Revista Brasileira de Prescrição e Fisiologia do Exercício
ISSN 1981-9900 ***versão eletrônica***

Periódico do Instituto Brasileiro de Pesquisa e Ensino em Fisiologia do Exercício

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PERFORMANCE COEFFICIENT OF THE MASTER VOLLEYBALL SKILLS

Nelson Kautzner Marques Junior[1]

ABSTRACT

Performance coefficient (PC) has the objective of determine the performance of the volleyball skills. What is the value of the PC of the master volleyball skills? The volleyball research did not have information. The objective of the study was to determine the PC of the master volleyball skills. The study was composed by 15 matches of the male master volleyball of the category 35 years or more. The data were collected with the camera in gymnasium. After the data collect, the researcher practiced the match analysis with a scout prepared in the Excel®. Kruskal Wallis Anova and new statistic did not identify statistical difference of the PC of all skills during each set (serve, reception, set, attack, block and defense). Spearman correlation detected only a statistical difference (serve x block, R = 0,18, p = 0,003). Kruskal Wallis Anova and new statistic did not identify statistical difference of the PC of each court zone of the serve, of the block and of the reception. But the same statistic identified statistical difference of the PC of each court zone of the defense, of the set and of the attack. In conclusion, match analysis is an important “tool” for the master volleyball.

Key words: Match analysis. Training. Statistics. Sports technique.

RESUMEN

Coeficiente de rendimiento de las acciones de juego del voleibol master

El coeficiente de rendimiento (CR) tiene el objetivo de determinar el desempeño de las habilidades del voleibol. ¿Cuál es el valor del CR de las acciones de juego del voleibol master? La investigación de voleibol no tenía información. El objetivo del estudio fue determinar el CR de las acciones de juego del voleibol master. El estudio fue compuesto por 15 partidos del voleibol master masculino de la categoría de 35 años o más. Los datos fueron recogidos con la cámara en el gimnasio. Después de la recolección de datos, el investigador practicó el match analysis con un scout elaborado en el Excel®. Anova de Kruskal Wallis y nueva estadística no identificaron diferencia estadística del CR de todas las acciones del juego durante cada set (servicio, recepción, distribución, ataque, bloqueo y defensa). Correlación de Spearman detectó sólo una diferencia estadística (servicio x bloqueo, R = 0,18, p = 0,003). Anova de Kruskal Wallis y nueva estadística no identificaron diferencia estadística del CR de cada zona del servicio, del bloqueo y de la recepción. Pero la misma estadística identificó diferencia estadística del CR de cada zona de la defensa, de la distribución y del ataque. En conclusión, el análisis de partidos es una "herramienta" importante para el voleibol master.

Palabras clave: Análisis del juego. Entrenamiento. Estadística. Técnica deportiva.

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ISSN 1981-9900 ***versão eletrônica***

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INTRODUCTION

The performance of the volleyball skills were much researched in volleyball literature (Palao and collaborators, 2016; Silva and collaborators, 2016). But the volleyball studies were about the professional volleyball (Marques Junior, 2013) and the young volleyball (Arruda and Marques Junior, 2015).

The volleyball studies about the skills determined the serve, the block and the attack how the most important skills for the team win the match (Marques Junior, 2015; Oliveira and collaborators, 2016). Then, the volleyball skills practiced point during the match were the best skills for the volleyball team get the victory (Drikos and collaborators, 2009; Silva, Lacerda and João, 2014).

The reception, the set and the defense the volleyball literature informed about these skills (Sánchez and collaborators, 2015). The volleyball research determined the relation between the reception, the set and the attack (Costa and collaborators, 2017a; Rocha and Barbanti, 2004). The good reception causes a good set and the attack has more successful. Others volleyball skills with a relation during the match were determined by volleyball literature, a good block is important for the success in the defense (Mesquita and collaborators, 2013).

Performance coefficient was developed by Coleman (2002) with the objective of determine the performance of the volleyball skills. Coleman (2002) practiced the following classification of the performance coefficient for the volleyball skills: 2,50 or more is an excellent performance of an international level volleyball team, 2,30 to 2,49 is a low performance of an international level volleyball team, 2,20 to 2,29 is a good performance of a club level volleyball team, 2 to 2,19 is a medium performance of a club level volleyball team and 1,99 or less is a bad performance of a club level volleyball team.

However, volleyball literature did not determine the performance coefficient of the male master volleyball of the category 35 years or more during the sets (Marcelino and collaborators, 2009, 2010; Marques Junior and Arruda, 2015). Only a study about the male master volleyball studied the performance coefficient of a volleyball team during the 2nd shift of the Carioca Championship of 2016 (Marques Junior, 2017). Therefore, the volleyball literature needs more research about this theme.

What is the value of the performance coefficient of the male master volleyball skills of the category 35 years or more?

The volleyball research did not have information about these results (Costa and collaborators, 2017; Peiró and collaborators, 2016), only the study of Marques Junior (2017).

The objective of the study was to determine the performance coefficient of the master volleyball skills.

MATERIALS AND METHODS

The study was composed by 15 matches of the male master volleyball of the category 35 years or more during the Carioca Championship of 2016 (n = 9 matches) and of 2017 (n = 6 matches). The study had 15 matches during the 1st set, 15 matches during the 2nd set and 4 matches during the 3rd sets – total of 34 sets.

The matches of the master volleyball were filmed with the camera Sony® handycam, model DCR-SX20 on the tripod Mirage®.

After the data collect, the researcher practiced the match analysis with a scout prepared in the Excel® of Marques Junior and Arruda (2017) with the objective of determines the performance coefficient. The materials used during the match analysis were the following: a Compaq Presario CQ43 notebook was used with the scout, an Acer Aspire 4320 notebook was used to pass the image of the matches to the Philips 42 LCD television for this instrument reproduce the image of the matches. The figure illustrates these explanations.

The master volleyball is practiced with two sets of 25 points or two points of difference for the winner. When each team wins one set, the tie break (3rd set) is practiced with a set of 15 points or two points of difference for the winner.

The data were collected with the camera in gymnasium, at a distance of 2 meters (m) and a height of 2 m. All the matches were filmed in the Canto Rio gymnasium, club in Niterói, Rio de Janeiro, Brazil. The researcher positioned back of the court for filmed the match. Then, only a master

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volleyball team was analyzed with the scout prepared in the Excel®.

The researcher practiced the match analysis at a distance of 1 m from the television. The scout prepared in the Excel® was standardized for collect the data of the matches with the norms of Marques Junior and Arruda (2015).

The classification of the performance coefficient of the skills for the male master volleyball of the category 35 years or more was as follows: 0 to 1 is a low performance, 1,1 to 2 is a medium performance and 2,1 to 3 or more is a high performance (Marques Junior, 2017).

The results were expressed as mean and standard deviation, minimum and maximum, confidence interval of 95%. The effect size (ES) of Hedges and Olkin (1985) was calculated in the Excel®. The classification of the ES was based in Cano-Corres, Sánchez-Álvarez and Fuentes-Arderiu (2012), the classification was as follows: 0,20 or less is very small the effect, 0,21 to 0,49 is small the effect, 0,50 to 0,79 is medium the effect and 0,80 or more is great the effect.

