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ORIGINAL

COMPARATIVE ANALYSIS OF THE SERVE IN VOLLEYBALL BETWEEN THE SPANISH CHAMPIONSHIPS 2005-2010

ANÁLISIS COMPARATIVO DEL SAQUE EN VOLEIBOL ENTRE LOS CAMPEONATOS DE ESPAÑA 2005-2010

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ABSTRACT

The aim of this research was to analyze the changes in the characteristics of the serve between the male Under-16 Spanish Championships that took place in 2005 and 2010. Through systematic observation 1594 actions were analyzed. The measured variables were: serve zone, effectiveness, serve type, reception zone, in-game role of the receptor, serve direction and timing. The results showed that in recent years, the serve performed by players at training stages has undergone significant changes, such as improved efficiency, increased use of jump serve, and execution of the serve with a more tactical role. Despite of the closest approach of the serve to the existing high level profiles, it is recommended to train the serve in volleyball training stages according to the characteristics and level of players, avoiding mimicry of what happens at a high level.

KEY WORDS: serve, volleyball, formative stages.

RESUMEN

El objetivo fue analizar los cambios que ha experimentado el saque desde el Campeonato de España cadete masculino de 2005 al de 2010. Mediante la observación sistemática se analizaron 1594 acciones, en las cuales se midieron las siguientes variables: zona de origen, eficacia, tipo de saque, zona de recepción, función del receptor, dirección y temporalidad. Los resultados reflejaron que en los últimos años, el saque realizado por jugadores de categoría de formación ha sufrido modificaciones relevantes, tales como, mejora de la eficacia, incremento del empleo del saque en salto, y realización del saque con un carácter más táctico. Pese a la mayor aproximación del saque a los perfiles existentes en alto nivel, se recomienda que el saque de voleibol en categorías de formación se entrene en función de las características y nivel de los jugadores, evitando el mimetismo de lo que acontece en alto nivel.

PALABRAS CLAVES: saque, voleibol, etapas de formación.

INTRODUCTION

The serve is defined “*as the action of the ball being put into play by the right back row player, situated in the serve area*” (FIVB, 2013, p. 21). Despite the fact that the aim of the serve is undoubtedly to put the ball into play, today the volleyball serve can be understood in two ways. On the one hand, the serve that is based on achieving a direct point or an ace (Ureña, Santos, Martínez, Calvo & Oña, 2000; Quiroga et al., 2010), and on the other hand, the one that is based on providing this technical-tactical action with greater control, trying to send the ball to certain areas of the opponent’s side of the court, thus making it difficult for the opposing team to construct an attack (Ejem, 2001; Ureña et al., 2001; Afonso, Mesquita & Palao, 2005; Moreno, Moreno, Julián & Del Villar, 2005; Costa, Mesquita, Greco, Ferreira & Moraes, 2011). In agreement with this idea, the serve has changed from being an action used to start the game, to being an action with an offensive purpose (Coleman, 2009).

Due to the possibility of achieving a point by way of the serve, this is considered, like the attacks and blocks, a finalistic action that may determine the performance of a team in volleyball (Asterios, Kostantinos, Athanasios & Dimitrios, 2009; Drikos, Kountouris, Laios & Laios, 2009; Dávila, García-Hermoso & Saavedra, 2012). Among all the finalistic actions, the serve is the second action that correlates the most with achieving a point (Fernandes & Moutinho, 1996), the first of these being the attack (Palao, Santos & Ureña, 2004a; Marcelino, Mesquita, Castro & Sampaio, 2008), and the third the block (Oliveira, Mesquita & Oliveira, 2005).

When analysing the game in volleyball, it is essential to consider the interaction dynamics between the events of the game (Hale, 2001). Therefore, it is necessary to bear in mind the cooperation relations among players of the same team and the opposition relations with the opposite team (Lames and McGarry, 2007). In this sense, and during the development of a piece of play in volleyball, the technical-tactical serve action has a significant influence on subsequent actions (Asterios et al., 2009). Thus, executing a good serve reduces the use of first tempo attacks and increases second tempo attacks (Palao, Santos & Ureña, 2004b; Papadimitriu, Pashali, Sermaki, Mellas & Papas, 2004). All of this leads to an improvement in block performance, due mainly to a significant increase of triple blocks (Palao et al., 2004b).

