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Section III – Sports Training

DE GRUYTER OPEN

Analysis of Setting Efficacy in Young Male and Female Volleyball Players

by
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The main objective of this study was to analyse the variables that predicted setting efficacy in complex I (KI) in volleyball, in formative categories and depending on gender. The study sample was comprised of 5842 game actions carried out by the 16 male category and the 18 female category teams that participated in the Under-16 Spanish Championship. The dependent variable was setting efficacy. The independent variables were grouped into: serve variables (a serve zone, the type of serve, striking technique, an in-game role of the server and serve direction), reception variables (a reception zone, a receiver player and reception efficacy) and setting variables (a setter`s position, a setting zone, the type of a set, setting technique, a set´s area and tempo of a set). Multinomial logistic regression showed that the best predictive variables of setting efficacy, both in female and male categories, were reception efficacy, setting technique and tempo of a set. In the male category, the jump serve was the greatest predictor of setting efficacy, while in the female category, it was the set´s area. Therefore, in the male category, it was not only the preceding action that affected setting efficacy, but also the serve. On the contrary, in the female category, only variables of the action itself and of the previous action, reception, affected setting efficacy. The results obtained in the present study should be taken into account in the training process of both male and female volleyball players in formative stages.

Key words: *notational analysis, performance, gender.*

Introduction

Gender differences are very much present in the field of sport. In sports such as volleyball, some of the reasons why these differences occur are game structure, techniques and tactics used, strength and flexibility, as well as anthropometric and psychological characteristics (Palao et al., 2004). Furthermore, the efficacy of game actions also varies depending on gender (Palao et al., 2009).

Volleyball is organised into a sequential and cyclic structure (Beal, 1989; Buscà and Febrer, 2012) producing several game complexes, namely complex I (KI) and complex II (KII) (Beal, 1989; Palao et al., 2004). KI is known as the attack phase and it includes the actions of reception, setting, attack and attack coverage (Palao et al., 2004). This is a stable phase with low contextual interference due to the fact that it only depends on one action i.e. the serve (Castro et al., 2011). The opposite team responds to the serve, carrying out an offensive organisation by means of a good attack (Costa et al., 2012; Papadimitriou et al., 2004). On the contrary, KII, known as the defence phase, is a complex that has great contextual interference, with a high time deficit in the execution of the defence action, produced by the high speed of the attack (Costa et al., 2012). This phase includes the block, on-court defence, setting, counter-attack and counter-attack coverage actions (Palao et al., 2004). The main objective of complex II is to neutralise and counteract the attack of the opposite team, making it possible to optimally

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construct the counter-attack. This will permit scoring the point and guarantee continued possession of the serve (Ureña et al., 2002).

The setting is the second contact carried out in volleyball by a specialised player, the setter. The setter is an essential player in the team (Buscà and Febrer, 2012) and is responsible for organising the game (Silva et al., 2013). The setter is the player that takes the majority of tactical decisions as he or she is responsible for deciding where the ball is to be passed. The setter has to evaluate the limitations encountered in agreement with the game context (Afonso et al., 2010), seeking, with his or her action, to impair the attack-defence of the opposite team (Palao and Martinez, 2013).

Despite the fact that the setting is greatly limited by the preceding actions, the setter is able to invert bad conditions of the setting (Papadimitriuo et al., 2004). Furthermore, a high percentage of the attack efficacy depends on the setting quality (Buscà and Feber, 2012; Silva et al., 2013), and there could even be a relationship between the setting and the team´s performance (Palao et al., 2005) or the final result of the match (Silva et al., 2013).

Due to the importance of the setting in a game, different research studies have been carried out on elite and formative stages, both in male and female categories. Thus, with regard to the category, a large number of jump and second tempo settings are carried out at the elite level, while the most frequent settings in formative stages are standing and third tempo ones (González-Silva et al., 2015; Papadimitriou et al., 2004). Furthermore, at the elite level, more attack points are achieved in the male category when the setter is the defender, whereas the opposite occurs in the female category (Palao et al., 2005). On the contrary, no differences have been found regarding the setting in formative stages (González-Silva et al., 2015; Palao and Echeverría, 2008). Setting variables have been of interest to researchers and many of them have been analysed, i.e. the setter´s position (Palao et al., 2005; Silva et al., 2013), the setting zone (Afonso et al., 2010; Palao and Ahrabi-Fard, 2011), setting technique (Palao and Martínez, 2013), as well as variables that influence (the type of a serve, a reception zone, a receiver player, reception efficacy) or are influenced (attack efficacy) by the setting (Afonso et al., 2012; Silva, et al., 2014).

The present study assessed the influence of the gender variable on an important game action in volleyball, namely setting. As only few studies have been conducted in formative categories, the main objective of the research was to analyse the variables that predicted setting efficacy in KI, both in formative categories and differentiated by gender. Thus, we aimed to provide key elements to address the training process.

