STUDY ON THE RELATIONSHIP BETWEEN THE EFFICIENCY OF THE ACTIONS IN THE GAME AND THE RESULT OF THE MATCH

A.M. COJOCARU[1]   M. COJOCARU[1]

Abstract: *The paper wants to highlight the connection between the efficiency of the game actions, i.e. the level of the players' technique and the final result of the game. The main purpose of this research was to emphasize and present the importance of efficiency in game actions, which have the role of determining the outcome of the match. The study was conducted on all participants in the National Volleyball Championship of Romania, male 2021/2022. Analysis of the game variables (serve, serve reception, set, and spike and attack reception) and game outcome were performed through the 1992 FIVB recording system, which confirmed the study's hypothesis that increased player efficiency leads to winning games.*

Key words: *Volleyball, efficiency, performance, game result.*

1. Introduction

The use of informatics in sports activities creates the possibility of building models, as a result of superior mathematical processing, that satisfy the need to optimize a certain field and implicitly in sports. In these situations, simulations of human behavior and even sports games, such as volleyball, can be used, with the intention of analyzing sports performance more objectively [10]. This leads to a growing need to achieve a fair, unbiased assessment of performance in training, especially in preparation for participation in competitions [4].

The efficiency and economic indicators, with which the playing activity of the athletes is objectified, are gaining more and more interest; they constitute the benchmarks towards which all the efforts of the coaches and players are combined [13].

Knowing the performance of each player and his contribution compared to the others, to the achievement of the game, is of major importance, both for the technician and for the athlete. Analyzing the games of the teams aspiring to a final tournament, in terms of the quantitative and qualitative values, which the team as a whole and the players separately,

---

[1] Faculty of Physical Education and Sport, Spiru Haret *University* of Bucharest

achieve during the evolution of a game, it is highlighted that, between the quantitative values (weight) and the qualitative values (efficiency), there is a determination ratio, in which the value level of the opposing opposition has a decisive importance [7]. The higher the values level of efficiency, the lower the quantitative values, expressing a very good index of economy. From this point of view, some have tried to track and analyze the performance indicators of a team, by comparing the results of winning and losing teams [5].

In the game of volleyball, one of the most widespread in the world, on the 2nd place after football, the results of the teams are analyzed by the games won, and this depends on the efficiency of the technical-tactical actions in the game. These technical-tactical actions specific to the game of volleyball are the service, the reception of the service, the lifting, the attack, the blocking and the defense, which must be automated in relation to the game, so that they are effective [15].

Thus they began to be studied through the prism of the game relations between the service and the reception of the service [1], between attack and blocking [6] or the quality of the lifter and the efficiency of the service [16].

Efficiency leads to the achievement of performance through game actions and is measured in relation to the effect of actions on points played and is a predictive factor on the winner of a game.

Coaches need this game analysis, actually a game statistic, which extracts objective data on player performance during matches.

2. Material and methods

The study sample consisted of 168 male players between the ages of 17 and 41. The participants belonged to the 12 volleyball teams from the National Senior Volleyball Championship, from Romania. The study took place in the 2021/2022 season.

2.1 Research hypotheses

The hypothesis of the research consisted in the fact that: The level of efficiency of the game actions of the players from the winning teams will be higher compared to that of the players from the defeated teams.

2.2. Measures

The measurement was made taking into account the relationship between the variables of the study, also involved in volleyball performance.

Thus, the dependent variable was the result of the match, and the independent variable counted from several variables of the game, namely the efficiency of the game actions, the efficiency of the service, of taking over the attack, lifting, blocking and attacking.

To evaluate the efficiency, the FIVB statistics system was used. Thus, the awarding of qualifications was done using the evaluation scale developed by F.I.V.B. and presented in the "Manual for F.I.V.B. Statistical Match Record in 1992.

It distinguishes several levels of performance in different game actions. So, it is accepted as a valid tool for the research community and has been previously applied in numerous studies.

