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The main objective of this research was to determine the association between performance in the different game actions and the final classification of the teams, in male volleyball. The systematic observation was used to analyse the 7888 game actions corresponding to the 21 teams participating in the male Spanish Championship, U-19 category. The study variables were: performance in all game actions and classification. A Cluster analysis was performed to establish the different classification groups. The data analysis was performed through an inferential analysis with the Chi-Square and Cramer's V. The results showed the significant association between the final classification and the actions of reception, setting, attack, block and defense ( $p < 0.05$ ). These results show that higher performance in all game actions, except serve, are associated with a better position in the final ranking. These results can be taken into account in the training process of male volleyball players, U-19 category.

## Analysis of performance in game actions in volleyball, according to the classification

**KEY-WORDS:**

Classification. Performance.

Game actions. Volleyball.

## Análise da performance de ações de jogo em voleibol, de acordo com a classificação

**RESUMO**

O objetivo do estudo era saber a associação entre a efetividade nas diferentes ações de jogo no voleibol e a classificação final. Eles foram analisados por meio da observação contínua e regular de 7888 ações de jogo, dos 21 times do Campeonato de Espanha Masculina Juvenil, em 2012. As variáveis de estudo: efetividade nas seis ações de jogo e classificação final. A análise de Cluster foi realizado para estabelecer os diferentes grupos de classificação. A análise de dados foi conduzida por um inferencial de análise inclusive os valores de Chi-quadrado e V de Cramer. Os resultados mostraram uma associação significativa entre a classificação final e as ações de recepção, colocação, ataque, bloqueio e defesa ( $p < 0.05$ ). Estes resultados nos mostram que há um resultado maior em todas as ações de jogo, excluindo o saque, e se associam com uma posição melhor na classificação final. Estes resultados podem ser levados em conta durante o processo de treinamento da categoria de jogo considerada no momento presente do estudo.

**PALAVRAS CHAVE:**

Classificação final. Eficácia.

Ações de jogo. Voleibol.

## INTRODUCTION

Performance analysis in sport is based on the interpretation of different performance indicators, which allow us to develop different tactical and technical evaluations<sup>(6)</sup>, that can be useful in training planning<sup>(15)</sup>. Among the different performance indicators in sport we can highlight game actions' efficacy<sup>(5)</sup>, won/lost points<sup>(11)</sup>, set result<sup>(5)</sup>, match result<sup>(3)</sup>, and final classification<sup>(10)</sup>.

In volleyball, the most used indicator for performance analysis is the game actions' efficacy<sup>(15)</sup>. The actions in volleyball are cyclical and sequential, differentiating four fundamental game complexes<sup>(2)</sup>. The complex 0 (K0) includes the action of the serve, by which the play starts, and aims to achieve direct point or reduce the options of the opposite attack<sup>(17)</sup>. Complex 1 (K1), or attack phase, includes the actions of reception, setting, attack and attack coverage. The objective of this complex is to neutralize and counteract the opposing serve, and build an attack to obtain the point<sup>(13)</sup>. Complex 2 (K2), or defense phase, includes block, defense, setting, counterattack and counterattack coverage. The objective of this complex is to neutralize and counteract the counterattack, and build a counterattack that allows to obtain the point<sup>(16)</sup>. Complex 3 (K3), or counterattack phase, includes the actions of block, defense, setting, counterattacking and counterattack coverage. Its main objective is to neutralize and counteract the counterattack from the K2 of the opposing team, and to organize a new counterattack<sup>(9)</sup>.

In volleyball, there are two types of actions: intermediate and finalists. Intermediate actions are those with which it is not usual to obtain a direct point (reception, setting and defense)<sup>(11)</sup>. The finalist actions are those that usually obtain a direct point (serve, attack and block)<sup>(12)</sup>. Therefore, a player/team can get point mainly in four different ways: by serve, attack, block, or through unforced errors of the opponent<sup>(7)</sup>.