Consequently, the aim of this study is to analyse the setting action in KI, trying to understand the variables that will predict efficacy, in both male and female categories, in formative stages.

Material and Methods

Sample

The study sample was comprised of a total of 5842 game actions, carried out by the 34 teams (16 male and 18 female teams) participating in the Under-16 Spanish Championship, whose age varied between 14 and 16 years (M = 14.98, SD = .618 in the male category; M = 14.94, SD =.703 in the female category). The number of actions observed is shown in Table 1. The observed actions corresponded to one match played by each of the participating teams. This means that a total of 72 sets were observed, 36 sets of the male category and 36 sets of the female category. The championship was played on a neutral ground for both teams, so it was not necessary to take into account whether the teams played at home or away.

Variables

The dependent variable considered in our study was *setting efficacy*, defined as the performance or effect obtained in the setting. The FIVB system criteria were used, as in preceding studies (Palao and Martínez, 2013). Differentiation was made between: a bad setting (setting that did not permit carrying out an attack); a good setting (a setting that limited the attack options) and a perfect setting (a setting that permitted all the attack options).

The independent variables considered in our study were grouped into serve, reception and setting variables. The serve variables were:

1) a *serve zone*, defined as the zone from where the serve was carried out, covering a 9 m

wide space located behind the baseline of the court and as an extension to the sidelines of the court, differentiating three zones of origin. The categories were: zone 5, zone 6 and zone 1 (Gil et al., 2011);

2) a *serve type*, defined as the type of a serve used by the player, considering the location of the player at the time of contact with the ball. The categories were: a jump serve and a standing serve (Afonso et al., 2012; Costa et al., 2012);

3) *striking technique*, defined as the type of serve technique used by the player, considering the flight trajectory of the ball after striking it. The categories were: powerful and non-powerful;

4) an *in-game role of the server*, defined as the in-game role of the player serving. The categories were: a receiver-attacker, a setter, an opposite and middle attacker (Afonso et al., 2012);

5) a *serve direction*, defined as the direction determined by the serve depending on the serve zone and the reception zone. The categories were: parallel, mid cross-court and long cross-court (Gil et al., 2011).

The reception variables were: 1) a *reception zone*, defined as the zone where the serve was received. The categories were: lane 1, lane 6, lane 5 and space between players (Afonso et al., 2010; Afonso et al., 2012; Lidor et al., 2007; López-Martínez and Palao, 2009);

2) a *receiver player,* defined as the in-game role of the player who received the serve. The categories were: a forward-attacker, other players and the libero (Afonso et al., 2012; Ureña et al., 2002);

3) *reception efficacy,* defined as the effect obtained in the reception. The FIVB system criteria were used, as in preceding studies (Palao and Echeverría, 2008). The categories were: a bad reception and a good reception.

The setting variables were: 1) a *setter´s position*, defined as the position of the player carrying out the second setting pass. The categories were: a defence zone and an attack zone (Palao and Ahrabi-Fard, 2011);

2) a *setting zone:* defined as the place on the court from where the setting pass was carried out. The categories were: an acceptable zone (a 6 m^2 area, 2 m deep from zone 1, and 3 m wide, located 2 m from the right sideline and 4 m from the left sideline); an unacceptable zone (which was the equivalent to the entire game area excluded in the two cases mentioned above) and an excellent zone (an 8 m^2 area, 2 m long by 4 m wide, located 2 m from the right sideline and 3 m from the left sideline) (Castro and Mesquita, 2010);

3) the *type of a set:* defined as the setting carried out by the player depending on his or her position in the area. The categories were: a jump set and a standing set (Afonso et al., 2010; Palao and Martínez, 2013; Papadimitriou et al., 2004);

4) *setting technique:* defined as the complete gesture used in the setting pass. The categories were: a forearm set and an overhand set;

5) a *set´s area:* defined as the area of the court where the attack strike was made. The categories were: a defence zone, zone 2, zone 3 and zone 4 (Papadimitriou et al., 2004);

6) *tempo of a set:* defined as the interaction between the moment when the setter made contact with the ball and the start of the attackers' approach. The categories were: first tempo, second tempo and third tempo (Papadimitriou et al., 2004).

Procedures

The data were collected on video. The matches were recorded using a SONY HDR-XR155 digital camera (M2TS format). This camera was located at one of the ends of the court, guaranteeing a height of 5 m above the floor level and a distance of 7 m behind the baseline, to obtain an optimal line of sight.

A systematic observation of different variables was carried out to obtain the data. To validate the observation system created, it was submitted to the criterion of four researchers (Level III volleyball coaches with experience in research and analysis of volleyball performance).