The result of each action is assessed using a 5-point scale based on the effect on the score or subsequent control of the ball by the team playing the ball, or by the opponent. Thus, in order: degree, evaluation and awarding criterion, we have:

AS   − 4 - point won;
EXCELLENT − 3 - limited control gained, maintained;
GOOD   − 2 - limited control gained, maintained;
WEAK   − 1 - lost control, no control;
ERROR   − 0 - lost point;

"Ace" (rated 4) is used only for the actions: serve, attack and block.
"Full control" (rated 3) is used when all possibilities are created for the subsequent construction of the game phase.
"Limited control" (rated 2) is used when further attack preparation cannot be accomplished using all options.
"No control" (rated 1) is used in the situation where the construction of the attack is not possible, but the ball still remains in play.
"Error" (rated 0) is used when punctuality is lost

The formula used to calculate the lifting and defense efficiency was as follows [12]:

$$E=\{[3 \times (A) + 2 \times (B) + 1 \times (C) - 1 \times (D)] \times 100\}/3 \times N$$

where:
- E = efficiency
- A = number of evaluated executions 3
- B = number of evaluated executions 2

- C = number of executions evaluated 1
- D = number of executions evaluated 0
- N = total number of executions

The formula used to calculate attack, blocking and service efficiency was as follows:

$$E=\{[4 \times (A) + 3 \times (B) + 2 \times (C) + 1 \times (D) - 1 \times (F)] \times 100\}/4 \times N$$

where:
- E = efficiency
- A = number of evaluated executions 4
- B = number of evaluated executions 3
- C = number of evaluated executions 2
- D = number of executions evaluated 1
- F = number of executions evaluated 0
- N = total number of executions.

The matches were recorded by each team, through the team statistician, using a digital camera, located at the end of the field, at a height of 2.5 m and which were centralized by the Central College of Coaches and analyzed, by the same person, in order to there were no errors in the interpretation of the records.

Game actions previously named as finding variables were recorded after each game of the 2021/2022 National Senior Championship.

Statistical analysis
Descriptive analysis and a T-test for independent samples were performed to verify differences between winners and losers in the studied variables, shown in table 1.

3. Result

Descriptive and inferential analysis of games   Table 1

	N	Average	DT	F(1,68)	Np^2	p
Serve efficiency	Winners	2.19	.78	3.74	.569	.58
	Losers	1.63	.60			
Dig efficiency	Winners	2.75	.78	16.85	.857	<.001
	Losers	1.45	.65			
Setting efficiency	Winners	2.78	.91	38.95	1.00	<.001
	Losers	1.98	.59			
Attack efficiency	Winners	2.78	.98	10.68	0.78	.06
	Losers	1.87	.68			
Block efficiency	Winners	2.45	.72	9.56	0,64	.04
	Losers	1.98	.58			

The results of the games   Table 2

Faza I		CS "U"	CS Arca	CS Dina	CS Olim	CS Rapi	CS Stii	CS Unir	CSA Ste	CSS CNE	CSU Sti	CSU UV	SCMU Cr
								Guest Team					
CS "U" Cluj (CS "U")			0-3	0-3	1-3	1-3	2-3	0-3	0-3	0-3	1-3	3-2	0-3
CS Arcada Galati (CS Arca)		3-0		3-0	3-0	3-0	3-0	3-0	2-3	3-0	3-0	3-0	3-1
CS Dinamo Bucuresti (CS Dina)		3-0	1-3		3-1	3-0	3-0	3-0	3-0	3-0	3-0	3-0	2-3
CS Olimpia Titanii (CS Olim)		3-0	0-3	1-3		3-0	3-1	3-0	0-3	3-0	3-0	3-0	1-3
CS Rapid Bucuresti (CS Rapi)		3-0	0-3	0-3	0-3		1-3	1-3	0-3	1-3	2-3	3-0	0-3
CS Stiinta Explorari Baia Mare (CS Stii)		3-0	0-3	2-3	2-3	3-0		3-1	3-2	2-3	3-1	3-0	1-3
CS Unirea Dej (CS Unir)		2-3	0-3	0-3	1-3	3-0	3-2		0-3	2-3	3-2	3-0	1-3
CSA Steaua Bucuresti (CSA Ste)		3-0	2-3	3-0	3-2	3-1	3-0	3-0		3-0	3-0	3-0	3-2
CSS CNE LAPI Dej SCM Zalau (CSS CNE)		3-1	1-3	1-3	3-0	3-0	3-0	3-0	0-3		3-0	3-0	1-3
CSU Stiinta Bucuresti (CSU Sti)		3-0	0-3	2-3	0-3	2-3	3-2	3-0	0-3	3-1		3-0	0-3
CSU UV Timisoara (CSU UV)		1-3	0-3	0-3	0-3	0-3	0-3	1-3	0-3	0-3	2-3		0-3
SCMU Craiova (SCMU Cr)		3-0	2-3	0-3	3-0	3-0	3-0	3-0	2-3	3-1	3-0	3-0	

The game of volleyball consists of the two structures, which are extremely important, in order to succeed in bringing points, both in the first structure SIDE OUT, and in the second one, BREAK POINT.