Many studies have analyzed performance in game actions, but few have tried to analyze them along with another performance indicator, such as the final classification. Therefore, the objective of the present investigation was to determine the association between performance in all game actions (serve, reception, setting, attack, block and defense) and the final classification, in male volleyball, U-19 category.

## METHOD

### SAMPLE

The sample of the study was comprised of 7888 game actions performed to the 221 players, corresponding to the 21 teams participating in the Spanish Championship, male U-19 category, in 2012. The observed actions were: 1555 serves, 1348 receptions, 1376 settings, 1548 attacks, 664 blocks and 1397 digs, at different game complexes in volleyball.

Two matches of each of the teams participating in the championship were observed, corresponding to the first phase of competition.

### VARIABLES AND INSTRUMENTS

The study variables were:

Performance in game actions, understood as the final result of the motor execution. It was measured in the actions of serve, reception, setting, attack, block and defense. They were measured through the International Volleyball Federation's Observation System, FIVB<sup>(4)</sup>. The instrument consists of a scale of 0 to 4 for the finalist actions (serve, attack and block), and 0 to 3 for intermediate actions (reception, setting and defense). The value 0 assumes error in the action and 4 the successful execution of the action (3 in the case of the intermediate actions).

The final classification, understood as the final position obtained by the team in the championship. To group the teams at different competitive levels, a cluster analysis was carried out (clustering criterion: Bayesian criterion of Schwarz). The cluster number was fixed in three and the variables used were: won/lost matches, won/lost sets, won/lost points. Three groups were established: first ranked teams (from 1 to 7), intermediate ranked teams (from 8 to 13), and last ranked teams (from 14 to 21).

### RELIABILITY

For the reliability of the observation, one observer training process was carried out (Physical Activity and Sport Sciences graduate, National Coach Level III with experience in volleyball training). The intra-observer values of Cohen's Kappa were greater than .81. To guarantee the time 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

An inferential analysis was performed to verify the associations between the performance in game actions and the final classification. This analysis is presented through the contingency tables, including the values of Chi-Square and Cramer's V, with a significance level of  $p < .05$ .

## RESULTS

### ASSOCIATION BETWEEN SERVE EFFICACY AND FINAL CLASSIFICATION.

There is no significant association between these two variables ( $\chi^2 = 8,693$ ; Cramer's V = .053;  $p = .369$ ).

ASSOCIATION BETWEEN RECEPTION EFFICACY AND FINAL CLASSIFICATION.

There is a significant association between these two variables ( $\chi^2 = 19,057$ ; Cramer's V = .084;  $p = .004$ ), contributing positively to the association: perfect reception with first ranked teams; and error and bad reception with last ranked teams (TABLE 1).

TABLE 1. Reception efficacy-classification contingency table.

		RECEPTION EFFICACY					
		Error-0	Bad-1	Good-2	Perfect-3	Total	
FINAL CLASSIFICATION	First ranked teams	Frequency	20	41	122	240	423
		Expected frequency	30.8	49.0	133.1	210.2	423.0
		Corrected residual	-2.4	-1.5	-1.4	3.5	
	Intermediate ranked teams	Frequency	25	34	113	166	338
		Expected frequency	24.6	39.1	106.3	168.0	338.0
		Corrected residual	.1	-1.0	.9	-.3	
	Last ranked teams	Frequency	53	81	189	264	587
		Expected frequency	42.7	67.9	184.6	291.8	587.0
		Corrected residual	2.2	2.2	.5	-3.0	
TOTAL	Frequency	98	156	424	670	1348	
	Expected frequency	98.0	156.0	424.0	670.0	1348.0	

0 cells (0%) with expected frequency lower than 5. The minimum expected frequency is 24.57

ASSOCIATION BETWEEN SETTING EFFICACY AND FINAL CLASSIFICATION.