For observation reliability, after collecting the video footage and prior to the coding process, two experienced observers were trained to survey and encode game actions. They underwent training using samples with different characteristics in different training sessions, and exceeding 10% of the total sample, as indicated by Tabachnick and Fidell (2007). The inter-observer Cohen's Kappa values reached, when observing all the variables, were higher than .75, in the sixth training session, which was the minimum value considered to attain almost perfect agreement (Fleiss et al., 2003). To guarantee the time reliability of the measurement, the same coding was executed on two occasions, with a time

difference of 10 days, obtaining Cohen's Kappa values of over .75.

Statistical Analysis

Firstly, the descriptive analysis of the variables was performed in order to discover the frequencies of each studied variable. Secondly, an inferential analysis was conducted to examine the relationships between the studied variables and setting efficacy. This analysis is presented through the contingency tables, including Chi-Square and Cramer's V values. The statistical significance level considered was $p<.05$. Finally, using the multinomial logistic regression model, the predictions of the dependent variable were obtained for each independent variable. The adjustment quality of the multinomial logistic regression model was measured by means of the determination coefficient known as Pseudo R-squared. One of the most commonly used in research is the determination coefficient proposed by Mc-Faddeen (1974), which is based on applying an auxiliary function (Λ), of which the formula is represented as follows (Mc-Faddeen, 1974): $R^2_{MF} = 1 \mid - \Lambda_J / \Lambda_0$

Values of 0.254 in the male category and 0.298 in the female category were obtained, so the models presented a good adjustment quality, as this fell within $0.2 \leq R^2_{MF} \geq 0.4$ (Mc-Faddeen, 1974). All the results indicate significant differences depending on gender.

Result

Descriptive analysis

With respect to the serve variables, the most frequent *serve direction* in the male category was mid-diagonal (42.9%), and the zone 4 attacker was the player that carried out this action most often (33.8%). The serves were mainly carried out from zone 1 (46.9%) in the jump serve (54.1%) and with a non-powerful *striking technique* (87.8%). In the female category, the main direction was mid-diagonal (39.7%), and the player who executed the action most often was the middle player (32.3%). The serves were mainly carried out from zone 1 (45.9%), they were standing serves (68.4%) and used a non-powerful *striking technique* (79.3%).

With respect to the reception variables, in the male category, lane 6 (42.8%) was the most common *reception zone*, and it was the player called other (38%) who carried out this action most often. The most frequent reception was a good reception (33.8%). In the female category, lane 6 (39%) was the most common *reception zone*, and it was the player called other (35.9%) who carried out this action most often. The most frequent reception was a good reception (33.4%).

Finally, with respect to the setting variables, in the male category, the most frequent setter´s position was the defence zone (44.1%). The setting was normally carried out from an excellent zone (29.8%), where the standing set was the most common (59.8%), using an overhand set technique (55%). Settings were normally carried out towards zone 4 (32.1%) by means of a third tempo set (44.3%). With respect to efficacy, the perfect setting (27.6%) was the one most commonly carried out. In the female category, the most frequent setter´s position was the defence area (41%). The setting was carried out most frequently from an unacceptable zone (25.4%) with greater prevalence of the standing set (63.8%), using an overhand set technique (37.7%). The most common setting was carried out towards zone 4 (29.7%) by means of a third tempo set (51.2%). The good setting (23.7%) was efficacy most frequent in this gender.

Inferential analysis

The relationships obtained between the independent variables and the dependent variables are shown through the inferential analysis, in male and female categories, indicating Chi-square and Cramer's V values.

In the male category (Table 2), there was a significant relationship between the *setting efficacy* dependent variable and the following independent variables: *a serve zone, the type of serve, a reception zone, a receiver player, reception efficacy, the setter´s position, a setting zone, the type of a set, setting technique, a set´s area and tempo of a set.* On the other hand, there was no significant relationship between the following independent variables: *serve striking technique, the in-game role of the server* and *a serve direction,* and the *setting efficacy* dependent variable. These independent variables could not be included in the multinomial logistic regression model.

In the female category (Table 2), there was a significant relationship between the *setting efficacy* dependent variable and the following independent variables: *a serve zone, the in-game role of the server, a reception zone, reception efficacy, a setting zone, the type of a set, setting technique, a set´s*

area and *tempo of a set.* On the other hand, there was no significant relationship between the independent variables, i.e. *the type of a serve, serve striking technique, a serve direction, a receiver player* and s*etter positions.* These independent variables could not be included in the multinomial logistic regression model.

Predictive analysis of the setting efficacy

The results of the multinomial logistic regression analysis, for the male category are presented in Tables 3 and 4. In relation to the serve, the *serve zone* and the *serve type* were the predictor variables for *setting efficacy*. Executing the serve from zone 6, instead of zone 1, increased the frequency (OR = 2.475) of a bad instead of perfect setting. Moreover, executing the jump serve instead of the standing serve increased the frequency (OR = 2.044) of a bad instead of perfect setting.