Figure 1 - The researcher practiced the match analysis of the master volleyball.

The researcher verified the performance coefficient of the skills during the sets of all the 15 matches. Then, the normality of the data was assessed by the Shapiro Wilk test (n = 50, p p≤0.05) and/or with the Kolmogorov Smirnov test (n>50, p≤0.05), but was observed the normality of the data through of the histogram.

In case of data normal, the difference between the performance coefficient of the skills in each set was analyzed using one way Anova, with accepted results with significance level of p≤0,05. The Tukey post hoc was used to identify the difference of the performance coefficient of the skills in each set, with accepted results with significance level of p≤0.05. In case of data not normal, the difference between the performance coefficient of the skills in each set was analyzed using Kruskal Wallis Anova, with accepted results with significance level of p≤0,05. The Dunn post hoc was used to identify the difference of the performance coefficient of the skills in each set, with accepted results with significance level of p≤0.05. After the calculation of the Anova, the new statistic of Cumming (2014) was performed for the significance p to be more precise.

The same statistical models of the sets were applied in the court zone.

The study verified the relation between skills through correlation. In case of data normal, Pearson correlation (r) was used, with accepted results with significance level of p≤0,05. In case of data not normal, Spearman correlation (R) was used, with accepted results with significance level of p≤0,05. The variables studied by the correlations were as follows: serve versus block, block versus defense, reception versus set and set versus attack.

All these statistical treatments were performed according to the procedures of the GraphPad Prism, version 5.0. The histogram, the bar graph and the correlation graph were elaborated according to the procedures of the GraphPad Prism, version 5.0. The bar graph with value of the mean was elaborate in the Excel®.

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RESULTS

The data of the performance coefficient (PC) of the skills of each set were presented in table 1.

The Kolmogorov Smirnov test detected data not normal of the performance coefficient of the 1st and 2nd set of all skills. The Shapiro Wilk test detected data not normal of the performance coefficient of the 3rd set of all skills. The histogram illustrates the data not normal of some skills.

Kruskal Wallis Anova did not identify statistical difference of the performance coefficient of all skills during each set. The results were as follows: serve [H (2) = 2.51, p = 0.28], reception [H (2) = 4.94, p = 0.08], set [H (2) = 0.03, p = 0.98], attack [H (2) = 1.71, p = 0.42], block [H (2) = 1.81, p = 0.40] and defense [H (2) = 3.01, p = 0.22]. The figure 3 illustrates the results.

Table 1 - Performance of the skills in each set – PC, minimum and maximum (min and max), confidence interval of 95% (IC 95%), effect size (ES) and classification.

Skills	1st set	2nd set	3rd set	ES and Classification
Serve	1.91 ± 0.47 (medium) 0 and 3,5 (min and max) 1.82 to 2 (IC 95%)	1.73 ± 0.73 (medium) 0 and 4 1.59 to 1.86	1.87 ± 0.55 (medium) 0 and 3 1.82 to 2	1st and 2nd set = 0,17 (very small) 1st and 3rd set = 0,04 (very small) 2nd and 3rd set = 0,13 (very small)
Reception	2.29 ± 0.47 (high) 0 and 3 2.14 to 2.43	2.39 ± 0.60 (high) 0 and 3 2.29 to 2.50	2.65 ± 0.48 (high) 0 and 3 2.44 to 2.86	1st and 2nd set = 0,10 (very small) 1st and 3rd set = 0,34 (small) 2nd and 3rd set = 0,25 (small)
Set	2.16 ± 0.63 (high) 0 and 3 2.05 to 2.26	2.12 ± 0.70 (high) 0 and 3 2 to 2.24	2.07 ± 0.48 (medium) 0 and 3 1.71 to 2.43	1st and 2nd set = 0,04 (very small) 1st and 3rd set = 0,09 (very small) 2nd and 3rd set = 0,05 (very small)
Attack	2.37 ± 1.11 (high) 0 and 4 2.20 to 2.54	2.24 ± 1.18 (high) 0 and 4 2.07 to 2.42	2.13 ± 1.16 (high) 0 and 4 1.68 to 2.57	1st and 2nd set = 0,12 (very small) 1st and 3rd set = 0,22 (small) 2nd and 3rd set = 0,10 (very small)
Block	1.74 ± 0.92 (medium) 0 and 4 1.62 to 1.86	1.66 ± 0.91 (medium) 0 and 4 1.53 to 1.79	1.86 ± 0.85 (medium) 0 and 4 1.60 to 2.13	1st and 2nd set = 0,08 (very small) 1st and 3rd set = 0,11 (very small) 2nd and 3rd set = 0,19 (very small)
Defense	1.57 ± 1.01 (medium) 0 and 3 1.42 to 1.73	1.41 ± 1.05 (medium) 0 and 3 1.25 to 1.57	1.33 ± 0.88 (medium) 0 and 3 1.03 to 1.64	1st and 2nd set = 0,15 (very small) 1st and 3rd set = 0,23 (small) 2nd and 3rd set = 0,08 (very small)

Legend: Classification of the PC: 0 to 1 (low), 1,1 to 2 (medium) and 2,1 to 3 or more (high).

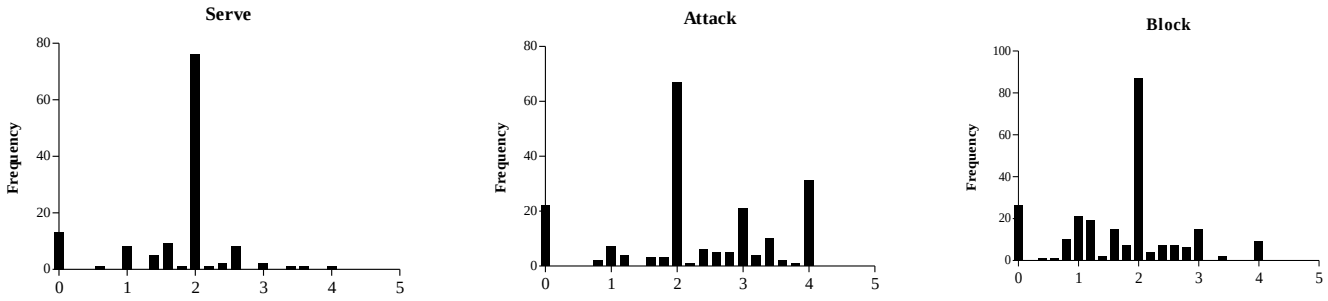

Figure 2 - Histogram.