The same thing emerges from the application of the T-test, where by comparing the independent samples, the significant difference can be observed between the teams' efficiencies, in service, attack, blocking, defense (taking over from attack) and lifting.

4. Discussions and Conclusions

The serve is the second action that contributes to bringing points to the team [2], it tends to be the main attack action, it expresses a tactical orientation

subordinating the biomechanics of the execution, which does not aim at simply putting the ball back into play, but straight to the point. Regularly, limiting the distance to 8 m from the bottom line and eliminating the possibility of blocking or attacking it, led to the appearance of brilliant executions with the net, performed both from the bottom line (without the jump) and from medium distance 4-5 m. So the serve, just like the attack and blocking, can be decisive in the performance of a team, it represents not only the achievement of points, but has a tactical significance, having an influence later, in the development of the game, which tends to get points. It has been observed that executing a good serve, in force or with a tactical orientation, can affect the performance of the reception, which is related to the attacking options of the opposing team. This influence of the serve on the attacking options causes an increase in blocking performance, which increases the efficiency of the defense.

The specialization of the takeover players increases the concern for increasing the difficulty of the service, aiming both at increasing the force of execution or planning the flight of the ball, as well as its distribution precisely defined tactically (alternating vulnerable areas on the field, weak players, etc.). The players primarily use a single procedure, each team having at least 2 players who perform it from the jump, with great constancy and effectiveness. The flight time of the ball, from the execution to the takeover, has generally decreased, due to both the faster trajectory and the higher impact force. For gliding service, the flight lasts between 110-180 hundredths of a second, while for the jump service, the duration is reduced to 60-90 hundredths of a second. Biomechanically, the execution of the jump is not typified, it remains more diversified, according to the particularities of jumping and hitting of each player. It is similar to the 2nd line jab attack, with an advanced landing from the jump spot, with the hit covered and slightly tangent.

Due to the importance of the serve in the development of the game, many research studies have aimed to determine the typical characteristics of the serve and how it affects the opposing team, both at a high level and in formative stages.

An increase in blocks with the touch of the ball represents the maturity level of the players, who advance towards great performance and who begin to count in bringing victory to a team [11]. An increase in deadlocks in times 1 and 2 shows the level of play, which is proving faster and faster in the construction phase. In terms of blocking and defense performance, there was a significant performance improvement when blocking was able to be more organized, resulting in slower attacks. This highlights the ability of the defenders to move and perform correct actions specific to the defense.

The defense becomes more and more aggressive and better organized, gaining an increased weight in the balance of the game. Defensive actions represent approximately 43% of the actions of the game, and within them, those specific to the second line with approximately 14%, tend to balance the specific weight of the block - 16%.

As for the defense action, it must be extremely well organized, starting from the anticipation of the attack, which influences the final action. Thus there are studies [3], which show that depending on the quality of the attack; the quality of the blocking also depends, which influences the quality of the defense or reception. A well-organized defense that manages to build a point attack increases the quality of the team, and leads it more towards victory [9].

It can be said that the attack is extremely important, but it is the defense that consolidates the success of a victory.

The lifter is considered the leader of the attack phase [8], and his involvement is decisive in the collective game. His main job is to pick up for attack. In addition, he acts a lot and with increased efficiency in defense and in securing actions. According to Papadimitriou et al. (2004), the setter is the "key player" in a volleyball team, because every time, in the home court, the second shot of the ball belongs to him, with the aim of directing the ball, intelligently towards the attackers, regardless of the area from which it operates.

He is fast, prompt in his reactions, with a developed sense and a high capacity for cooperation and coordination, but he also has the ability to correct less successful takeovers, transforming them into effective team attacks. The virtuoso mastery of the execution (kinesthetic sense, differentiation of muscular effort), the technical component of the actions according to the specialization, high indices of mobility of thought and creativity, anticipation of situations and self-control in critical moments, give him a

leading position in supporting the fighting spirit of the team.