The reception variables that predicted *setting efficacy* were the *reception zone* and *reception efficacy*. Carrying out a reception in lane 5, instead of in the seam, reduced the frequency (OR = 0.097) of a bad instead of perfect setting. In addition, executing a bad reception instead of a perfect reception increased the frequency (OR = 22.114) of a good instead of perfect setting, and executing a good reception instead of a perfect reception increased the frequency (OR = 1.693) of a good instead of perfect setting.

Finally, with respect to the setting, *the setting zone, setting technique* and *tempo of a set* were predictor variables for *setting efficacy*. Executing a setting from the acceptable zone instead of from the excellent zone increased the frequency (OR = 1.937) of a good instead of perfect setting. Regarding *setting technique*, executing a forearm set instead of an overhand set increased the frequency (OR = 6.974) of a bad instead of perfect setting. In addition, executing a forearm set instead of an overhand set increased the frequency (OR = 2.207) of a good instead of perfect setting. Regarding *tempo of a set*, executing a second tempo set instead of a third tempo one reduced the frequency (OR = 0.429) of a bad instead of perfect setting and executing a second tempo set instead of a third tempo one reduced the frequency (OR = 0.653) of a good instead of perfect setting.

The results of the multinomial logistic regression analysis for the female category are presented in Tables 5 and 6. With respect to the reception, the *reception efficacy* was the predictor variable for *setting efficacy*. Executing a bad reception or a good reception, instead of a perfect reception, increased the frequency (OR = 39.984 and OR = 2.952, respectively) of a bad instead of perfect setting, and executing a good reception instead of a perfect reception increased the frequency (OR = 1.826) of a good instead of perfect setting.

Table 1

Game actions observed for the category

Game actions observed	Game actions observed for the category		
	Male (n)	Female (n)	Total (n)
Serve	1080	1169	2249
Reception	964	1028	1992
Set	795	806	1601
Total	2839	3003	5842

Table 2

Relationships between independent variables and the dependent variable in male and female categories.

Variable	Male			Female		
	p	X^2	V de Cramer	*p*	X^2	V de Cramer
Serve zone	.012	12.905	.094	.014	12.573	.091
Serve type	.028	7.161	.099	.191	3.313	.066
Striking technique	.618	.964	.036	.655	.846	.033
In-game role of the server	.289	7.361	.071	.040	13.172	.093
Serve direction	.130	7.122	.069	.091	8.006	.073
Reception zone	.003	20.068	.177	.022	14.729	.099
Receiver player	.019	11.794	.089	.054	9.280	.078
Reception efficacy	.000	289.369	.443	.000	341.175	.474
Setter´s position	.003	11.403	.124	.912	.183	.016
Setting zone	.000	141.990	.310	.000	164.100	.329
Type of set	.000	40.130	.233	.028	7.133	.097
Setting technique	.000	196.412	.516	.000	191.090	.502
Set´s area	.000	58.298	.199	.000	77.184	.226
Tempo of a set	.000	87.477	.244	.000	112.179	.272

Table 3

Adjusted model for setting effectiveness in the male category. Variables related to the serve and the reception

Variable	Perfect %[a]	Good %	OR Crude	OR Adjusted	*p*	Bad %	OR Crude	OR Adjusted	*p*
Serve zone									
Zone 5	7.2	7.2	1.333 (.852-2.088)[c]	1.317 (.806-2.152)[c]	.272	5	1.551 (.938-2.567)[c]	1.484 (.746-2.953)[c]	.260
Zone 6	11.5	10.9	1.271 (.864-1.868)	1.303 (.853-1.989)	.221	10.7	2.065 (1.366-3.124)	2.475 (1.412-4.339)	.002
Zone 1[b]	21.6	16.2	.	.	.	9.7	.	.	.
Serve type									
Jump serve	18.6	18.6	1.379 (.986-1.930)	1.438 (.989-2.089)	.057	14.6	1.565 (1.083-2.262)	2.044 (1.226-3.408)	.006
Standing serve [b]	21.6	15.7		.	.	10.8	.	.	
Reception zone									
Lane 1	6.2	6.2	.667 (.106-4.178)	.646 (.090-4.612)	.663	5.4	.154 (.032-.738)	.161 (.022-1.198)	.074
Lane 5	12.2	9.9	.541 (.088-3.323)	.376 (.053-2.650)	.326	7	.103 (.022-.483)	.097 (.013-.703)	.021
Lane 6	21.6	17.8	.550 (.091-3.341)	.512 (.074-3.554)	.498	11.5	.097 (.021-.446)	.150 (.021-1.058)	.057
Space between players [b]	.3	.4	.	.	.	1.5	.	.	.
Receiver player									
Forward-attacker	11.2	9.6	1.213 (.790-1.861)	1.159 (.659-2.040)	.608	8	1.851 (1.140-3.007)	1.568 (.728-3.379)	.251
Other	13.9	14.1	1.431 (.963-2.128)	1.165 (.751-1.807)	.495	11.5	2.124 (1.348-3.347)	1.197 (.645-2.222)	.568
Líbero [b]	15.1	10.7	.	.	.	5.9	.	.	.
Reception efficacy									
Bad reception	.3	.3	1.979 (.274-14.268)	.603 (.077-4.744)	.631	10.4	226.187 (52.900-967.123)	22.114 (4.248-115.130)	.000
Good reception	14.6	21.2	2.877 (2.032-4.073)	1.696 (1.004-2.8533)	.048	10.4	4.189 (2.604-6.738)	1.472 (.681-3.182)	.326
Perfect reception [b]	25.4	12.8	.	.	.	4.3	.	.	.