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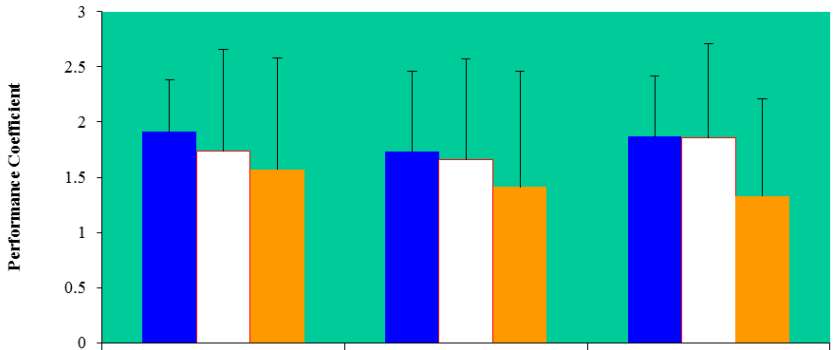
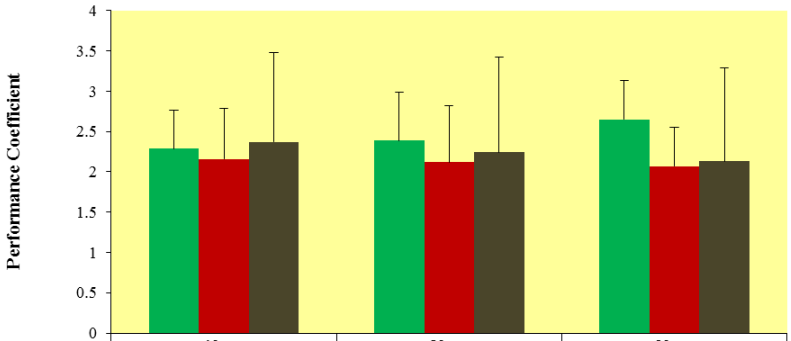


	1° set	2° set	3° set
Serve	1.91	1.73	1.87
Block	1.74	1.66	1.86
Defense	1.57	1.41	1.33



	1° set	2° set	3° set
Reception	2.29	2.39	2.65
Set	2.16	2.12	2.07
Attack	2.37	2.24	2.13

Figure 3 - Result of the performance coefficient of the skills of each set.

Table 2 - Results of the new statistic of the skills of each set.

Serve	Overlap	p	Reception	Overlap	p	Set	Overlap	p
1st set x 2nd set	1.28	0.29	1st set x 2nd set	1.70	0.65	1st set x 2nd set	1.70	0.65
1st set x 3rd set	0.52	0.71	1st set x 3rd set	1	0.42	1st set x 3rd set	0.57	0.80
2nd set x 3rd set	0.73	0.79	2nd set x 3rd set	1	0.59	2nd set x 3rd set	0.57	0.80
Attack	**Overlap**	**p**	**Block**	**Overlap**	**p**	**Defense**	**Overlap**	**p**
1st set x 2nd set	1.43	0.85	1st set x 2nd set	1.77	0.73	1st set x 2nd set	1.82	0.78
1st set x 3rd set	0.49	0.77	1st set x 3rd set	0.73	0.84	1st set x 3rd set	0.87	0.75
2nd set x 3rd set	0.80	0.93	2nd set x 3rd set	0.73	0.69	2nd set x 3rd set	0.87	0.87

Legend: n = 10 or more: Overlap of 0,50 or less* and p≤0,05* (statistical difference).

After of the calculation of the Kruskal Wallis Anova, the researcher practiced the new statistic of Cumming (2014) with the data of each set. The new statistic did not identify statistical difference of the performance coefficient of the serve, of the reception and of the set because the mean did not had the p less or equal the 0.05 and overlap of the confidence interval of 95% was not 0.50 or less (Cumming and Finch, 2005; Cumming, Fidler and Vaux, 2007). The table 2 shows the results of the skills of each set.

Therefore, new statistic detects statistical difference when the p and the confidence interval of 95% (is the overlap) have difference.

The table 3 shows the performance coefficient (PC) of the skills of all the 15 matches or 34 sets.

The figure 4 shows in ascending order the performance of the skills of the match.

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Table 3 - Performance of the skills of the match.

Skills	Match	IC 95%
Serve	1.82 ± 0.61 (medium)	1.74 to 1.90
Reception	2.37 ± 0.67 (high)	2.29 to 2.45
Set	2.13 ± 0.68 (high)	2.06 to 2.21
Attack	2.29 ± 1.15 (high)	2.17 to 2.41
Block	1.72 ± 0.91 (medium)	1.63 to 1.80
Defense	1.48 ± 1.02 (medium)	1.37 to 1.58

Legend: Classification of the PC: 0 to 1 (low), 1,1 to 2 (medium) and 2,1 to 3 or more (high).

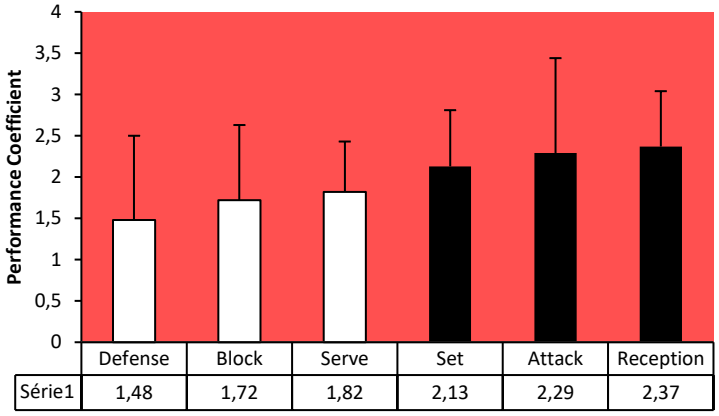

Figure 4 - Performance coefficient of the 15 matches (n = 34 sets) of the male master volleyball of the category 35 years or more.

