

Analyzing the attack players in volleyball through statistical methods

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Abstract

Background. Volleyball has developed into one of the fastest, strongest and spectacular sports nowadays, improving the speed of the game, strength of attacks and long rallies with a good defence technique. Statistics are often used for an objective analysis of volleyball parameters, coaches seeking to improve weaker aspects of the game and find new ways of training.

Aims. The aim of the study was to calculate the effectiveness of all the attack players distributed in three positions, in the case of the CSU Medicina Tîrgu Mureş team, during the 2016-2017 National Volleyball Championship.

Methods. Following our objective, we determined the quintiles and divided the value range of effectiveness: round 1-22 into five parts, with 5 grades from 1 to 5. The analysis of the relationship between the two variables and the intensity of this relationship was calculated with the Spearman rho correlation coefficient.

Results. For service in the first part of the championship, we registered the average score of 2.8 points, whereas in the second part the score was 3.2 points. As far as attack was concerned, in the first part of the championship the average score was 3 points compared with 2.4 points in the second part. The 3.5 points average in receiving was better in the first part of the championship than the 3 points in the second part.

Conclusions. The data provided by us are important, but not exclusively as a support for training; the athletes' level of training and the way they interact with the court remain a determining factor in winning games.

Key words: volleyball, sports performance, training, athletes, attack.

Introduction

Starting from the premise that “the evolution of contemporary society generates quantitative growth and unprecedented qualitative development in all fields, including performance sports, direct training for competition requires the setting of objectives that will maximise the capacity to mobilise the biological, motor and psychological potential of the athlete” (Teodorescu, 2009a) through exploitation of the current level of knowledge in the field. This explains why “the level attained today by the development of sports practice, like any activity with interdisciplinary characteristics, is permanently subject to alert dynamics, leaving behind the techniques and means used in training because they no longer correspond today to the demands of high performance in sport.” (Simion et al., 2011).

All the knowledge that ensures the best results in large-scale competitions, based on a logical organisation of the

training process and its corresponding structure, in the form of stages, periods, different cycles, can be brought together in the general theory of training periodization (Platonov, 2015), according to which the periodization of performance and high-performance sports training requires a division of the modern training process into elements with separate structures, which differ qualitatively and quantitatively under the existing principles and laws.

Sports performance as a way of valuing and asserting the human personality through the exceptional situations that it creates demands and emphasizes the high level of perfection attained by athletes (Teodorescu, 2009b), while competition develops the latent resources, highlighting the skills, spontaneity, creativity, and aesthetics. Performance in collective sports is mirrored by a series of inter-relational components, in the middle of a complex universe where there is a variety of phenomena expressed through general and specific systemic relationships that act synergistically to achieve sporting performances.

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In general, volleyball players have a body height which is higher than average, a slim shape, endurance, power, and the skill of jumping (Malousaris et al., 2008; Carvajal et al., 2012). It has been determined that being successful in volleyball is directly related to power (vertical jump), which is one of the basic motor functions, to speed, flexibility and a low body fat percentage (Imek et al., 2007; Ivanovic, 2009; Koç & Aslan, 2010; Con et al., 2012).

In a volleyball match, the attack may occur either from receiving the service or from a counterattack. These two components have been differentiated to gain access to new and more detailed information (total number of attacks = number of attacks from receiving + number of counterattacks). The game of volleyball, relatively simple, once, by training players and multilateral actions, speed of the game, has gained widespread popularity and is being increasingly accepted by the audience (Cojocar & Cojocar, 2018).

Some authors (Zetou et al., 2007) argued that attacks present an increased efficiency in situations of starting from service.

Attack is the component which is the most used and efficient in the game to gain points; it is also the most common element of the match. Therefore, if it is possible to increase the effectiveness of a point by counterattack or attack after receiving the service, then the probability of winning also increases.

If a team is effective in attacking from receiving the service, then it can keep a balanced score to continue playing. By adding an effective counterattack, this team will most certainly ensure the conditions to win the match, as it can score points after an attack in a counterattack situation.

There are, however, two non-complete elements distinguished as failure-related differentiation variables: receiving from service error and error from setting the ball. In volleyball, points can only derive from finalization skills (for example, service, attack, blocking), but all previous abilities influence the final decision and therefore the result of the match. The role of information technology in our lives must not be neglected; electronic devices are very useful in nowadays sports performance, as many scientific papers prove it (Szabo et al., 2019a).

Material and methods

Period and place of the research

The research was conducted at the “George Emil Palade” University of Medicine, Pharmacy, Science, and Technology of Târgu Mureș, during the first and second part of the 2016-2017 National Volleyball Championship, and it was performed under the Declaration of Helsinki (2013). It also met the ethical standards for Sport and Exercise Science Research (Harriss & Atkinson, 2013).

Subjects and groups

The subjects of our investigation were all the attack players distributed in three positions; 6 players were analyzed in the case of the CSU Medicina Târgu Mureș team, during the 2016-2017 National Volleyball Championship.