"a" Category of references for the dependent variable. "b" Category of references for the independent variable. "c" Numbers in brackets refer to the 95% confidence interval.

Table 4

Adjusted model for setting effectiveness in the male category. Variables related to the set.

Variable	Perfect %[a]	Good %	OR Crude	OR Adjusted	*p*	Bad %	OR Crude	OR Adjusted	*p*
Setter´s position									
Defence zone	25.2	22.6	1.169 (.824-1.660)	1.056 (.709-1.572)	.790	13	.628 (.434-.909)	.654 (.386-1.106)	.113
Attack zone [b]	15.2	11.6		.	.	12.4	.		.
Setting zone									
Acceptable zone	12.9	11.5	1.670 (1.132-2.464)	1.101 (.657-1.842)	.716	4.1	1.294 (.759-2.207)	.650 (.307-1.373)	.259
Not aceptable zone	4.7	10.6	4.160 (2.590-6.682)	1.937 (1.010-3.717)	.047	15.8	13.463 (8.088-22.412)	1.853 (.805-4.268)	.147
Excellent zone [b]	22.7	12.2		.	.	5.5	.	.	.
Type of a set									
Jump set	11.5	5.5	.485 (.319-0.736)	.651 (.390-1.086)	.100	1.5	.158 (.081-.304)	.517 (.225-1.186)	.119
Standing set [b]	28.8	28.7		.	.	24		.	.
Setting technique									
Foream set	2.2	7	4.537 (2.518-8.175)	2.207 (1.136-4.290)	.020	15.7	27.906 (15.566-50.029)	6.974 (3.331-14.603)	.000
Overhand set [b]	38.1	27.3		.	.	9.7		.	.
Set´s area									
Defence zone	2.4	1.9	.819 (.392-1.712)	.549 (.246-1.228)	.144	6.4	5.222 (2.825-9.653)	1.540 (.653-3.634)	.324
Zone 2	11.5	9.5	.867 (.584-1.287)	.996 (.638-1.556)	.987	6.1	1.059 (.667-1.680)	1.445 (.784-2.662)	.238
Zone 3	7.4	5	.708 (.438-1.144)	1.714 (.549-5.348)	.354	3.2	.836 (.475-1.471)	3.050 (.752-12.364)	.118
Zone 4 [b]			.				.		
Tempo of a set									
1º	6.2%	4.2	.512 (.308-.850)	.653 (.191-2.234)	.497	1.4	.188 (.092-.387)	.360 (.074-1.756)	.206
2º	15.7	6	.288 (.191-.435)	.381 (.242-.601)	.000	2.4	.134 (.078-.232)	.429 (.220-.837)	.013
3º [b]	18.4	24.2	.	.	.	21.5	.	.	.

"a" Category of references for the dependent variable.
"b" Category of references for the independent variable.
"c" Numbers in brackets refer to the 95% confidence interval.

Table 5

Adjusted model of setting effectiveness in the female category. Variables related to the serve and the reception

Variable	Perfect % [a]	Good %	OR Crude	OR Adjusted	*p*	Bad %	OR Crude	OR Adjusted	*p*
In-game role of the server									
Receiver-attacker	13.2	10.8	.631 (.412-.967)[c]	.816 (.501-1.329)[c]	.415	9	.553 (.356-.860)[c]	.763 (.419-1.389)[c]	.377
Setter	5.4	6.6	.938 (.559-1.574)	1.207 (.669-2.178)	.531	6.5	.973 (.578-1.638)	1.326 (.664-2.649)	.424
Opposite	4.3	7	1.235 (.724-2.109)	1.358 (.740-2.492)	.323	4.7	.888 (.503-1.567)	1.131 (.539-2.375)	.745
Middle attacker [b]	9.2	12			.	11.3	.	.	.
Reception zone									
Lane 1	6.9	6.3	.755 (.288-1.981)	.659 (.219-1.979)	.457	5.8	.331 (.139-0.789)	.392 (.121-1.275)	.120
Lane 5	10.1	9.6	.776 (.304-1.980)	.759 (.261-2.210)	.613	8.3	.320 (.138-.741)	.328 (.104-1.035)	.057
Lane 6	14	19	1.111 (.445-2.778)	1.025 (.358-2.930)	.964	14.2	.399 (.176-.901)	.617 (.204-1.865)	.392
Space between players [b]	1.2	1.4	.			3.2	.	.	.
Reception efficacy									
Bad reception	.0	.0	3.101 (.722-13.317)	.847 (.173-4.150)	.838	.1	240.739 (70.517-821.861)	38.984 (9.447-160.877)	.000
Good reception	.4	.7	3.3801 (2.630-5.493)	1.826 (1.013-3.292)	.045	14.9	6.935 (4.118-11.680)	2.952 (1.286-6.778)	.011
Perfect reception [b]	12.4	25.3	.			13.4	.	.	.