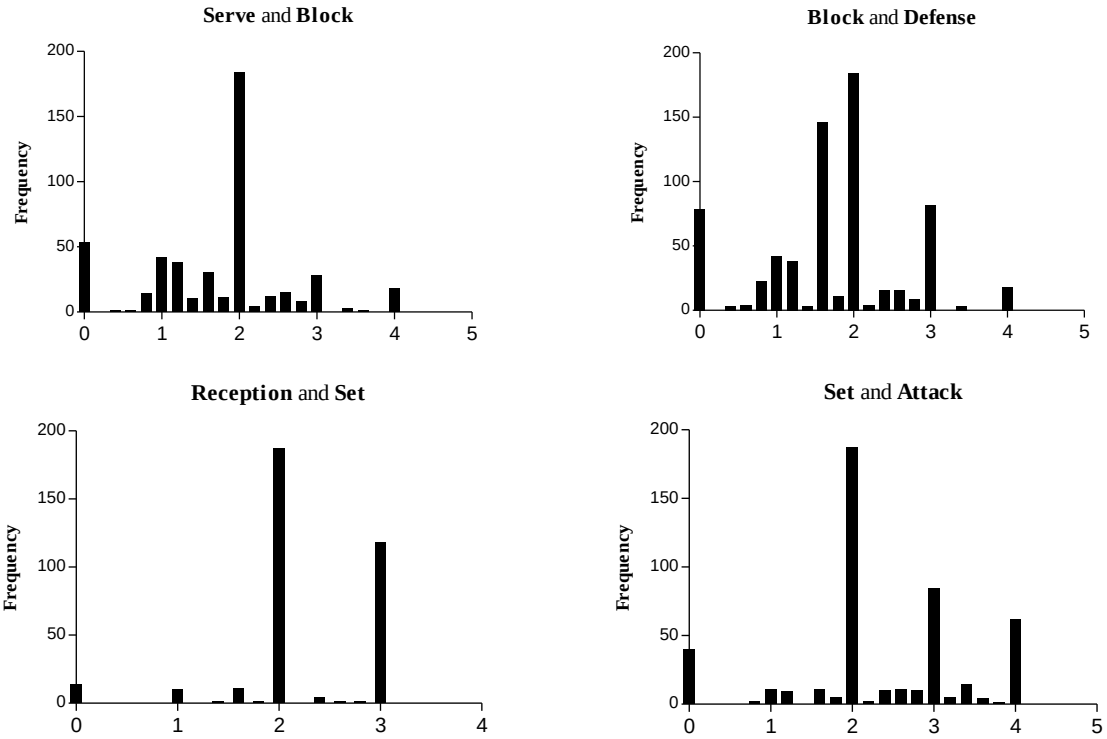

Figure 5 - Histogram.

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The Kolmogorov Smirnov test detected data not normal of the performance coefficient of the skills of the correlation. The histogram illustrates the data not normal of the skills.

The researcher verified the relation between the skills through of the Spearman correlation (R). The table 4 shows the results.

The figure 6 shows the correlation graphics.

Table 4 - R Spearman of the skills.

Variable	R	p	IC 95%
serve x block	0.18 (very low)	0.003*	0.05 to 0.31
block x defense	0.03	0.45	-0.06 to 0.14
reception x set	-0.04	0.47	-0.16 to 0.08
set x attack	-0.04	0.41	-0.15 to 0.06

Legend: p≤0.05* (statistical difference).

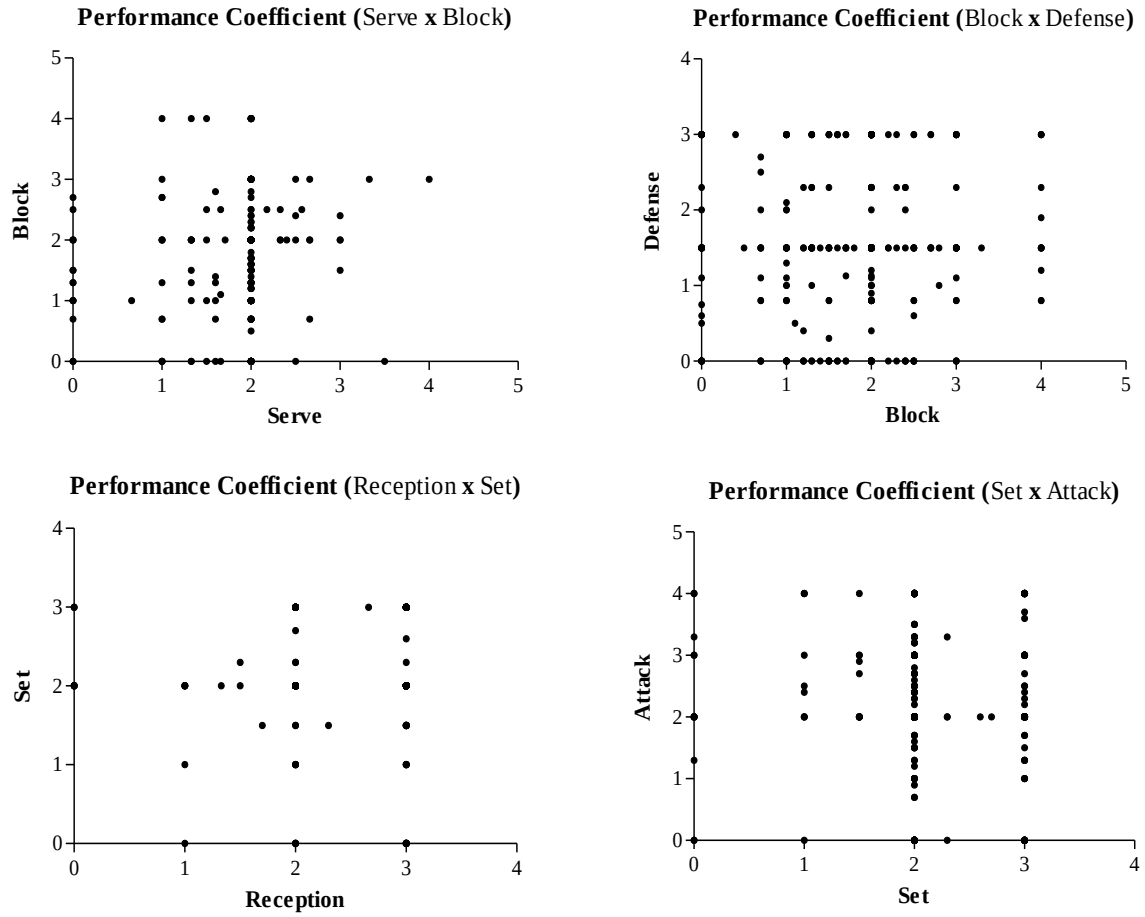

Figure 6 - Result of the correlation about the performance coefficient of the skill.

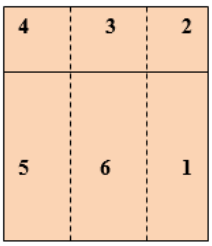

Figure 7 - Court zone of the volleyball.

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Table 5 - Performance of the serve in each court zone - PC, minimum and maximum (min and max), confidence interval of 95% (IC 95%), effect size (ES) and classification.

Skill	Zone 1	Zone 5	Zone 6	ES and Classification
Serve	1.77 ± 0.63 (medium) 0 and 3,5 (min and max) 1.66 to 1.88 (IC 95%)	1.85 ± 0.63 (medium) 0 and 4 1.70 to 2	1.89 ± 0.56 (medium) 0 and 3 1.74 to 2.05	zone 1 and zone 2 = 0.08 (very small) zone 1 and zone 5 = 0.12 (very small) zone 5 and zone 6 = 0.04 (very small)

Legend: Classification of the PC: 0 to 1 (low), 1.1 to 2 (medium) and 2.1 to 3 or more (high).

The researcher determined the performance coefficient of the skill in each court zone. The volleyball is composed of six zones and the figure 7 illustrates the zones.

The data of the performance coefficient (PC) of the serve of each court zone were presented in table 5.

The Kolmogorov Smirnov test detected data not normal of the performance coefficient of the serve in each court zone that the volleyball player practiced the skill. The histogram illustrates the data not normal of the serve.

Kruskal Wallis Anova did not identify statistical difference of the performance coefficient of the serve of each court zone that the volleyball player practiced the skill, H (2) = 2.45, p = 0.29. The figure 9 illustrates the results.

