How context influences the tactical-technical behavior of learners: the case of volleyball

Como o contexto influencia o comportamento técnico e tático de aprendizes: o caso do voleibol

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Abstract – This study compared the tactical-technical behavior between two distinct situations of reduced volleyball games. The sample consisted of 12 games played by doubles, 6 of which were played in 3.0m x 3.0m (SIT1) and 6 of 2.0m x 4.5m (SIT2) courts. Thus, the behavior of 12 participants, with mean age of 16.7 ± 1.5 years and 3.2 ± 1.2 years of practice, was compared. The results showed that at reception, better results were obtained in adjustment and decision making in SIT2, whereas in SIT1, efficiency was higher; in setting, it was observed that SIT2 presented better results in technical performance, adjustment and efficiency, whereas in SIT1, efficiency was higher; in SIT2, attack, better results were observed in adjustment and decision-making. It was concluded that environmental restrictions influence the behaviors of learners, showing that different ecological contexts provide actions inherent to the specific game environment.

Key words: Efficiency; Learning; Volleyball.

Resumo – *O estudo comparou o comportamento tático-técnico entre duas situações distintas de jogos reduzidos no voleibol. A amostra constituiu-se de 12 jogos disputados por duplas, sendo 6 praticados em quadras de 3,0m x 3,0m (SIT1) e 6 de 2,0m x 4,5m (SIT2). Assim, comparou-se o comportamento de 12 participantes, com idade média de 16,7 ±1,5 anos e com 3,2 ±1,2 anos de prática. Os resultados mostraram que na recepção houve melhores resultados no ajustamento e na tomada de decisão na SIT2, enquanto que na SIT1 a eficácia foi mais elevada; no levantamento observou-se que a SIT2 apresentou melhores resultados no desempenho técnico, ajustamento e eficiência, enquanto que na SIT1 a eficácia foi mais elevada; no ataque, na SIT2, observou-se melhores resultados no ajustamento e na tomada de decisão. Conclui-se que as restrições ambientais influenciam nos comportamentos dos aprendizes, evidenciando que contextos ecológicos diferentes oportunizam ações inerentes ao ambiente específico de jogo.*

Palavras-chave: *Aprendizagem; Eficiência; Voleibol.*

INTRODUCTION

Studies on small-sided games (SSGs) in various sports have shown that reducing the number of players is a common strategy in invasion games and aim to reduce the attention demands of players[1], to increase the amount of tactical-technical actions performed by players [2], consequently allowing players to gain more tactical experience in situational contexts[3,4]. Moreover, research in this area shows that there are differences in tactical-technical behavior according to invasion sports such as soccer[5-7], basketball[8], handball[9], hockey[10] among others, as they are organized by their respective specificities.

In this context, it was observed that in soccer, reduced games provide offensive sequences with greater ball circulation, according to athletes' experience[3], and the manipulation of the court size and number of players changes the technical-tactical demand according to the objectives of training sessions[4,5]. Thus, the manipulation of task constraints such as number of players and court size changes the likelihood of the occurrence of emerging tactical behaviors, as well as exploration in different regions of the court searching for the solution for tasks[6]. In addition, it was observed that in basketball, adaptations of rules are necessary to achieve different tactical goals[8]; while in hockey, the reduction in the number of players allows increasing the performance of sport-related skills, suggesting that the court size allows the improvement of technical skills and timely decision-making regarding environmental restrictions[10].

However, it is not clear how tactical behaviors, specifically how task constraints change[11], and studies on this topic about volleyball are scarce in literature. Thus, the aim of the present study was to compare the tactical-technical behavior on the side-out (reception, setting and attacking), due to its high efficacy[12,13], between two distinct situations of reduced volleyball games.

METHOD

Sample

The sample consisted of 12 games, totaling 227 receptions, 191 settings and 216 attacks, from which the tactical-technical behavior of 12 participants with average age of 16.7 ± 1.5 years and 3.2 ± 1.2 years of practice and participants of the Goiás Youth Male Volleyball Team was compared. This research followed recommendations of the Research Ethics Committee and was approved according to protocol number 1.986.220 of the Federal University of Goiás.

Design

Athletes were divided into pairs, and the highest ranked athlete paired with the worst ranked athlete and so on. Ranking was performed by three experienced volleyball coaches and the participants' technical and tactical levels were considered. For this study, the definition proposed by Erickson et al.[14] was adopted.