"a" Category of references for the dependent variable. "b" Category of references for the independent variable. "c" Numbers in brackets refer to the 95% confidence interval.

Table 6

Adjusted model of setting effectiveness in the female category.
Variables related to the set

Variable	Perfect % [a]	Good %	OR Crude	OR Adjusted	*p*	Bad %	OR Crude	OR Adjusted	*p*
Setting zone									
Acceptable zone	9.8	14.2	2.413 (1.610-3.617)	1.339 (.789-2.272)	.279	5.2	1.804 (1.072-3.036)	.808 (.398-1.641)	.555
Not aceptable zone	47	11.6	3.979 (2.473-6.401)	1.256 (.656-2.405)	.492	20.5	14.360 (8.681-23.754)	1.858 (.872-3.959)	.108
Excellent zone [b]	17.8	10.8				5.5	.	.	.
Type of a set									
Jump set	3	1,6	.437 (.212-.898)	1.141 (.483-2.695)	.764	1.4	.466 (.222-,978)	1.466 (.510-4.216)	.478
Standing set [b]	29.3	35				29.8		.	.
Setting technique									
Foream ser	4.3	15.8	4.950 (3.196-7.667)	2.791 (1.627-4.790)	.000	23.8	20.304 (12.658-32.566)	5.679 (3.045-10.592)	.000
Overhand set [b]	27.9	20.6				7.6		.	.
Set´s area									
Defense zone	.7	3.4	4.248 (1.575-11.460)	2.835 (.992-8.104)	.052	7.%	13.945 (5.374-36.188)	3.357 (1.101-10.237)	.033
Zone 2	7	10	1.218 (.792-1.875)	1.991 (1.201-3.301)	.008	5.2	0.885 (.539-1.452)	2.146 (1.125-4.095)	.021
Zone 3	9.5	5.5	0.489 (.310-.770)	2.106 (1.121-3.956)	.021	6.1	.774 (.490-1.223)	3.004 (1.397-6.458)	.005
Zone 4 [b]	15.1	17.7				12.2		.	.
Tempo of a set									
1º	3.3	1.2	.196 (.089-.432)	.289 (.109-.768)	.013	1	.206 (.090-.469)	.716 (.225-2.278)	.572
2º	10.9	2.5	.123 (.072-.211)	.157 (.085-.288)	.000	2.6	.153 (.090-.261)	.441 (.211-.924)	.030
3º [b]	18.1	32.9				27.6		.	.

"a" Category of references for the dependent variable.
"b" Category of references for the independent variable.
"c" Numbers in brackets refer to the 95% confidence interval.

Setting technique, the s*et´s area and tempo of a set* were setting variables that predicted *setting efficacy*. Executing a forearm set instead of an overhand set increased the frequency (OR = 5.679) of a bad instead of perfect setting. In addition, executing a forearm set instead of an overhand set increased the frequency (OR = 2.791) of a good instead of perfect setting. Regarding the *set´s area,* executing a setting towards the defender zone, zone two or zone three instead of towards zone four increased the frequency (OR = 3.357, OR = 2.146 and OR = 3.004, respectively) of a bad instead of perfect setting. In addition, executing a setting towards zone two or zone three instead of zone four increased the frequency (OR = 1.991 and OR = 2.106, respectively) of a good instead of perfect setting. Finally, executing a second tempo set instead of a third tempo one reduced the frequency (OR = 0.441) of a bad instead of perfect setting and executing a first or second tempo set

instead of a third tempo one reduced the frequency (OR = 0.441 and OR = 0.157, respectively) of a good instead of perfect setting.

Discussion

Numerous research studies conducted in the field of sport sciences have aimed to determine factors influencing performance in sport (Hughes and Bartlett, 2002; Sampaio and Leite, 2013). However, these factors are very specific and depend on different variables such as the type of sport, the level or game category and even on gender of the players. Therefore, to be able to provide information to improve the training process, specific studies must be carried out to help discover the variables that predict performance in specific contexts, levels or gender. Thus, the main objective of this study was to analyse the variables that predicted setting efficacy in KI, in formative stage volleyball players, both in male and female categories.