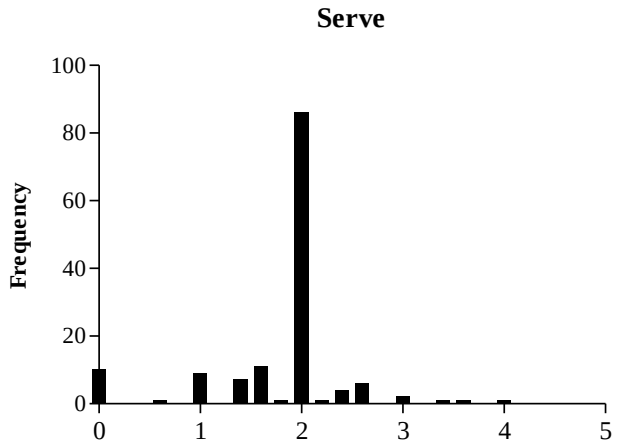

Figure 8 - Histogram.

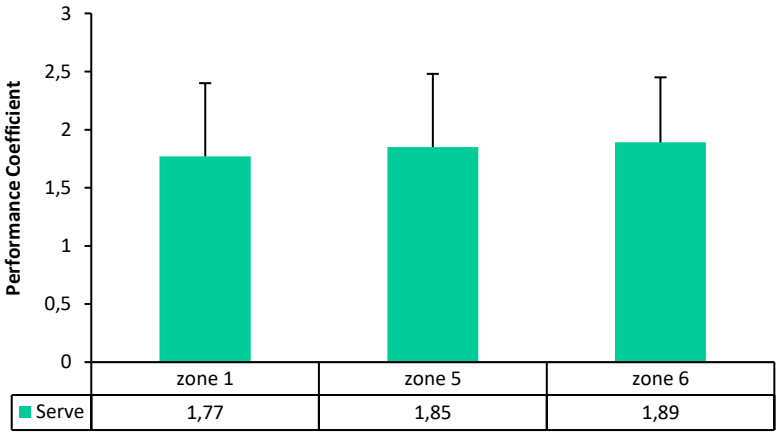

Figure 9 - Performance coefficient of the serve of each court zone (15 matches or 34 sets).

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Table 6 - Results of the new statistic of the serve of each court zone.

Serve	Overlap	p
zone 1 x zone 5	1.22	0.27
zone 1 x zone 6	1.30	0.32
zone 5 x zone 6	1.83	1

Legend: n = 10 or more: Overlap of 0.50 or less* and p≤0.05* (statistical difference).

Table 7 - Performance of the block in each court zone.

Skill	Zone 2	Zone 3	Zone 4	ES and Classification
Block	1.68 ± 0.86 (medium) 0 and 4 (min and max) 1.55 to 1.81 (IC 95%)	1.75 ± 1 (medium) 0 and 4 1.58 to 1.92	1.71 ± 0.92 (medium) 0 and 4 1.57 to 1.86	zone 2 and zone 3 = 0.07 (very small) zone 2 and zone 4 = 0.03 (very small) zone 3 and zone 4 = 0.04 (very small)

Legend: Classification of the PC: 0 to 1 (low), 1.1 to 2 (medium) and 2.1 to 3 or more (high).

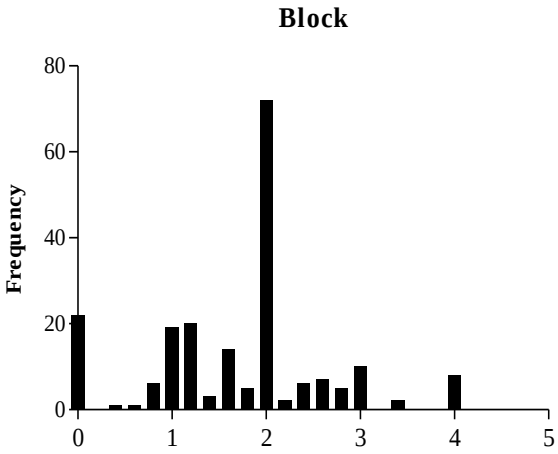

Figure 10 - Histogram.

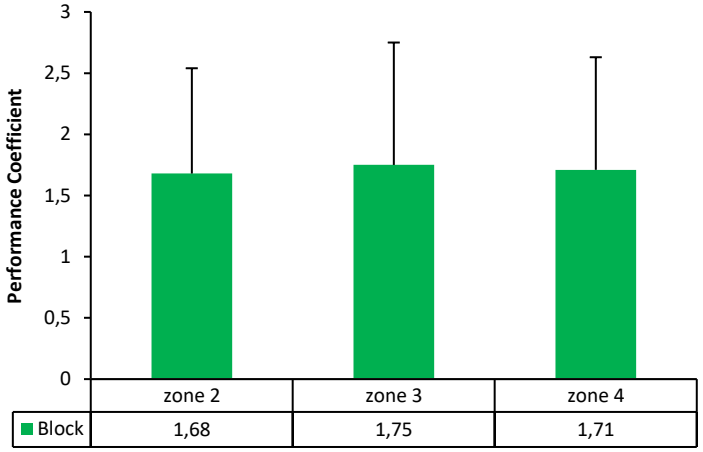

Figure 11 - Performance coefficient of the block of each court zone (15 matches or 34 sets).

The new statistic did not identify statistical difference of the performance coefficient of the serve of each court zone. The table 6 shows the results.

The data of the performance coefficient (PC) of the block of each court zone were presented in table 7.

The Kolmogorov Smirnov test detected data not normal of the performance coefficient of the block in each court zone that the volleyball player practiced the skill. The histogram illustrates the data not normal of the block.

Kruskal Wallis Anova did not identify statistical difference of the performance coefficient of the block of each court zone that the volleyball player practiced the skill, H (2) = 1.45, p = 0.48. The figure 11 illustrates the results.

The new statistic did not identify statistical difference of the performance coefficient of the block of each court zone. The table 8 shows the results.

The data of the performance coefficient (PC) of the defense of each court zone were presented in table 9.

Table 8 - Results of the new statistic of the block of each court zone.

Block	Overlap	p
zone 2 x zone 3	1.44	0.43
zone 2 x zone 4	1.37	0.37
zone 3 x zone 4	1.78	1

Legend: n = 10 or more: Overlap of 0.50 or less* and p≤0.05* (statistical difference).

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Table 9 - Performance of the defense in each court zone.