Different changes have taken place in the regulation throughout the history of volleyball, which have affected the serve, and its offensive capacity, to varying degrees. In 1994, noteworthy was the increase of the serve area from 3 to 9 metres. This made it more difficult for the receiving team, as it caused variations in the direction traced by the ball, from the different service zone possibilities to the destination (Gerbrands & Murphy, 1995). Another important change took place in 1999, when the possibility of the ball being able to touch the net was established. This favoured continuity in the game and led to players taking greater risks when executing the serve. Both changes in regulation provide advantages to the serve, and therefore to the game complex II (defence complex).

Numerous research studies have been developed to determine how the execution of the serve influences the reception and setting of the opposite team and the block of the serving team (Palao et al., 2004a; Costa et al., 2011; Ureña, Vavassori, León & González, 2011; Afonso, Esteves, Araújo, Thomas & Mesquita, 2012). On the other hand, research studies developed at high level and in formative stage categories have focused on analysing which variables (service zone, serve type, reception zone, served direction, receiver player and serve speed) are significantly associated both with serve effectiveness (Moras et al., 2008; Palao, Manzanares & Ortega, 2009; Gil, Del Villar, Moreno, García-González & Moreno, 2011; López-Martínez & Palao, 2011; Marcelino, Mesquita & Sampaio, 2011) and with reception effectiveness (Katsikadelli, 1995; Callejón & Hernández, 2009; Costa et al., 2011). This type of study provides valid information that can guide the sport training practice, as well as the approach that research studies should take (Mesquita, Palao, Marcelino & Afonso, 2013).

However, research studies that suggest that situational variables, such as the quality of the opposition and state of the match, may determine the performance of a team in competition, are more and more frequent (Marcelino et al., 2011; Marcelino, Sampaio & Mesquita, 2012). On the other hand, there are few studies that have focused on analysing the evolution of the serve in volleyball, considering two different moments in time. Along this line, we can highlight the research studies carried out by Katsikadelli (1996, 1998), which verified how the use of the jump serve increased between the 1994 World Championship and the European Championship of 1995. Thus, and given the lack of research studies performed in formative stage categories, as far as the analysis of the game is concerned, the main objective of the study was to analyse the evolution of the serve between the 2005 Spanish Championship and the 2010 Spanish Championship.

MATERIAL AND METHODS

Sample

A total of 1594 serve actions were analysed. 886 belonged to 9 teams participating in the 2005 Male Cadet Spanish Championship of Regional Teams, and 708 belonged to another 9 teams participating in the same Championship held in 2010. The teams that formed part of the research study were ranked in different positions in the final classification. One match played by each participating team was analysed.

Variables

The variables considered in the study were the following: service zone, serve effectiveness, serve type, reception zone, receiver player, serve direction and temporality. The degree of openness of each one of the variables is indicated below.

- *Service zone*: defined as the place from where the serve is made. Three zones were considered as extensions of the back row zones 1, 6 and 5 (Moraes, Mesquita & Costa, 2008):
 - Zone 1: The serve is executed in the 3 metre wide strip, from the right sideline and behind the baseline.
 - Zone 6: The serve is executed in the 3 metre wide strip, located 3 metres from the sidelines and behind the baseline.
 - Zone 5: The serve is executed in the 3 metre wide strip, from the left sideline and behind the baseline.
- *Serve effectiveness*: Defined as the performance or effect obtained with the serve. To evaluate the effectiveness, the FIVB (International

Volleyball Federation) statistical system, adapted from Coleman (1975) was used. The following values were differentiated:

- 0: Serve error.
 - 1: Serve that permits the construction of some type of attack.
 - 2: Serve that limits the attack construction options, not permitting the execution of rapid attacks.
 - 3: Serve that makes it impossible to construct the attack and entails sending a free-ball.
 - 4: Direct point or ace.
- *Serve type*: Defined as the type of serve use by the player, considering the location of the athlete at the moment of contact with the ball. Two possibilities were established in agreement with the differentiation made by Costa et al. (2012):
 - Standing: serve where the player is in contact with the floor.
 - Jump: serve where the player's feet are not in contact with the floor.
 - *Reception zone*: Defined as the area where the serve is received. Three reception lanes and seams were differentiated, which were also considered by Gil, Del Villar et al. (2011):
 - Lane 1: The reception is made in the 3 metre wide by 9 metre long lane located on the right-hand side of the court.
 - Lane 6: The reception is made in the 3 metre wide by 9 metre long lane located in the middle of the court.
 - Lane 5: The reception is made in the 3 metre wide by 9 metre long lane located on the left-hand side of the court.
 - Seam: The ball is sent to an intermediate and conflict area between two receivers.
 - *Receiver player*: Defined as the role or in game role of the player who the serve is aimed at for reception. Three in game roles were differentiated, coinciding with those established by Ureña, Calvo & Lozano (2002):