In volleyball, the action that shows the best correlation with victory is the attack shot, [8]. For the attacking player we can outline a model with extended attributes, to which, along with the addition of height values and efficiency in attack and blocking, he is requested to make a special contribution in defense. It can be seen that the training methodology for very tall players is quite well outlined in many volleyball schools, as long as players over 2m, with a high level of mastery and skill, manage to casually attack in different quick phases, against the background of travel and multiple request, to take defense with precision and acrobatics from attack and service, disproving the ingrained belief that very tall people lack coordination and skill. Even if we are talking about the shooter model, there are many own opinions, some giving priority to athletic stature and motor qualities, others to the technical-tactical level or team cooperation, it is obvious that the future belongs to very good shooters in the "collective game", with high effectiveness, both of the shares in line I, as well as those in line II. The players will have to make as few mistakes as possible. The shooter model is mainly associated with safety of execution, under conditions of high mental and functional motor demands, anticipation of the situation and operative thinking, concentration and distributiveness of attention, coordination of movements and speed of the moving object.

The attack, as a finishing action of the team, is the one that has a strong correlation with winning a game,

becoming a relevant indicator of success in the game of volleyball.

References

1. Ejem, M.: *Brief technical evaluation of the 27th Olympiad in Sydney.* The Coach, 2001; 1, p.6-12.

2. Fernandes, S., Moutinho, C.A. : *Importancia relativa da eficiência dos proc de jogo na prestação competitiva de uma equipa de voleibol de rendimento.* In: Moutinho C, Pinto D. (Eds.). *Estudos CEJD 1.* Porto: FCDEF-UP. 1996, p. 72-77.

3. Hughes, M., Daniel, R.: *Playing patterns of elite and non-elite volleyball.* In: International Journal of Performance Analysis in Sport*,* 2003; 3(1), p.50-56.

4. Hughes, M., Bartlett, B.: *What is performance analysis?* In: Hughes M, Franks I. (Eds). The essentials of performance analysis: an introduction. London, Routledge, 2008, p. 8-20.

5. Jones, N.M., Mellalieu, S.D., James, N.: *Team performance indicators in rugby union as a function of winner and loser.* International Journal of Performance Analysis in Sport*,* 2004; 4, p.61–71.

6. Lobietti, R.: *A review of blocking in volleyball: from the notational analysis to biomechanics.* Journal of Human Sport and Exercise, 2009; 4(2), p.93-99.

7. Losada, J. L., Manolov, R.: *The process of basic training, applied training, maintaining the performance of an observer.* Quality & Quantity, 49(1), p. 339-347, 2015. doi 10.1007/s11135-014-9989-7

8. Marcelino, R., Mesquita, I., Afonso, J.: *The weight of terminal actions in Volleyball. Contributions of the spike, serve and block for the teams rankings in the World League 2005.* In: International Journal of Performance Analysis in Sport, 2005; 88(2), p.1-7.

9. Miskin, M., Fellingham, G., Florence L.: *Skill Importance in Women's Volleyball.* In: Journal of Quantitative Analysis in Sports. 2010; 6(2), p. 1-14.

10. Nelson, L., Groom, R.: *The analysis of athletic performance: Some practical and philosophical considerations.* In: Sport Educ Soc., 2012; 17(5), p. 687-701.

11. Oliveira, R.: *Caracterização da eficácia do ataque, bloco e serviço no voleibol de elevado rendimento competitivo.* IV Seminário de Iniciação à Investigação Cientifica. FCDEF-UP. 2005.

12. Palao, J., Manzanares, P., Ortega, E.: *Techniques used and efficacy of volleyball skills in relation to gender.* In: International Journal of Performance Analysis in Sport*,* 2009; 9(2), p. 281-293.

13. Palao, J. M., Hernández-Hernández, E.: *Game statistical system and criteria used by Spanish volleyball coaches.* In: International Journal of Performance Analysis in Sport, 14(2), 2014, p. 564-573.

14. Papadimitriou, K., Pashali, E., Sermaki, I., et al.: *The effect of the opponents serve on the offensive actions of Greek setters in Volleyball games.* International Journal of Performance Analysis in Sport, 2004; 4(1):23-33.

15. Silva, M., Marcelino, R., Lacerda, D., et al.: *Match Analysis in Volleyball: A systematic review*. In: Montenegrin J. Sports Sci. Med. 2016, 5, p. 35–46.

16. Zetou, E., Moustakidis, A., Tsigilis, N., Komninakidou, A.: *Does Effectiveness of Skill in Complex I Predict Win in Men's Olympic Volleyball Games?* In: Journal of Quantitative Analysis in Sports, 2007; 3(4), p.1-11.