Zone	Defense	Min and Max	IC 95%	ES and Classification
1 (back zone)	1.35 ± 1 (medium)	0 and 3	1.13 to 1.56	zone 1 and zone 2 = 0.12 (very small) zone 1 and zone 3 = 0.41 (small) zone 1 and zone 4 = 0.01 (very small) zone 1 and zone 5 = 0.15 (very small) zone 1 and 6 = 0.29 (very small)
5 (back zone)	1.20 ± 1.06 (medium)	0 and 3	0.95 to 1.14	zone 5 and zone 2 = 0.27 (small) zone 5 and zone 3 = **0.55** (**medium**) zone 5 and zone 4 = 0.16 (very small) zone 5 and zone 6 = 0.44 (small)
6 (back zone)	1.64 ± 1 (medium)	0 and 3	1.43 to 1.84	zone 6 and zone 2 = 0.17 (very small) zone 6 and zone 3 = 0.12 (very small) zone 6 and zone 4 = 0.24 (small)
2 (front zone)	1.47 ± 1 (medium)	0 and 3	1.15 to 2.02	zone 2 and zone 3 = 0.29 (small) zone 2 and zone 4 = 0.11 (very small)
3 (front zone)	1.76 ± 0.98 (medium)	0 and 3	1.51 to 2.02	zone 3 and zone 4 = 0.39 (small)
4 (front zone)	1.36 ± 0.98 (medium)	0 and 3	1.04 to 1.67	-

Legend: Classification of the PC: 0 to 1 (low), 1.1 to 2 (medium) and 2.1 to 3 or more (high).

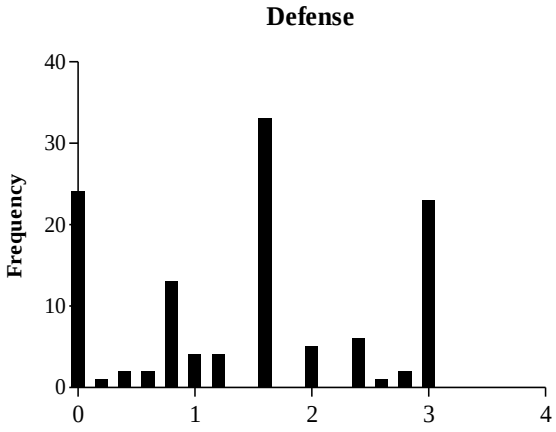

Figure 12 - Histogram.

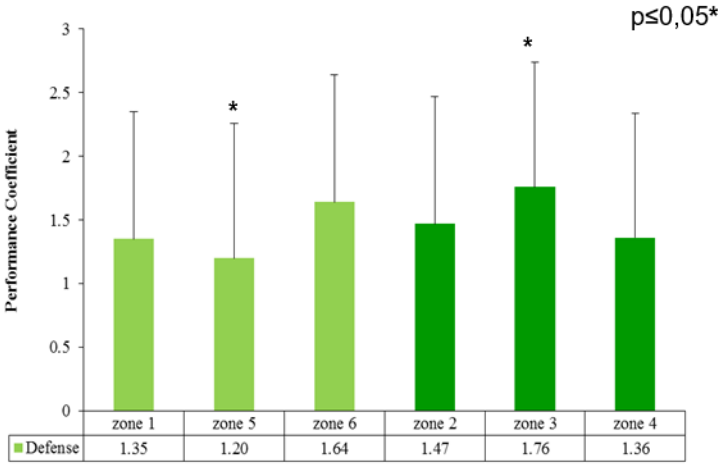

Figure 13 - Performance coefficient of the defense of each court zone (15 matches or 34 sets).

The Kolmogorov Smirnov test detected data not normal of the performance coefficient of the defense in each court zone that the volleyball player practiced the skill. The histogram illustrates the data not normal of the defense.

Kruskal Wallis Anova identified statistical difference of the performance coefficient of the defense of each court zone that the volleyball player practiced the skill, H (5) = 15.88, p = 0.007. The post hoc Dunn detected statistical difference (p≤0.05) between the zone 5 (mean = 1.20) versus the zone 3 (mean = 1.76) – difference in rank sum = -63.77. The figure 13 illustrates the results.

The new statistic detected statistical difference in a comparison of the defense, zone 5 (back zone) versus the zone 3 (front zone). The table 10 shows the results.

Table 10 - Results of the new statistic of the defense of each court zone.

Defense	Overlap	p	Defense	Overlap	p	Zone	Overlap	p
zone 1 x zone 2	1.57	0.57	zone 5 x zone 3	-0.05*	0.004*	zone 2 x zone 3	0.95	0.14
zone 1 x zone 3	0.09*	0.11	zone 5 x zone 4	1.64	0.61	zone 2 x zone 4	1.65	0.65
zone 1 x zone 4	1.82	1	zone 5 x zone 6	1.17	0.11	zone 3 x zone 4	0.61	0.05*
zone 1 x zone 5	1.55	0.52	zone 6 x zone 2	1.23	0.28			
zone 1 x zone 6	0.57	0.04*	zone 6 x zone 3	1.57	0.54			
zone 5 x zone 2	1.27	0.30	zone 6 x zone 4	0.86	0.11			

Legend: n = 10 or more: Overlap of 0.50 or less* and p≤0.05* (statistical difference).

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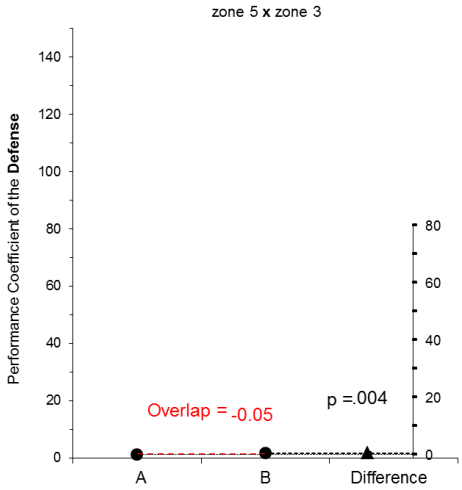

Figure 14 - Result of the statistical difference of the defense of each court zone.

Table 11 - Performance of the set in each court zone.

Zone	Set	Min and Max	IC 95%	ES and Classification
1 (back zone)	1.80 ± 0.64 (medium)	0 and 3	1.63 to 1.98	zone 1 and zone 2 = 0.41 (small) zone 1 and zone 3 = **0.53** (**medium**) zone 1 and zone 4 = 0.14 (very small) zone 1 and zone 5 = 0.16 (very small) zone 1 and 6 = 0.26 (small)
5 (back zone)	1.96 ± 0.52 (medium)	0 and 3	1.77 to 2.16	zone 5 and zone 2 = 0.25 (small) zone 5 and zone 3 = 0.38 (small) zone 5 and zone 4 = 0.02 (very small) zone 5 and zone 6 = 0.10 (very small)
6 (back zone)	2.06 ± 0.50 (medium)	0 and 3	1.77 to 2.16	zone 6 and zone 2 = 0.15 (very small) zone 6 and zone 3 = 0.28 (small) zone 6 and zone 4 = 0.12 (very small)
2 (front zone)	2.21 ± 0.87 (high)	0 and 3	2.02 to 2.40	zone 2 and zone 3 = 0.13 (very small) zone 2 and zone 4 = 0.27 (small)
3 (front zone)	2.34 ± 0.57 (high)	0 and 3	2.19 to 2.49	zone 3 and zone 4 = 0.40 (small)
4 (front zone)	1.94 ± 0.16 (medium)	1,5 and 2	1.88 to 2	-

Legend: Classification of the PC: 0 to 1 (low), 1.1 to 2 (medium) and 2.1 to 3 or more (high).