The reception efficacy, setting technique and setting tempo variables were predictors of setting efficacy, both in male and female categories. More specifically, receptions that represented a freeball or receptions that did not permit carrying out all the attack options reduced setting efficacy. Along the lines of our results, previous studies had shown the importance of the serve reception quality (Marelić et al., 2004; Papadimitriou et al., 2004). There is scientific evidence that this reception quality has a significant influence on the setters' offensive organisation (Papadimitriu et al., 2004; Ureña et al., 2001). Thus, apart from having the best conditions to set, the setters will be more effective in the setting (Afonso et al., 2010; Papadimitriou et al., 2004; Silva et al., 2014).

Although the relationship between the reception and setting efficacy can be observed at all game levels (Ureña et al., 2001), this is much more pronounced in formative stages (Costa et al., 2011). In these stages, where the setters' technical level has not been consolidated yet and they do not have many technical resources (Selinger and Ackerman, 1991), the setting quality decreases when the reception is inadequate (Ureña et al., 2001).

In our study, forearm settings reduced setting efficacy and overhand settings were the most effective. Coinciding with our results, studies on elite athletes show that maximum setting efficacy and precision is reached when the setting is carried out with an overhand action (Palao et al., 2009; Ramos et al., 2004). Likewise, our study clearly shows that setting efficacy decreased with third tempo settings. Fast settings are carried out in play when the ball arrives in optimal conditions (Afonso et al., 2010). These settings are perfect and this could be one of the explanations for the results obtained in our study.

In the male category, the serve zone, the type of a serve, a reception zone and a setting zone were the variables that seemed to predict setting efficacy. This did not occur in the female category. More specifically, serves made from zone 6 and jump serves decreased the efficacy of the opposite team's setting. Similar results were obtained by Afonso et al. (2010) and Ureña et al. (2011), who found a significant relationship between the jump serve and the non-construction of K1. Since it is known that a powerful and aggressive serve in volleyball has a considerable influence on setting efficacy, in formative stages it is advisable for players who have adequate technical mastery and development to try to improve the use of this type of serve during the training process.

In our study, receiving in the seams reduced the subsequent setting efficacy. The seam known also as a conflict zone introduces disorder in the players, causing a decrease in reception efficacy, which determines the subsequent setting (Papadimitriou et al., 2004). Likewise, the reception zone determines the zone from which the ball is sent to the setter (Afonso et al., 2012), and numerous studies have showed the importance of carrying out tactical serves to specific zones of the court: a setter's penetration zone (Lidor et al., 2007), a seam between players (López-Martínez and Palao, 2009), sidelines and a baseline (Afonso et al., 2012; Moreno et al., 2007). Serves towards these specific zones of the court usually make reception difficult, reducing the number of balls that reach optimal zones for the setter.

With respect to the setting zone, our results show that when a setting was made from an acceptable zone, setting efficacy decreased compared to when it was carried out from a perfect or excellent zone. In line with our results, different studies have showed that settings

carried out from non-excellent zones were generally accompanied by non-perfect settings (Afonso et al., 2010). These results may indicate that there is a causal relationship between the setting zone and setting efficacy, what is in accordance with the findings of Silva et al. (2013) study.

In the female category, only one variable, i.e. a set´s area, was a predictor of setting efficacy. This did not occur in the male category. Setting efficacy decreased on those occasions when the setter did not send the ball to zone four. Therefore, in formative stages and in the female category, regardless of the zone from where the setting is made, the most mastered, automated pass that setters carry out more confidently is towards zone four. This was also confirmed in the study of Costa et al. (2010).

Conclusions

Reception efficacy and setting technique (more specifically, the execution of the setting by an overhand pass) were the main variables that predicted setting efficacy in volleyball in formative stages.

In the male category, but not so in females, the type of a serve acted as a predictor of setting efficacy. Thus, it is deemed advisable to evaluate the level of play and development of the players, and to place emphasis on certain types of serves during training.

In youth female players, but not in males, the set's zone was a predictor variable of setting efficacy. Thus, placing emphasis on training setting technique would be recommended in order to increase its efficacy as well as to improve the technical-tactical experience, thus increasing variability in the attack game.