Test applied

The analysis of the relationship between the two variables and the intensity of this relationship was

calculated with the Spearman rho r correlation coefficient. This is a number between -1 and 1, as r approaches 1 in absolute value; the greater the linear relationship intensity between 2 variables, the stronger the link. If the coefficient is a minus, there is a negative correlation, so a variable increases and the other decreases, and if the coefficient is a plus, the correlation is positive, so both variables grow. The following are empirical rules for interpreting the correlation coefficient:

- r ranging from -0.25 to 0.25: poor or null correlation;
- r ranging from 0.25 to 0.50 or between -0.25 and -0.50: acceptable correlation;
- r ranging from 0.50 to 0.75 or between -0.50 and -0.75: moderate to good correlation;
- r higher than 0.75 or lower than -0.75: very good correlation.

This link was graphically represented with the scatter diagram of dispersion, which by the orientation and dispersion of the cloud point provides an image of the relationship between the two variables.

To make these correlations, we used the following encoding: a score of 3-0 was coded with 3 (3 minus 0), a score of 3-1 was coded with 2 (3 minus 1), a score of 3-2 was coded with 1 (3 minus 2). We considered a clear victory 3-0 to be coded with a high number and a close victory 3-2 with a smaller number. These correlations were made for the matches won. A correlation was established between the efficiency of a particular position/technical parameter and the result.

However, a poor and statistically insignificant correlation has to be pointed out: the two players in this position did not have a spectacular contribution to winning.

Based on the effectiveness of all the players distributed in the three positions, over the 22 rounds of the championship, we could calculate the quintiles (by dividing the value range of effectiveness: round 1-22 into five parts), 5 grades from 1 to 5. The table below summarises the efficiency of the three positions. For each player, we calculated a median of efficiency over the 22 rounds (Table I and II).

Interpretation: if a player at the service parameter has a median of 55 (for player IV), then he fits between the 60th percentile and the 80th percentile, so he has grade 4. We can also calculate the player's mark by rounds, rank the effectiveness of the player in the round pursued according to the percentiles in the table, and so the corresponding score can be highlighted. Based on this table, the score for each player can be seen below.

Statistical processing

For statistical analysis, Click & Scout software for volleyball was used, based on the match report file in all the championship games, over 22 rounds (1); (Szabo, 2016; Szabo & Sopa, 2015; Szabo et al., 2019a).

In the first stage, all the data files from Click&Scout software were extracted and the effectiveness of the attack players for the technical components attack, receiving and service was computed.

Keeping in mind that one aim of this study was to highlight the difference between efficiency in the first round and the second round of the tournament (Table I and II), we applied the statistical Z test. Great differences between the first and the second rounds were considered as statistical significance expressed by the p-value.

Results

Comparative analysis of attack player performances

Opposite - Player IV and *TS* - After service and attack parameter

Regarding the evolution of player IV, at service and in attack during the 22 rounds, it can be concluded that:

- at service, the player had a high efficiency curve in rounds 6, 7 and 16, and a reduced efficiency in round 20;
- in attack, efficiency was high in rounds 1, 8, 15, and 21, and low in round 20.

Player TS had the following results:

- high efficiency at service in rounds 11, 15, and 18, and reduced efficiency in round 13, 14, and 20;
- in attack, efficiency was high in rounds 1, 8, 15, and 21, whereas low values were recorded for rounds 2, 14, and 22.

Middle blockers - Players *LU* and *IA* - after service and attack:

Player LU

At service, the player had a high efficiency in rounds 1, 4 and 13, and a low efficiency in rounds 3, 6, 7, and 15. In attack, the effectiveness of the executions was high in rounds 1, 3, 5, and 19, while low values were recorded in rounds 13, 15, and 17.

Player IA

At service, this player had a high efficiency in rounds 4, 17, and 21, and a low efficiency in rounds 6, 20, and 22. In attack, the player scored high in rounds 4, 15, 19, and 21, and low in rounds 10, 14, and 18.

Outside hitters - Players *TR* and *RA* - After service, receiving, and attack:

Player TR

At service, player TR achieved a high efficiency in rounds 11, 15, and 22, and a low efficiency in rounds 7 and 14. Effective receiving was recorded in rounds 3, 6, 12, and 17, and reduced efficiency was registered in rounds 15 and 18.

In attack, effectiveness was high in rounds 1 and 5, while it had low values in rounds 4, 14, and 18.

Player RA

At service, the player had a high efficiency in rounds 3, 6 and, 14, and a reduced efficiency in rounds 5 and 20.

During receiving, high efficiency indices were recorded in rounds 1, 8, and 20, and low values were found in rounds 9 and 12.

Regarding the attack, efficiency was high in rounds 1 and 3, and it was low in rounds 14 and 16.