- Zone 4 attacker: The serve is aimed at and received by the zone 4 attacker.
 - Líbero player: The serve is aimed at and received by the líbero player.
 - Others: The serve is aimed at and received by a player with in game roles other than those mentioned above.
- *Serve direction*: Defined as the direction determined by the serve depending on the service zone and the reception zone. The following serve directions were differentiated, which were also considered by Afonso et al. (2012):
 - Parallel: The service zone and the reception zone are in line. This direction corresponds to serves from 1 to 5, from 6 to 6 and from 5 to 1.
 - Mid crosscourt: The service zone of the serve is in an area close to the reception zone. This direction corresponds to serves from 1 to 6, from 6 to 5, from 6 to 1, and from 5 to 6.
 - Long crosscourt: The service zone of the serve is in an area further away from the reception zone. This direction corresponds to serves from 1 to 1 and from 5 to 5.
 - *Temporality*: Defined as the year when the Spanish Male Cadet (Under-16) Championship of Regional Teams took place. Two possibilities were differentiated:
 - Spanish Championship held in 2005.
 - Spanish Championship held in 2010.

Measures and instruments

All the variables were measured via indirect and external systematic observation (Anguera, 1996; Medina & Delgado, 1999). The matches were recorded using a SONY HDR-XR155 digital camera on M2TS format. This camera was placed at one of the ends of the court, at a height of 5 m above floor level. This meant that it was possible to optimally record all the serves made by both teams.

Reliability of observation

To guarantee the reliability of the observation, an observer with experience in this role and knowledgeable about volleyball carried out a training process where a sample of over 10% the total sample was used (Tabachnick & Fidell, 2007). The intra-observer Cohen's Kappa values reached in the observation of all the variables was over .81, a value as from which, almost perfect concordance is considered (Landis and Koch, 1977). To guarantee the temporal reliability of the measurement, the same coding was developed on two occasions, with a time difference of 10 days, obtaining Cohen's Kappa values of over .81.

Statistical Analysis

The IBM SPSS Statistics 19.0 statistics program was used to analyse the data. The descriptive statistics were obtained based on the percentage of occurrence of the categories belonging to each one of the variables. The inferential analysis was carried out based on the contingency tables, the Chi Square values and Cramer's V, to discover the possible existing associations between the different variables considered in the study and the temporality. The conditions of validity were guaranteed to be able to apply the Chi Square Test (minimum frequency expected is greater than one and no more than 20% of the boxes of the table have expected frequencies of less than five). To analyse the corrected residuals, a value of >2 was taken to establish an excitatory relationship and <-2 to establish an inhibitory relationship. The statistical significance level considered was $p<.05$.

RESULTS

— *Service zone-Temporality*

In agreement with the frequency distribution, in both championships, zone 1 was the zone from which the majority of the serves were executed (51.6% of the serves in 2005 and 50.8% in 2010), followed by zone 6 (33.5% of the serves in 2005 and 27.3% in 2010) and zone 5 (14.9% of the serves in 2005 and 21.9% in 2010). The inferential analysis told us that there was a significant association between service zone and temporality ($\chi^2= 15.753$; Cramer's V =.099; $p<.001$). The cells that positively contributed to this association were: serve from zone 5 with 2010 Championship and serve from zone 6 with 2005 Championship.