The figure 14 illustrates the results with statistical difference of the defense, zone 5 (back zone) versus the zone 3 (front zone).

Therefore, the significance p and new statistic detected statistical difference during the defense of the zone 5 (back zone) versus the zone 3 (front zone). Then, the study detected only statistical difference in one comparison.

The data of the performance coefficient (PC) of the set of each court zone were presented in table 11.

The Kolmogorov Smirnov test detected data not normal of the performance coefficient of the set in each court zone that the volleyball player practiced the skill. The histogram illustrates the data not normal of the set.

Kruskal Wallis Anova identified statistical difference of the performance coefficient of the set of each court zone that the volleyball player practiced the skill, H (5) = 37.89, p = 0.0001. The post hoc Dunn detected statistical difference ($p \leq 0.05$) of the following comparisons: zone 2 (mean = 2.21) versus zone 1 (mean = 1.80) - difference in rank sum = 59.04, zone 5 (mean = 1.96) - difference in rank sum = 47.38 and zone 4 (1.94) - difference in rank sum = 54.55. Zone 3 (mean = 2.34) versus zone 1 - difference in rank sum = 65.70, zone 5 - difference in rank sum = 54.04 and zone 4 - difference in rank sum = 61.21. The figure 16 illustrates the results.

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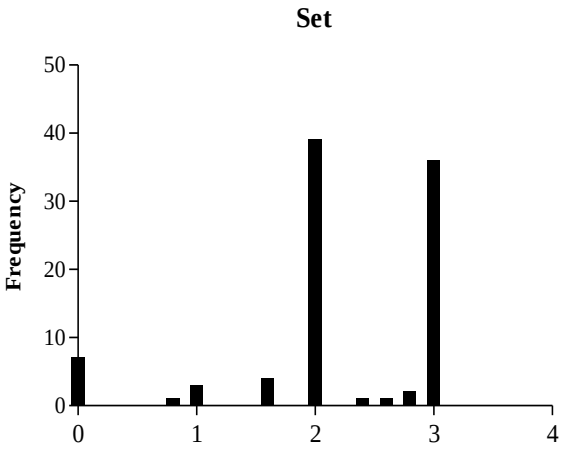

Figure 15 - Histogram.

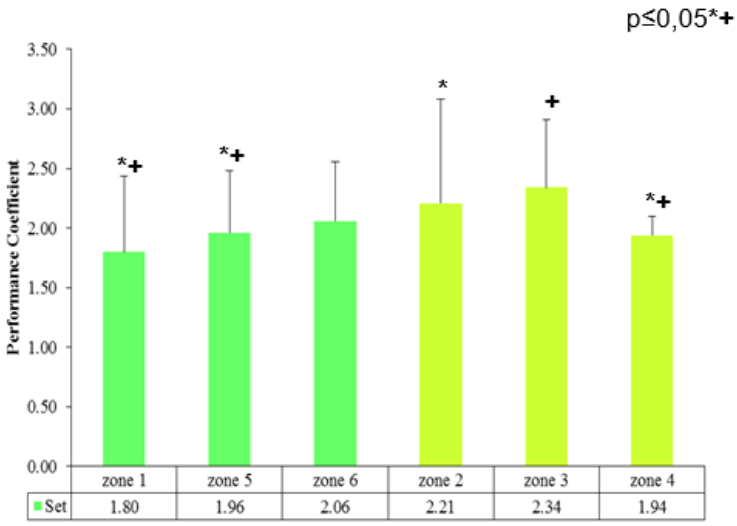

Figure 16 - Performance coefficient of the set of each court zone (15 matches or 34 sets).

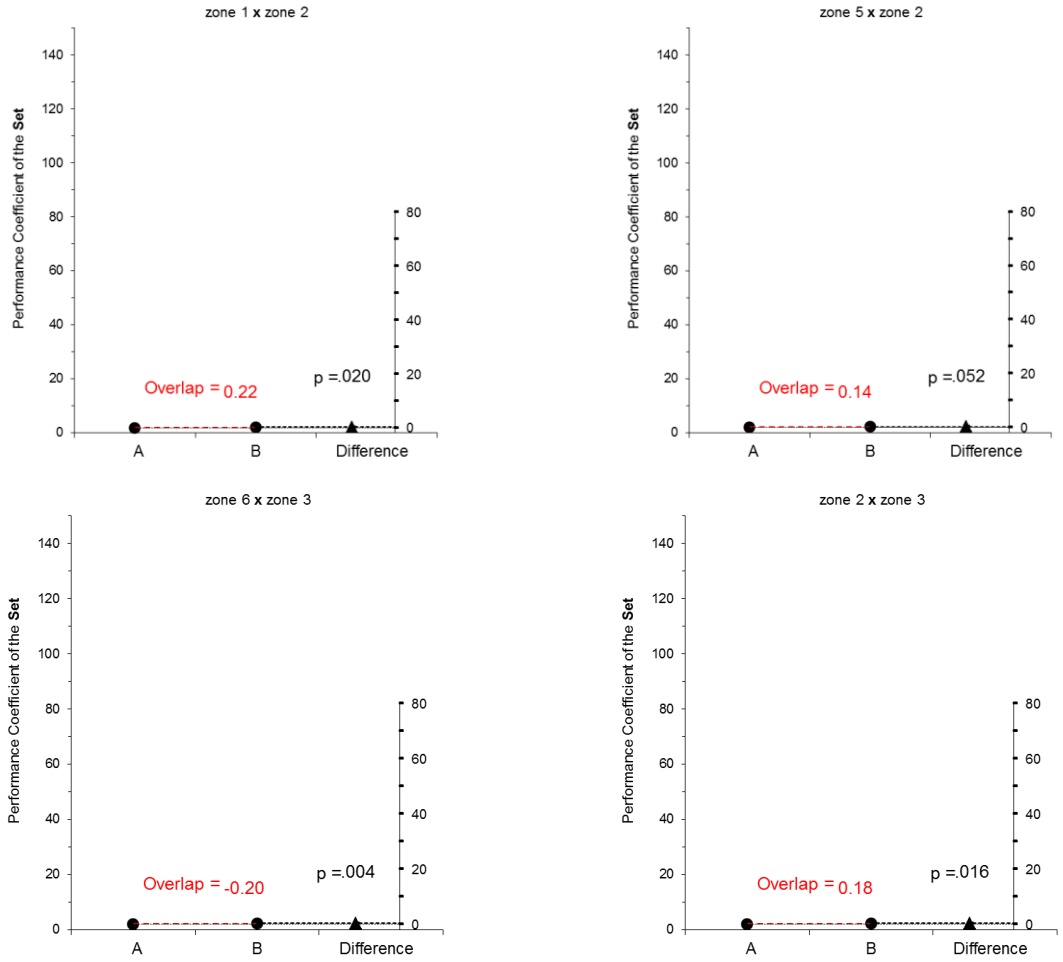

Figure 17 - Result of the statistical difference of the set of each court zone.

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Table 12 - Results of the new statistic of the set of each court zone.

