.05	36.66±25.70	15.83±21.51	93.33±9.84
Rightward pass	28.33±15.27	60.00±24.49	11.66±16.42	97.50±4.52

(a) = the significant difference regarding the preference for attack area 1 when the step comes from left and right ($p < 0.05$).

(b) = the significant difference regarding the preference for attack area 5 when the step comes from left and right ($p < 0.05$).

(c) = the significant difference between the preference for attack area 1 and the preference for attack area 6 when the step comes from the right ($p < 0.05$).

(d) = the significant difference between the preference for the attack area 5 and the attack area 6 when the step comes from the right ($p < 0.05$).

Table 02. Feats and faults in performing the spike-player in the areas imposed in the training conditions

Imposed attack area	Feats from 10 imposed (%)	Fault towards Left (%)	Fault towards right (%)
Area 1	83.30±12.30	4.16±6.68	12.50±7.53
Area 5	90.00±10.44	5.83±9.00	4.16±6.68

The players' feats in performing the leftward passing and rightward passing spike-player during training, while in games from both sides.

Table 03. Experimental team's preferences for the areas in the second line during games

Team	Zone 1 (%)	Zone 5 (%)	Zone 6 (%)	Total feats (%)
	23.87±14.59	26.42±9.07	49.65±10.01	90.55±7.34
	20.84±6.65	37.97±7.72	41.17±3.78	87.15±2.46

Table 04. Preferences and feats for the attack areas in the second line: leftward pass and rightward pass during training and from both directions during the game.

Step's direction	Zone 1 (%)	Zone 5 (%)	Zone 6 (%)	Out of total feats (%)
Leftward pass	47.50±20.05	36.66±25.70	15.82±21.05	97.50±4.52
Rightward pass	28.33±15.27	60.00±24.49	11.66±16.42	93.33±9.84
From both sides	25.71±3.61	30.92±5.71	43.27±6.56	82.95±6.49

(a) = the statistically significant difference regarding the preference for the attack area 1 between training and game ($p < 0.05$);

(b) = the statistically significant difference regarding the preference for the attack area 5 between training and game ($p < 0.05$);

(c) = the statistically significant difference regarding the preference for the attack area 6 between training and game ($p < 0.05$);

(d) = the statistically significant difference regarding the percentage of spikes' kills during training and game ($p < 0.05$);

(e) = the statistically significant difference regarding the preference for the attack area 1 and the preference for the service area 6 during the game ($p < 0.05$);

(f) = the statistically significant difference regarding the preference for the attack area 5 and the preference for the attack area 6 during the game ($p < 0.05$).

7. Conclusion

a) The preference for the attack areas 1, 5, 6, during training has been investigated in two situations, as indicated by the side from where the ball is set in order to be hit: from left and from the right (table 01). Thus, when the ball is set from the left, the preference for the attack area 1 is significantly greater than the preference for the attack area 5 at $p < 0.005$, while when the ball is set from the right, the preference for the attack area 6 is significantly lower than the one for the areas 1 and 5 at $p < 0.005$ and $p < 0.0005$ respectively. The fact that during the tests the players performed spikes in the centre of the first line (in area 3) which gives them the possibility to choose from the three areas.

The fact that area 6 is least preferred can be explained, given that due to the block the attacker is used to round area 6, as well as due to the reality that this area is best defended, provided the attack system is specific to most volleyball teams in Romania.

Comparing results for the attack areas in the two situations, leftward and rightward passing, it has resulted in a preference significantly greater for area 1 at $p < 0.05$ and significantly lower for the attack area 5 at $p < 0.005$, when the spike-player is leftward rather than rightward. Consequently, we noticed that the attack area of the opponent's court, corresponding to the side from where the pass is received, is significantly preferred. Thus, if the spike-player is conducted from the centre, from the normal pass, area 5 is preferred when the ball is set from the left, while when the ball is set from the right, area 5 is more preferred. Then again, we have not discovered an explanation for this situation in these particular literature. In our opinion, the explanation could be of a biomechanical nature: the players do not soar vertically to the net, which enables movements to be made in the scapular-humeral joint, but only the movements on the direction alike to the one followed by the whole body and of low supination, namely in area 6 and mostly in area 1.

When the ball is set from the right side, players have their left arm parallel to the net, the right arm is loose and can easily perform movements of pronation and supination alike, namely it can attack in all three areas at ease.

b) During an official game, the preference for the attack areas 1 and 5 is significantly lower than the preference for the attack area 6 at $p < 0.05$ (table 03).

Comparing the players' results from the two situations during training (leftward and rightward pass) and during the game, we have noticed the following:

- when the ball is set from the left in training circumstances, the preference for area 1 is significantly greater than during the game at $p < 0.05$;
- when the ball is set from the left and from the right, the preference for the attack area 6 during training is significantly lower than the during the game at $p < 0.05$;
- when the ball is set from the right, the preference for area 5 is significantly greater during training than during the game, at $p < 0.05$.

Despite the fact that among the preferences for the attack areas in training circumstances and the ones during the game there exists a discordance, it has also been found that between the preferences for the attack areas when the ball is set from the left during training and in an official game circumstance, there is a significant positive correlation at $p < 0.005$, as well as between the preference for the attack areas when the ball is set from the right during training and the preferences during the game at $p < 0.05$. Thus, between the preferences for attack areas during training and during the official game there is a direct connection, namely, these preferences evolve in the same manner.

Preferences for the attack areas in the second line depend on the side from where the ball is set in order to be hit.

Preferences for the attack areas in the second line depend on the side from where the ball is set, namely from the left or the right, in order to be hit, when the players attack in the centre (area 3) from normal pass, more exactly it is most preferred in the area corresponding to the direction from where the ball comes from, namely from left-area 1, or from right-area 5.

The performnatonal laterality of the tested players during the performance of a spike depends on the side from where the ball is set in order to be hit, to be specific when the spike is in the centre, with normal leftward pass, the greatest feats are achieved in the case of area 1, while when the spike is performed with a pass from the right, in area 5 there shall the greatest feats be achieved.

Between the preferences for the attack area in the second line during training and during games, there exists a discordance, however, the preferences in a game circumstance are opposite to the ones in a training circumstance, which means that between the preferences during training and games there are significant positive correlations, as a result there is a direct linkage.

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