Table 1. Inferential analysis Service zone-Temporality

		Temporality		Total	
		2005	2010		
Service zone	Zone 1	Count	457	360	817
		Expected frequency	454,1	362,9	817.0
		% Temporality	51,6%	50,8%	51.3%
		Adjusted residuals	0,3	-0,3	
	Zone 5	Count	132	155	287
		Expected frequency	159,5	127,5	287.0
		% Temporality	14,9%	21,9%	18.0%
		Adjusted residuals	-3,6	3,6	
	Zone 6	Count	297	193	490
		Expected frequency	272,4	217,6	490.0
		% Temporality	33,5%	27,3%	30.7%
		Adjusted residuals	2,7	-2,7	
Total	Count	886	708	1594	
	Expected frequency	886.0	708,0	1594,0	
	% Temporality	100%	100%	100%	

0 boxes (0%) have an expected frequency of less than 5. The minimum expected frequency is 127.48.

— *Effectiveness-temporality*

The descriptive statistics indicated that in the 2005 Championship, serves with effectiveness 1 (serve that permits the construction of some type of attack) were the most common serves, with a percentage of 35.7%. In the 2010 Championship, serves with effectiveness 2 (serves that permit the attack construction options, not permitting the execution of rapid attacks) were the most frequent serves, with a percentage of 37.3%. With respect to average effectiveness, in the 2005 Championship, average effectiveness of 1.64 was obtained whilst in the 2010 Championship, average effectiveness of 1.83 was obtained. The inferential analysis revealed that there is a significant association between both variables ($\chi^2= 18.033$; Cramer's $V = .106$; $p=.001$). The cells that positively contributed to this association were: effectiveness 1 with 2005 Championship and effectiveness 2 with 2010 Championship.

Table 2. Inferential analysis effectiveness-temporality

		Temporality		Total	
		2005	2010		
Effectiveness	Effectiveness 0	Count	123	82	205
		Expected frequency	113,9	91,1	205,0
		% Temporality	13,9%	11,6%	12,9%
		Adjusted residuals	1,4	-1,4	
	Effectiveness 1	Count	316	196	512
		Expected frequency	284,6	227,4	512,0
		% Temporality	35,7%	27,7%	32,1%
		Adjusted residuals	3,4	-3,4	
	Effectiveness 2	Count	268	264	532
		Expected frequency	295,7	236,3	532,0
		% Temporality	30,2%	37,3%	33,4%
		Adjusted residuals	-3,0	3,0	
Effectiveness 3	Count	109	93	202	
	Expected frequency	112,3	89,7	202,0	
	% Temporality	12,3%	13,1%	12,7%	
	Adjusted residuals	-0,5	0,5		
Effectiveness 4	Count	70	73	143	
	Expected frequency	79,5	63,5	143,0	
	% Temporality	7,9%	10,3%	9,0%	
	Adjusted residuals	-1,7	1,7		
Total	Count	886	708	1594	
	Expected frequency	886,0	708,0	1594,0	
	% Temporality	100%	100%	100%	

0 boxes (.0%) have an expected frequency of less than 5. The minimum expected frequency is 63.52.

— *Serve type-temporality*

With respect to the serve type variable, in the 2005 Championship, the percentage of standing serves (49.2%) was very similar to the percentage of jump serves (50.8%). On the contrary, at the 2010 Championship, the percentage of jump serves (56.6%) was higher than standing serves (43.4%). The inferential analysis indicated that there is a significant association between both variables ($\chi^2= 5.360$; Cramer' V =.059; $p=.021$). The cells that positively contributed to this association were: standing serve with 2005 Championship and jump serve with 2010 Championship.

Table 3. Inferential analysis serve type-temporality

		Temporality		Total	
		2005	2010		
Serve type	Standing	Count	419	307	726
		Expected frequency	396,3	329,7	726.0
		% Temporality	49,2%	43,4%	46.6%
		Adjusted residuals	2,3	-2,3	
	Jump	Count	432	401	833
		Expected frequency	454,7	378,3	833.0
		% Temporality	50,8%	56,6%	53.4%
Adjusted residuals		-2,3	2,3		
Total	Count	851	708	1559	
	Expected frequency	851.0	708,0	1559,0	

0 boxes (.0%) have an expected frequency of less than 5. The minimum expected frequency is 329.70.

— *Reception zone-temporality*

With respect to the reception zone, in both championships, lane 6 was the area of the court where the majority of the receptions were made (53.9% in 2005 and 49.5% in 2010), followed by reception in Lane 5 (24.0% in 2005 and 31.3% in 2010) and reception in Lane 1 (17.82% in 2005 and 15.8% in 2010). Receptions in the seams were a lot fewer in both championships (4.9% in 2005 and 3.4% in 2010). The inferential analysis indicated that there is a significant association between both variables ($\chi^2= 10.233$; Cramer's $V = .086$; $p=.017$). The cell that positively contributed to this association was reception in Lane 5 with 2010 Championship, with the same association occurring negatively with the 2005 Championship.