Each pair played two games on the first day of intervention with minimum interval of 10 minutes and the second day of intervention occurred after a 48h interval in which each pair played two more games with the same interval and respecting the same sequence of games, totaling twelve games. Games took place on 9 m2 courts with different configurations. On the first day, situation 1 (SIT1) occurred on court with dimensions of 3.0m x 3.0m (Figure 1-a), while the second day, situation 2 (SIT2) occurred on court with dimensions of 2.0m x 4.5m (Figure 1-b).
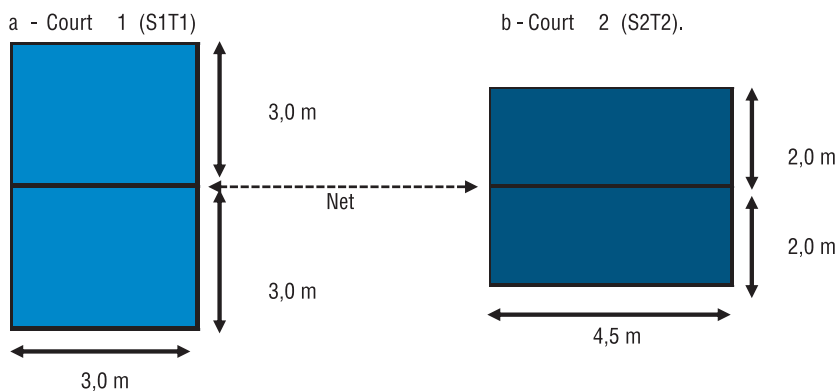

Figure 1. Dimensions of playing courts

Tactical-technical behavior assessment

In order to evaluate participants' tactical and technical behavior, the instrument validated by Collet et al.[15] was used, and reception, set and attack fundamentals were analyzed, according to performance components related to efficiency, effectiveness, decision making and adjustment. Thus, in the reception evaluation, indicators were determined taking into account the objective of recovering the ball for attack construction. In the setting evaluation, it was sought to contemplate the main action elements, considering the ideal conditions to perform the set movement and the attack evaluation, which are elements that determine the success in returning the ball to the opponent court. According to Porath et al.[16], the performance analysis observation criteria are based on the following: efficiency - characterized by the execution of technical skill; effectiveness - result obtained in the execution of skills; adjustment - stages of preparation for action and decision making - decision possibilities in each action.

Data Collection Procedure

Games were filmed by four cameras arranged at ground level, one on each side of the court and at a distance of 3 meters from the boundary lines of the court. Sony cameras with 1080p HD definition and frequency rate of 60 Hz were used. Collection was performed by four researchers who collected images for further analysis and afterwards, 2 of them were responsible for replacing the ball each time the point occurred, 1 for refereeing the game and 1 for timing the match time.

Statistical Procedures

For descriptive analysis of data, data were used in frequencies, percentages, means and standard deviations. Game situations were compared by the Student's t-test to assess athletes' performance, and the chi-square (x2) and power of the *phi* effect (φ) were used to analyze categorical variables, and the significance value in both cases was p <0.05. To calculate reliability, 30% of actions were reanalyzed, exceeding the reference value of 10%[17] and intra-observer values were between 0.90 and 0.98 and inter-observer values between 0.88 and 0.98. Data were analyzed in the Statistical Package Social Science software (SPSS).

RESULTS

Results were presented according to fundamentals reception, setting and attack. On reception, the t-test for independent samples showed difference in item 1 [t (178.38) = -6.704; p <0.05] and item 2 [t (225) = -3.951; p <0.05] of the adjustment in relation to the game situation (table 1). Thus, in the 4.5m x 2.0m situation, athletes moved to occupy the position in the space where the ball was more likely to fall (item 1) and placed themselves in a position of expectation and adjusted their position according to the proximity of side lines (item 2) more often than in the 3.0m x 3.0m situation. The t-test for independent samples showed no difference in reception efficiency in relation to the game situation.