References

Afonso J, Esteves F, Araújo R, Thomas L, Mesquita I. Tactical determinants of setting zone in elite men's volleyball. *J Sports Sci Med,* 2012; 11: 64-70

Afonso J, Mesquita I, Marcelino R, da Silva A. Analysis of the setter´s tactical action in high-performance women´s volleyball. *Kinesiology,* 2010; 42(1): 82-89

Beal D. Basic Team System and Tactics. In FIVB (Ed.), *Coaches Manual I*. Lausanne: FIVB, 335-356; 1989

Buscà B, Febrer J. Temporal fight between the middle blocker and the setter in high level volleyball. *Rev int med cienc act fís deporte,* 2012; 12(46): 313-327

Castro J, Mesquita I. Analysis of the attack tempo determinants in volleyball's complex II – a study on elite male teams. *Int J Perf Anal Spor,* 2010; 10(3): 197-206

Castro J, Souza A, Mesquita I. Attack efficacy in Volleyball: elite male team. *Percept Motor Skill*, 2011; 113(2): 395-408

Costa GC, Afonso J, Brant E, Mesquita I. Differences in game patterns between male and female youth volleyball. *Kinesiology,* 2012; 44(1): 60-66

Costa GC, Caetano CJ, Ferreira N, Junqueira G, Costa P, Mesquita I. Determinants of attack tactics in Youth male elite voleyball. *Int J Perf Anal Spor,* 2011; 11: 96-104

Costa GC, Mesquita I, Greco PJ, Ferreria NN, Moraes JC. Relationship between the type, time and the effect of the attack on youth female elite volleyball. *Mot. Eur. J. Hum. Mov,* 2010; 24: 121-132

Fleiss J, Levin B, Paik M. *Statistical methods for rates and proportions*. NY: John Wiley & Sons; 2003

Gil A, Del Villar F, Moreno A, García-González L, Moreno MP. Analysis of the efficacy of volleyball serve formation in category. *Rev int med cienc act fís deporte,* 2011; 11(44): 721-737

González-Silva J, Moreno A, Fernández-Echeverría C, Claver F, Moreno MP. Analysis of the type of set in volleyball, in U-16 category. *Kronos,* 2015; 14(1)

Hughes M, Bartlett R. The use of performance indicators in performance analysis. *J Sport Sci,* 2002; 20(10): 739-754

Lidor R, Arnon M, Hershko Y, Maayan G, Falk B. Accuracy in a volleyball service test in rested and physical exertion conditions in elite and near-elite adolescent players. *J Strength Cond Res*, 2007; 21(3): 937–942

López-Martínez AB, Palao JM. Effect of Serve Execution on Serve Efficacy in Men's and Women's Beach Volleyball. *Internatinal Journal of Applied Sports Sciences*, 2009; 21(1): 1-16

McFadden D. Conditional logit analysis of qualitative choice behavior. In Zarembka P. (ed.) *Frontiers in Econometrics*. New York: Academic Press, 105-142; 1974

Palao JM, Ahrabi-Fard F. Side-out success in relation to setter´s position on court in women´s college volleyball. *International Journal of Applied Sports Sciences,* 2011; 23(1): 155-167

Palao JM, Manzanares P, Ortega E. Techniques used and efficacy of volleyball skills in relation to gender. *Int J Perf Anal Spor,* 2009; 9(2): 281-293

Palao JM, Martínez S. Use of jump set in relationship to the competition level in male volleyball. *SporTK*, 2013; 1(2): 43-49

Palao JM, Santos JA, Ureña A. Effect of team level on skill performance in volleyball. *Int J Perf Anal Spor,* 2004; 4(2): 50-60

Palao J, Santos J, Ureña A. The effect of setter´s position on the spike in volleyball. *J Hum Movement Stud,* 2005; 48(1): 25-40

Papadimitriou K, Pashali E, Sermaki I, Mellas S, Papas M. The effect of the opponents' serve on the offensive actions of Greek setters in volleyball games. *Int J Perf Anal Spor*, 2004; 4(1): 23-33

Ramos MHKP, Nascimiento JV, Donegá AL, Novaes AJ, Souza RR, Silva TJ, Lopes AS. Setting action's internal structure on brazilian male volleyball national championship teams 2002/2003. *R. Bras. Ci. e Mov,* 2004; 12(4): 33-37

Sampaio J, Leite N. Performance indicators in game sports. In T McGarry, P O´Donoghue, J Sampaio (Eds). *Routledge Handbook of Sports Performance Analysis*. Oxon: Routledge, 115-126; 2013

Selinger A, Ackermann-Blount J. *Power Volleyball*. Thessaloniki: Salto; 1991

Silva M, Lacerda D, João PV. Match analysis of discrimination skills according to the setter attack zone position in high level volleyball. *Int J Perf Anal Spor,* 2013; 13(2): 452-460

Silva M, Lacerda D, João PV. Game-Related Volleyball Skills that Influence Victory. *Journal of Human Kinetics,* 2014; 41:173-179

Tabachnick BG, Fidell LS. *Using multivariate statistics.* Boston: Allyn and Bacon; 2007

Ureña A, Calvo RM, Lozano C. A study of reception in the top level of Spanish male volleyball after the introduction of the libero player. *Rev int med cienc act fís deporte,* 2002; 2(4): 37-49

Ureña A, Vavassori R, León J, González M. Jump serve incidence on the attack phase in the spanish under-14 volleyball. *Revista Internacional De Ciencias Del Deporte,* 2011; 7(26): 384-392

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