Table 4. Inferential analysis reception zone-temporality

		Temporality		Total	
		2005	2010		
Reception zone	Lane 1	Count	131	99	230
		Expected frequency	126.3	103.7	230.0
		% Temporality	17.2%	15.8%	16.6%
		Adjusted residuals	.7	-.7	
	Lane 5	Count	183	196	379
		Expected frequency	208.1	170.9	379.0
		% Temporality	24.0%	31.3%	27.3%
		Adjusted residuals	-3.0	3.0	
	Lane 6	Count	411	310	721
		Expected frequency	395.8	325.2	721.0
		% Temporality	53.9%	49.5%	51.9%
		Adjusted residuals	1.6	-1.6	
	Seam	Count	37	21	58
		Expected frequency	31.8	26.2	58.0
		% Temporality	4.9%	3.4%	4.2%
Adjusted residuals		1.4	-1.4		
Total	Count	762	626	1388	
	Expected frequency	762.0	626.0	1388.0	
	% Temporality	100%	100%	100%	

0 boxes (.0%) have an expected frequency of less than 5. The minimum expected frequency is 26.16.

— *Receiver player-temporality*

In the receiver player variable, the “*others*” category was the category that appeared in both Championships with a higher percentage (42.5% in 2005 and 42.4% in 2010), followed by the libero player (32.9% in 2005 and 29.3% in 2010) and the zone 4 attacker (24.7% in 2005 and 28.3% in 2010). The inferential analysis indicated that there is not a significant association between both variables ($\chi^2= 3.106$; Cramer’s $V = .048$; $p=.212$).

— *Serve direction-temporality*

With respect to the serve direction, the mid crosscourt serve was the most frequent both in the 2005 Championship (57.7% of the serve), and in the 2010 Championship (53% of the serves), followed by the parallel direction (28.4% in 2005 and 31.6% in 2010) and long crosscourt (13.9% in 2005 and 15.3% in 2010). The inferential results indicated that there is not a significant association between serve direction and temporality ($\chi^2= 2.908$; Cramer’s $V = .046$; $p=.234$).

DISCUSSION

The objective of the study was to analyse the evolution of the serve in formative stage categories between the 2005 Spanish Championship and the 2010 Spanish Championship.

As far as the service zone is concerned, in both championships the majority of the serves were made from zone 1. This result coincides with preceding studies carried out on formative stage categories (García-Tormo, Redondo, Valladares & Morante, 2006; Gil, Moreno, Moreno, García-González & Del Villar, 2010a) and at high level (Callejón, 2006; Moreno, García de Alcaraz, Moreno, Molina & Santos, 2007; Moraes et al., 2008; Quiroga et al., 2010). Further to this result, noteworthy is the significant association between the service zone and temporality variables, where the execution of serves from zone 5 with the 2010 Championship has a positive contribution. On the one hand, this tells us that over the last few years, serving players try to apply greater variability to this technical-tactical action by modifying their service position. On the other hand, players try to carry out the serve action with a certain tactical intention, carrying out the serve from a specific zone depending on a series of indicators of the opposite team, such as weaker receivers, reception level and rotation of the opposite team (Boucherin, 1975).

With respect to serve effectiveness, we can interpret that this has improved with time. In the 2005 championship, the serves that permitted the construction of some type of attack appeared more frequently than expected on the basis of chance (effectiveness 1), whilst in the 2010 Championship, the serves that did not permit the construction of rapid attacks appeared more frequently than expected on the basis of chance (effectiveness 2). This represents a significant decrease in success in complex I (organised attack after receipt of the serve), which favours the defensive work of the serving team (Ureña et al., 2000).