Table 1. Analysis of reception in relation to the game situation

		Aspects analyzed	Situation	Mean ± SD	P
Reception	Adjustment	Player moves to occupy position where the ball is more likely to fall (item 1)	3.0m x 3.0m	0.14 ± 0.35	0.001*
			4.5m x 2.0m	0.53 ± 0.50	
		Player is in expectation position and adjust his position according to the proximity of the sidelines (left foot forward when closer to the line on his left or right foot forward when closer to the line on his right) (item 2).	3.0m x 3.0m	0.34 ± 0.48	0.001*
			4.5m x 2.0m	0.60 ± 0.48	
		After receiving, player moves to perform the next action (attack or cover) (item 3)	3.0m x 3.0m	0.65 ± 0.48	0.256
			4.5m x 2.0m	0.72 ± 0.45	
	Efficiency	Lower limbs are semi-flexed and flat on the floor at the moment of contact (item 1).	3.0m x 3.0m	0.82 ± 0.38	0.617
			4.5m x 2.0m	0.85 ± 0.36	
		Player positions the body behind the ball and contacts the ball in the middle of supports (item 2).	3.0m x 3.0m	0.94 ± 0.23	0.387
			4.5m x 2.0m	0.91 ± 0.28	
		Contacts the ball on the forearm platform with the upper limbs in extension (forearm pass) or contacts the ball above and in front of the forehead (touch) level (item 3).	3.0m x 3.0m	0.98 ± 0.15	0.793
			4.5m x 2.0m	0.98 ± 0.14	

Note * Difference found for p <0.05.

The inferential analysis of data through the chi-square test showed that there was association (x2 = 14.57; p <0.001; φ = 0.25) between decision making at reception and game situation (table 1). It was observed that there was positive association of decision making item 2 (keep the ball in play

in the team itself, but without direction) with game played in the 3.0m x 3.0m court and item 3 (anticipates and directs the ball into the setting zone) with game played on the 4.5m x 2.0m court. On the other hand, there was negative association between item 2 and game played on the 4.5m x 2.0m court and item 3 with game played on the 3.0m x 3.0m court. The inferential analysis of data by means of the chi-square test showed that there was association ($x2 = 5.83$; $p < 0.05$; $\phi = 0.16$) between reception effectiveness and game situation (table 2). It was found that there was positive association of item 2 (continuity) with game played on the 4.5m x 2.0m court and item 3 (excellent reception or point when sending the ball to the opposing court) with game played on the 3.0m x 3.0m court. However, there was negative association between item 2 with 3.0m x 3.0m court game and item 3 with the 4.5m x 2.0m court game.

Table 2. Decision making and reception effectiveness according to game situation

			Situation		Total
			3.0m x 3.0m	4.5m x 2.0m	
Decision Making in Reception	Send the ball directly to the opposing court.	Occurred	3	3	6
		Expected	3.3	2.7	6.0
		% DM in reception	50.0%	50.0%	100.0%
		% Situation	2.4%	2.9%	2.6%
		Adjusted residue	-.2	.2	
	Keep the ball in play on the team itself but without direction (ball up)	Occurred	85	46	131
		Expected	71.0	60.0	131.0
		% DM in reception	64.9%	35.1%	100.0%
		% Situation	69.1%	44.2%	57.7%
		Adjusted residue	3.8*	-3.8*	
	Anticipate and direct the ball to the setting zone.	Occurred	35	55	90
		Expected	48.8	41.2	90.0
		% DM in reception	38.9%	61.1%	100.0%
		% Situation	28.5%	52.9%	39.6%
		Adjusted residue	-3.7*	3.7*	
Total		Occurred	123	104	227
		% DM in reception	54.2%	45.8%	100.0%
Reception effectiveness	Error.	Occurred	3	4	7
		Expected	3.8	3.2	7,0
		% Reception effectiveness	42.9%	57.1%	100.0%
		% Situation	2.4%	3.8%	3.1%
		Adjusted residue	-.6	.6	
	Continuity.	Occurred	79	80	159
		Expected	86.2	72.8	159.0
		% Reception effectiveness	49.7%	50.3%	100.0%
		% Situation	64.2%	76.9%	70.0%
		Adjusted residue	-2.1*	2.1*	
	Excellent Reception or point when sending the ball to the opposing court.	Occurred	41	20	61
		Expected	33.1	27.9	61.0
		% Reception effectiveness	67.2%	32.8%	100.0%
		% Situation	33.3%	19.2%	26.9%
		Adjusted residue	2.4*	-2.4*	
		Occurred	123	104	227
		% Reception effectiveness	54.2%	45.8%	100.0%

Note * Difference found for $p < 0.05$.