There is a significant association between these two variables ( $\chi^2 = 33.973$ ; Cramer's V.111;  $p = .000$ ), contributing positively to the association: perfect setting with first ranked teams, and error, bad and good setting with last ranked teams (TABLE 2).

TABLE 2. Setting efficacy-classification contingency table.

		Setting efficacy					
		Error-0	Bad-1	Innacurate-2	Good-3	Perfect-4	Total
FINAL CLASSIFICATION	First ranked teams	Frequency	6	2	15	173	269
		Expected frequency	9.8	7.4	19.6	193.6	234.5
		Corrected residual	-1.5	-2.5	-1.3	-2.4	3.9
	Intermediate ranked teams	Frequency	5	5	18	150	195
		Expected frequency	7.9	6.0	15.7	155.3	188.1
		Corrected residual	-1.2	-.5	.7	-.7	.8

Last ranked teams	Frequency	15	25	250	230	538
	Expected frequency	11.3	8.6	22.7	224.0	271.3
	Corrected residual	2.6	2.8	.6	2.9	-4.6
TOTAL	Frequency	29	22	58	573	694
	Expected frequency	29.0	22.0	58.0	573.0	694.0

0 cells (0%) with expected frequency lower than 5. The minimum expected frequency is 5.96.

ASSOCIATION BETWEEN ATTACK EFFICACY AND FINAL CLASSIFICATION.

There is a significant association between these two variables ( $\chi^2 = 27,488$ ; Cramer's V = .094;  $p = .001$ ), contributing positively to the association: attack point with first ranked teams, and bad attack with last ranked teams (TABLE 3).

TABLE 3. Attack efficacy-classification contingency table

		ATTACK EFFICACY					
		Error-0	Bad-1	Weak-2	Good-3	Point-4	Total
FINAL CLASSIFICATION	First ranked teams	Frequency	82	52	65	74	238
		Expected frequency	89.5	63.0	73.0	85.2	200.4
		Corrected residual	-1.1	-1.8	-1.2	-1.6	4.2
	Intermediate ranked teams	Frequency	72	47	67	72	174
		Expected frequency	75.6	53.3	61.7	72.0	169.4
		Corrected residual	-.5	-1.1	.9	.0	.5
	Last ranked teams	Frequency	117	92	89	112	195
		Expected frequency	105.9	74.6	86.4	100.8	237.2
		Corrected residual	1.5	2.7	.4	1.6	-4.5
TOTAL	Frequency	271	191	221	258	607	
	Expected frequency	271.0	191.0	221.0	258.0	607.0	

0 cells (0%) with expected frequency lower than 5. The minimum expected frequency is 53.30.

ASSOCIATION BETWEEN BLOCK EFFICACY AND FINAL CLASSIFICATION.

There is a significant association between these two variables ( $\chi^2 = 18,488$ ; Cramer's V = .118;  $p = .018$ ), contributing positively to the association: block point with first ranked teams, and bad block with last ranked teams (TABLE 4).

TABLE 4. Block efficacy-classification contingency table

		BLOCK EFFICACY						
		Error-0	Bad-1	Weak-2	Good-3	Point-4	Total	
FINAL CLASSIFICATION	First ranked teams	Frequency	76	31	37	32	79	255
		Expected frequency	83.0	31.5	39.2	37.6	63.8	255.0
		Corrected residual	-1.2	-.1	-.5	-1.3	2.8	
	Intermediate ranked teams	Frequency	63	14	34	35	43	189
		Expected frequency	61.5	23.3	29.0	27.9	47.3	189.0
		Corrected residual	.3	-2.4	1.2	1.7	-.8	
	Last ranked teams	Frequency	77	37	31	31	44	220
		Expected frequency	71.6	27.2	33.8	32.5	55.0	220.0
		Corrected residual	1.0	2.5	-.6	-.3	-2.1	
TOTAL	Frequency	216	82	102	98	166	664	
	Expected frequency	29.0	22.0	58.0	573.0	694.0	1376.0	

0 cells (0%) with expected frequency lower than 5. The minimum expected frequency is 5.96.