Table I
Example of ranking grades identified for efficiency in the first part – the second part

Parameters	E service	E receiving	E attack	Score-grade
Number of values	177	122	169	
Minimum	11.00	13.00	3.00	
20% percentile	33.00	50.00	19.00	1
40% percentile	40.20	57.00	29.00	2
60% percentile	47.00	65.00	38.00	3
80% percentile	55.40	75.00	59.00	4
Maximum	100.0	100.0	100.0	5
Mean	45.41	62.53	39.02	
Std. deviation	17.12	18.55	24.56	
Median	44.00	62.00	33.00	

Table I presents the efficiency score interval for each technical item. For example, if a player had an efficiency of 59 at service, his mark is 5 because it ranges between 55.40 and 100.

Discussions

In recent years, as shown during the European Championships and the World Championships, there has been an increase in the topspin jumping service in both male and female volleyball games (Agelionidis, 2004). The increase is due to the use of this type of service which aims to improve performance by power and speed. Increasing the number of players performing this kind of service in competitions has determined the need to increase the volume of training for its accurate reception. Due to the physical requirements needed to carry out the topspin jump service, the use of service machines during training has become standard practice as they enable specific training for this type of receiving with no physical overload of players (Palao & Valadés, 2014). Most of the volleyball studies focus on the skills that determine the serve, the block, and the attack, and how these skills are the most

Table II

Ranking grades identified based on efficiency in the first and the second parts

Play.	Position	Service				Receiving				Attack			
		FP	Grade	SP	Grade	FP	Grade	SP	Grade	FP	Grade	SP	Grade
BA	Outside hitter	40	2	50	4								
TR	Outside hitter	33	2	45	3	70	4	59	3	20	2	21	2
RA	Outside hitter	47	4	44	3	61	3	57	3	21	2	19	2
IA	Middle block	47	4	42	3					38	4	32	3
LU	Middle block	41	3	39	2					44	4	33	3
PE	Middle block	40	2	52	4					67	5	26	2
TS	Opposite	50	4	46	3					23	2	25	2
IV	Opposite	38	2	53	4					23	2	34	3
Average of the grades		42	2.8	46.3	3.2	65.5	3.5	58	3	33.7	3	27.1	2.4

important ones for the team in winning the match (Marques, 2015; Oliveira, 2016). Some scientific papers discovered a statistical influence of sports on preventing deficiencies (Szabo et al., 2019b).

According to a recent study from 2014, the characteristics of service in males are: service from foot (7.1% of all services) performed at a speed of 42.0-55.0 km/h, the float jump service (40.7% of all services) performed at a speed of 40.0-75.0 km/h, and the topspin jump service (52.2% of all services) conducted at a speed of 73.0-104.0 km/h. The service features in the female game are: service from foot (45.9% of all services) performed at a speed of 43.0-61.0 km/h, the float jump service (37.5% of all services) at a speed of 40.0-61.0 km/h, and the topspin jump service (16.6% of all services) carried out at a speed of 66.0-89.0 km/h (Palao & Valadés, 2014). For women's volleyball, the effectiveness of service is higher due to: a lower net height; a lower capacity of the parameters of force and slower movement parameters on the court (***, 2012).

Receiving, service and defense in volleyball literature are considered to be very important in winning a game (Sánchez et al., 2015). Volleyball research has determined the relationship between reception, set, and attack (Costa et al., 2017; Rocha & Barbanti, 2004). Good reception causes a good set and the attack can be more successful (Marques, 2018). Other volleyball skills of importance during the match have been determined in volleyball literature; a good block is important for successful defense (Mesquita et al., 2013).

On court, technical skills are highly sought after although they require a continuous reassessment of the playing situation, as each game is influenced by the previous games and in turn influences the future games (Durkovic et al., 2008).

Volleyball match analysis has focused on the importance of team success and failure (Drikos et al., 2009). Some studies have concentrated on the receiving area associated with its variables, attack, and gaining the point from receiving the service (Amasay, 2008). These studies have shown that fixation of the receiving area determines the quality of the action both regarding the correlation between the efficacy of the receiving and the attack area, and the relationship between the moment and the effect of the attack and the number of players blocking the ball. However, these studies do not refer to the variables of the setter position.

Conclusions

1. The analysis of the tactical behavior of the players of the CSU Medicina Tîrgu Mure volleyball team highlighted the following aspects: service

2. The scores calculated based on the efficiency of the execution achieved by the players during service show that an average score of 2.8 points was registered in the first part of the championship and 3.2 points in the second part, which allows us to state that service was the only technical element with better results in the second part of the championship.

3. An analysis of the attack in the 22 rounds of the championship reveals the lack of efficiency of technical and tactical attack actions: in the first part of the championship

the average score was 3 points compared with 2.4 points in the second part, as this technical element correlates with winning.

4. Receiving was the best performed technical element in this championship, as evidenced by the scores gained (the 3.5 points average was better in the first part of the championship than the 3 points in the second part), the libero and the outside hitter players performing their full duties.

Conflicts of interest

There are no conflicts of interest.

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