In setting, the t-test for independent samples showed that there was difference in item 1 [t (144.88) = -6.96; p <0.05] of the adjustment in relation to game situation (table 3). Thus, in the 4.5m x 2.0m situation, athletes moved quickly to the setting position (item 1) more often than in the 3.0m x 3.0m situation. By analyzing the setting efficiency, the t-test for independent samples showed that there was difference in item 2 [t (144.88) = -4.75; p <0.05] in relation to the game situation (table 3). Thus, in the 4.5m x 2.0m situation, athletes coordinated flexion and extension of the upper and lower limbs (item 2) more often than in the 3.0m x 3.0m situation.

Table 3. Comparison of adjustment and setting efficiency in relation to game situation

		Aspects analyzed	Situation	Mean ± SD	p
Setting Efficiency	Adjustment Adjusts body position according to the ball trajectory (item 2).	Quickly moves to the setting position (item 1).	3.0m x 3.0m	0.11 ± 0.31	0.001*
			4.5m x 2.0m	0.55 ± 0.52	
			3.0m x 3.0m	0.99 ± 0.10	0.341
			4.5m x 2.0m	1.00 ± 0.00	
	Stabilizes body position according to the attack completion zone (setting at the frontal plane) (item 3).		3.0m x 3.0m	0.78 ± 0.42	0.708
			4.5m x 2.0m	0.80 ± 0.40	
	Contacts the ball on the forearm platform with the extended upper limbs (forearm pass) or contacts the ball above and in front of the forehead (touch) level (item 1).		3.0m x 3.0m	0.97 ± 0.17	0.147
			4.5m x 2.0m	0.92 ± 0.27	
	Coordinates flexion and extension of the upper and lower limbs (item 2).		3.0m x 3.0m	0.22 ± 0.42	0.001*
			4.5m x 2.0m	0.54 ± 0.50	
	At the moment of contact, moves the body position to the attack completion zone (item 3).		3.0m x 3.0m	0.83 ± 0.40	0.927
			4.5m x 2.0m	0.84 ± 0.37	

Note * Difference found for p <0.05.

Inferential analysis of data by the chi-square test showed that there was no association ($x2$ = 0.22; p> 0.05; ϕ = 0.03) between decision making in setting and game situation. However, there was association ($x2$ = 9.38; p <0.009; ϕ = 0.22) between setting effectiveness and game situation. It was observed that there was positive association between continuity with game played on the 4.5m x 2.0m court (3.0) and attack without block or single block with game played on the 3.0m x 3.0m court (2.3). On the other hand, there was negative association of continuity with game played on the 3.0m x 3.0m court (-3.0) and attack without block or single block with game played on the 4.5m x 2.0m court (-2.3).

The attack analysis by the t-test for independent samples showed that there was difference in item 1 [t (214) = -5.86; p <0.05] of the adjustment in relation to game situation. Thus, in the 4.5m x 2.0m situation, athletes waited for the setting to start the approach movement (item 1) more often than in the 3.0m x 3.0m situation. However, the t-test for independent samples showed no difference in attack efficiency in relation to game situation.

Inferential analysis of data through the chi-square test showed that there was association ($x2$ = 36.08; p <0.001; ϕ = 0.41) between attack deci-

sion making and game situation (Table 4). It was observed that there was positive association of item 1 (keeps the ball in play, but without direction) with game played on the 3.0m x 3.0m court and item 2 (directs the ball for a particular player) with game played on the 4.5m x 2.0m court. On the other hand, there was negative association between item 1 and game played on the 4.5m x 2.0m court and item 2 with game played on the 3.0m x 3.0m court. However, the inferential analysis of data through the chi-square test showed no association (x2 = 3.90; p> 0.05; ϕ = 0.13) between attack effectiveness and game situation.