#### ASSOCIATION BETWEEN DEFENSE EFFICACY AND FINAL CLASSIFICATION.

There is a significant association between these two variables ( $\chi^2 = 31,896$ ; Cramer's V = .107;  $p = .000$ ), contributing positively to the association: perfect defense with first ranked teams, and bad defense with last ranked teams (TABLE 5).

TABLE 5. Defense efficacy-classification contingency table

		DEFENSE EFFICACY					
		Error-0	Bad-1	Good-2	Perfect-3	Total	
FINAL CLASSIFICATION	First ranked teams	Frequency	163	33	80	154	430
		Expected frequency	160.4	53.9	81.3	134.5	430.0
		Corrected residual	.3	-3.7	-.2	2.4	
	Intermediate ranked teams	Frequency	133	45	83	138	399
		Expected frequency	148.8	50.0	75.4	124.8	399.0
		Corrected residual	-1.9	-.9	1.1	1.7	
	Last ranked teams	Frequency	225	97	101	145	568
		Expected frequency	211.8	71.2	107.3	177.7	568.0
		Corrected residual	1.5	4.3	-.9	-3.8	
TOTAL	Frequency	521	175	264	437	1397	
	Expected frequency	521.0	175.0	264.0	437.0	1397.0	

0 cells (0%) with expected frequency lower than 5. The minimum expected frequency is 49.98.

## DISCUSION

According to our results, in male U-19 category, the first ranked teams perform, more than expected by random, perfect receptions, defenses and settings, and also attack and block points; last ranked teams perform, more than expected by random, bad receptions, attacks, blocks and defenses, error receptions, and error, bad or good settings.

No studies have been found correlating performance in game actions with classification, but a number of studies have shown correlations between the finalist actions efficacy and the victory<sup>(1)</sup>. On the other hand, studies in formative stages did not show correlation between the intermediate actions and winning the point, but if with finalist actions<sup>(8)</sup>. The results of these studies are in line with our results, since both the intermediate and final actions efficacy are associated with performance, measured through different indicators.

On the other hand, in our study, there is no significant association between the serve efficacy and the final classification. Therefore, these results are not in line with previous studies carried out in high level volleyball<sup>(1)</sup>.

The results of our study may be due to the serve skill of players in formative stages players, poor than high level, as well as to the high risk of error of this action when looking for efficacy.

To conclude, we can indicate that the first ranked teams perform, more than expected by random, perfect intermediate actions and finalist actions obtaining direct point (attack and block). Therefore, it is advisable to control and to optimize the quality and efficacy of the actions performed in training, with the aim of improving teams' performance.

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## A monitorização do treino no futebol não-profissional. O TRIMP como parâmetro de avaliação da carga interna

## PALAVRAS CHAVE:

Futebol. Monitorização do Treino. Carga Interna. TRIMP.

## RESUMO

O estudo pretendeu descrever, caracterizar e comparar a dinâmica das cargas de treino ao longo do microciclo de uma equipa de futebol não-profissional, utilizando o TRIMP como parâmetro da carga interna. A amostra foi constituída por 17 jogadores do sexo masculino (24.7±3.4 anos, 177.8±4,8 cm) que durante a época 2015/2016 competiram por um clube do campeonato Pro-Nacional da Associação de Futebol de Lisboa. Os jogadores foram monitorizados durante 8 semanas consecutivas durante o período competitivo. Não foram observadas diferenças significativas na carga de treino entre microciclos ( $p=0.081$ ). Contudo, foram verificadas diferenças significativas na carga de treino interna entre Defesas e Médios ( $p<0.05$ ). Os resultados mostram que a carga interna varia durante o microciclo, no qual o segundo treino apresenta uma carga mais elevada. Relacionando a carga interna com as posições ocupadas no terreno de jogo, os resultados obtidos sugerem que o treino deve potenciar os requisitos físicos específicos existentes na competição.