With reference to the serve type, we have also observed an evolution between both championships. In the 2010 championship, like the 2005 championship, the jump serve occurred more frequently than expected on the basis of chance. Along this same line, Agelonidis (2004) in his longitudinal study with top level players, found that the appearance of the jump serve significantly increased following the 1992 European Championship (20.8%) until the 2002 European Championship (99.2%). Likewise, Katsikadelli (1998) found an increase in the use of the jump serve between the 1994 World Championship and the 1995 European Championship. In our study, players in formative stage categories have shown a similar tendency to what occurred at a high level, with respect to the increase of the jump serve. This leads us to believe that players in formative stage categories are willing to assume a high risk level with the execution of the jump serve, as the team that is serving is at a clear disadvantage with respect to the team that is preparing to construct the attack. Therefore, the execution of the jump serve, despite the fact that it leads to a greater number of errors and of points with respect to the standing serve (López-Martínez & Palao, 2011), is an ideal tool that purports to frustrate the execution of programmed attacks by the opposite team (Moras *et al.*, 2008; Quiroga et al., 2010; Afonso et al., 2012).

With respect to the reception zone, in both championships the majority of serves were received in the centre of the court. This result coincides with previous studies performed in formative stage categories (Gil *et al.*, 2010a; Gil, Del Villar et al., 2011) and at high level (Lozano, Valadés, Hernández, Calvo & Ureña, 2001; Maia & Mesquita, 2006; Moreno et al., 2007; López-Martínez &

Palao, 2011). The fact that in formative stage categories, the serves were sent towards the centre of the court may be motivated by the action-point score system. This system is characterised because an error in the serve represents a point for the opposite team. Therefore, sending the ball towards the centre of the court provides the player with more security, as he/she is exposed to a lower risk of missing the serve, than if the serve were sent towards the sides of the court (Moreno *et al.*, 2007). Despite these descriptive results, the inferential analysis showed a significant association between the reception zone and temporality, reception in lane 5 being more frequent than expected on the basis of chance in the 2010 Championship. This tells us, together with the results obtained in the service zone variable, that the players in the 2010 Championship, apart from providing more variability to the serve, purported to make serves to zones further away from the setter, in order to reduce the possibilities of the opposite team successfully organising and constructing the attack (Papadimitriou *et al.*, 2004).

With respect to the receiver player, in both championships, the serves were sent to a greater extent to other players than the libero player or zone 4 attackers. These results are in agreement with those obtained in previous studies, which indicated that the players who received more often were the back row receivers, both in formative stages (Gil, Moreno, Moreno, García-González & Del Villar, 2011), and at high level (Ureña, Calvo & Gallardo, 2000; Callejón & Hernández, 2009). In scientific literature, there are research studies that have tried to establish which players are more effective in reception. The majority of these studies indicate that the libero player is among the players with the highest level of effectiveness (João, Mesquita & Sampaio, 2006). In this sense, predictive type studies at high level have concluded that if the serve is aimed at any other player than the libero player, the possibilities of a lower quality reception increase (Afonso *et al.*, 2012). In our case, the fact that the zone 4 attacker players received to a lesser extent than those players who are neither zone 4 attacker nor libero players, may be related to the fact that, with the incorporation of reception and defence specialist players, the reception responsibility of the more offensive players is reduced.

Regarding the serve direction, in both championships, the majority of the serves traced a mid crosscourt direction, the percentage of serves tracing a long crosscourt direction being reduced. These results coincide with those obtained in preceding research studies, both in formative stage categories (Bailasha, 2001; García-Tormo *et al.*, 2006; Gil *et al.*, 2010a) and at high level (Lozano, Calvo, Cervelló, & Ureña, 2003; Moreno *et al.*, 2007; Afonso *et al.*, 2012).

Finally, we must highlight that the results obtained must be taken with certain caution, as the degree of association between variables is relatively low. Consequently, more research studies must be proposed in formative stage categories, in order to continue going deeper into the knowledge of the different technical-tactical actions of volleyball.

CONCLUSIONS

Over the last few years, the volleyball serve in formative stage categories has undergone changes with respect to the usual tendency in these categories. Thus, the serve effectiveness has improved, which represents a significant decrease in the success in complex I, thus favouring the defensive work of the serving team.

Likewise, the use of the jump serve has increased. In this sense, the serve in formative stages is becoming similar to the profiles that exist at high level.

In connection with the above, the serve has become a more tactical action, as players have tried to aim the serves more towards areas further away from the setter.

Despite the above, the volleyball serve in formative stage categories should be considered and trained in agreement with the characteristics and level of the players, avoiding mimicry of what prevails at high level.

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