Table 4. Decision making in attack according to the game situation

| | | | Situation | | Total |
			3.0m x 3.0m	4.5m x 2.0m	
Decision making in attack	Keeps the ball in play. but without direction.	Occurred	96	56	152
		Expected	80.2	71.8	152.0
		% DM in attack	63.2%	36.8%	100.0%
		% Situation	84.2%	54.9%	70.4%
		Adjusted Residue	4.7*	-4.7*	
	Directs the ball to a particular player (collective tactic).	Occurred	0	26	26
		Expected	13.7	12.3	26.0
		% DM in attack	0.0%	100.0%	100.0%
		% Situation	0.0%	25.5%	12.0%
		Adjusted Residue	-5.7*	5.7*	
	Deflects the ball from the block by attacking in the free space of the opposing court or exploit the block.	Occurred	18	20	38
		Expected	20.1	17.9	38.0
		% DM in attack	47.4%	52.6%	100.0%
		% Situation	15.8%	19.6%	17.6%
		Adjusted Residue	-.7	.7	
Total		Occurred	114	102	216
		% DM in attack	52.8%	47.2%	100.0%

Note * Difference found for p <0.05.

DISCUSSION

The aim of the present study was to compare the tactical-technical behavior on the side-out between two distinct situations of reduced volleyball games. Reception results showed that in SIT2, there were better results in technical performance, specifically adjustment and decision making, while in SIT1, effectiveness was higher. There was no difference in efficiency as a function of the situation in which the game was played. Although no studies were found on this subject, it was observed that the court size interferes with the service performance, and the court size interferes with the service power and consequently the service-reception relationship[18]. In this context, it is clear that the technical gesture is conditioned by the momentary tactics and the game unpredictability[19], and, based on the

ecological theory, cognition emerges from the organism-environment relationship, which are related to environmental restrictions[20,21], that is, changes in tactical-technical behavior are dependent on environmental changes. In this context, it could be inferred that when the court presented shorter length, technical and decision-making aspects presented higher rates, while when court is longer, efficiency was higher. In this context, it is possible to infer that shorter court allows better technical performance at reception; however, due to the distance from the actual playing situation, it reduces the action effectiveness.

Regarding setting, it was observed that in SIT2, there were better results in technical performance, adjustment and efficiency, while in SIT1, effectiveness was higher. There was no difference in decision making as a function the situation in which the game was played. These results corroborate literature, since volleyball actions influence subsequent game procedures[12,13], thus justifying the higher efficacy in SIT1. In addition, differences in court dimensions that influence the player's tactical-technical behavior[10], may justify the technical performance results. On the other hand, knowing that the adjustment and efficiency criteria are related to the player's posture before ball contact, as well as to the motor performance[16,19], it may be suggested that in SIT2, higher demand of these technical aspects became necessary, since reception in this situation was less effective compared to SIT1.

The attack analysis showed that in SIT2, there were better results in technical performance, specifically in adjustment and decision making. There was no difference in efficiency and effectiveness as a function of the situation in which the game was played. These results corroborate literature, since volleyball actions are dependent on previous actions[12,13] and that sports performance is associated with adequate effectiveness in tactical-technical actions[19].

From the results found, it was observed that environmental restrictions, as well as the interrelationship among game procedures, have led to different tactical-technical behaviors. In this context, the pedagogical strategy of using reduced games for sports teaching [3,7,8] should be rethought according to the situational constraints inherent to the type of game [5,11], and court dimensions interfere with tactical-technical learning [10].

CONCLUSION

Taken together, the results contributed to a better understanding of changes in the tactical-technical behavior of volleyball players in relation to two different court sizes with the same square footage (9m2). In this context, the results suggest that court sizing should be considered in the elaboration of the teaching and learning processes in volleyball, and different ecological contexts provide opportunities inherent to the specific game environment. Further studies should be carried out to consolidate knowledge about how pedagogical principles influence the behavior of volleyball players.

COMPLIANCE WITH ETHICAL STANDARDS

Funding

Ethical approval

Ethical approval was obtained from the local Human Research Ethics Committee – Universidade Federal de Goiás and the protocol (no. 2.394.440) was written in accordance with the standards set by the Declaration of Helsinki.

Conflict of interest statement

The authors have no conflict of interests to declare.

Author Contributions

Conceived and designed the experiments: Freire AB, Mitre GP, Castro HO, Costa GCT. Performed the experiments: Rocha ACR, Silva Junior AB, Martins LR, Maia MP. Analyzed the data: Costa GCT. Contributed reagents/materials/analysis tools: Rocha ACR, Silva Junior AB, Martins LR, Maia MP. Wrote the paper: Rocha ACR, Freire AB, Mitre GP, Castro HO, Costa GCT.

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