Set	Overlap	p	Set	Overlap	p	Set	Overlap	p
zone 1 x zone 2	0,22*	0,02*	zone 5 x zone 3	-0.60	0.001*	zone 2 x zone 3	0,18*	0.01*
zone 1 x zone 3	-1.09	0.001*	zone 5 x zone 4	0.01*	1	zone 2 x zone 4	0.01*	0.51
zone 1 x zone 4	1.18	0.40	zone 5 x zone 6	1.24	0.28	zone 3 x zone 4	-3.07	0.001*
zone 1 x zone 5	1.36	0.41	zone 6 x zone 2	0.60	0.10			
zone 1 x zone 6	0.57	0.05*	zone 6 x zone 3	-0,20*	0,004*			
zone 5 x zone 2	0,14*	0,05*	zone 6 x zone 4	0.01*	0.19			

Legend: n = 10 or more: Overlap of 0,50 or less* and p≤0,05* (statistical difference).

Table 13 - Performance of the attack in each court zone.

Zone	Attack	Min and Max	IC 95%	ES and Classification
1 (back zone)	2.24 ± 0.84 (high)	0 and 4	1.90 to 2.57	zone 1 and zone 2 = 0.01 (very small) zone 1 and zone 3 = 0.21 (small) zone 1 and zone 4 = 0.08 (very small) zone 1 and zone 5 = **0.51** (**medium**) zone 1 and 6 = 0.48 (very small)
5 (back zone)	1.71 ± 1.06 (medium)	0 and 4	1.09 to 2.33	zone 5 and zone 2 = **0.53** (**medium**) zone 5 and zone 3 = **0.73** (**medium**) zone 5 and zone 4 = **0.60** (**medium**) zone 5 and zone 6 = 0.04 (very small)
6 (back zone)	1.75 ± 1.19 (medium)	0 and 4	1.37 to 2.13	zone 6 and zone 2 = **0.49** (**medium**) zone 6 and zone 3 = **0.69** (**medium**) zone 6 and zone 4 = **0.56** (**medium**)
2 (front zone)	2.25 ± 1.15 (high)	0 and 4	2.03 to 2.46	zone 2 and zone 3 = 0.20 (very small) zone 2 and zone 4 = 0.07 (very small)
3 (front zone)	2.45 ± 1.01 (high)	0 and 4	2.24 to 2.66	zone 3 and zone 4 = 0.13 (very small)
4 (front zone)	2.32 ± 1.21 (high)	0 and 4	2.10 to 2.54	-

Legend: Classification of the PC: 0 to 1 (low), 1.1 to 2 (medium) and 2.1 to 3 or more (high).

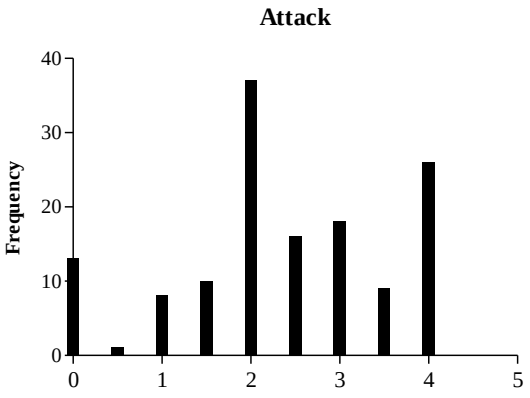

Figure 18 - Histogram.

p≤0,05+

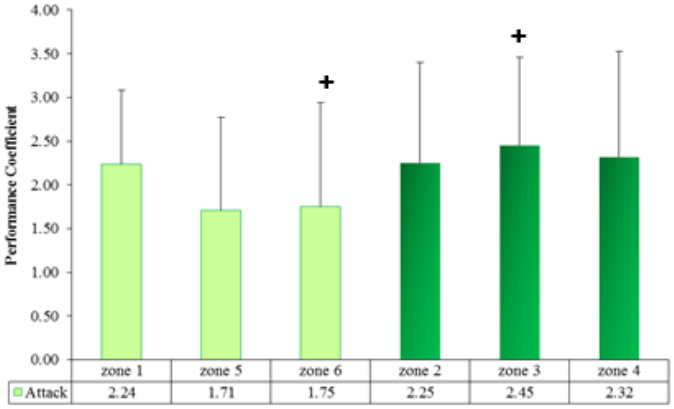

Figure 19 - Performance coefficient of the attack of each court zone (15 matches or 34 sets).

The new statistic detected statistical difference in the following comparisons of the set: zone 1 (back zone) versus the zone 2 (front zone), zone 5 (back zone) versus the zone 2 (front zone), zone 6 (back zone) versus the zone 3 (front zone) and zone 2 (front zone) versus the zone 3 (front zone). The table 12 shows the results.

The figure 17 illustrates the results with statistical difference of the set.

Therefore, the significance p and the new statistic detected statistical difference of the set of each court zone only in two comparisons, zone 1 versus the zone 2 and zone 5 versus the zone 2. Then, the study detected only statistical difference in two comparisons.

The data of the performance coefficient (PC) of the attack of each court zone were presented in table 13.

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The Kolmogorov Smirnov test detected data not normal of the performance coefficient of the attack in each court zone that the volleyball player practiced the skill. The histogram illustrates the data not normal of the attack.

Kruskal Wallis Anova identified statistical difference of the performance coefficient of the attack of each court zone that the volleyball player practiced the skill, H (5) = 14.87, p = 0.01. The post hoc Dunn detected statistical difference (p≤0.05) between the zone 6 (mean = 1.75) versus the zone 3 (mean = 2.45) – difference in rank sum = -68.75. The figure 19 illustrates the results.

The new statistic detected statistical difference in the following comparisons of the attack: zone 1 (back zone) versus the zone 6 (back zone), zone 5 (back zone) versus the zone 3 (front zone), zone 6 (back zone) versus the zone 2 (front zone), zone 6 (back zone) versus the zone 3 (front zone) and zone 6 versus the zone 4 (front zone). The table 14 shows the results.

The figure 20 illustrates the results with statistical difference of the attack.

Table 14 - Results of the new statistic of the attack of each court zone.

Attack	Overlap	p	Attack	Overlap	p	Attack	Overlap	p
zone 1 x zone 2	1.54	1	zone 5 x zone 3	0.22*	0.01*	zone 2 x zone 3	1.02	0.17
zone 1 x zone 3	1.24	0.34	zone 5 x zone 4	0.53	0.07	zone 2 x zone 4	1.50	0.48
zone 1 x zone 4	1.64	0.68	zone 5 x zone 6	1.58	1	zone 3 x zone 4	1.51	0.49
zone 1 x zone 5	0.88	0.08	zone 6 x zone 2	0.05*	0.008*			
zone 1 x zone 6	0.42*	0.03*	zone 6 x zone 3	-0.47*	0.001*			
zone 5 x zone 2	0.71	0.08	zone 6 x zone 4	-0.17*	0.005*			

Legend: n = 10 or more: Overlap of 0,50 or less* and p≤0,05* (statistical difference).

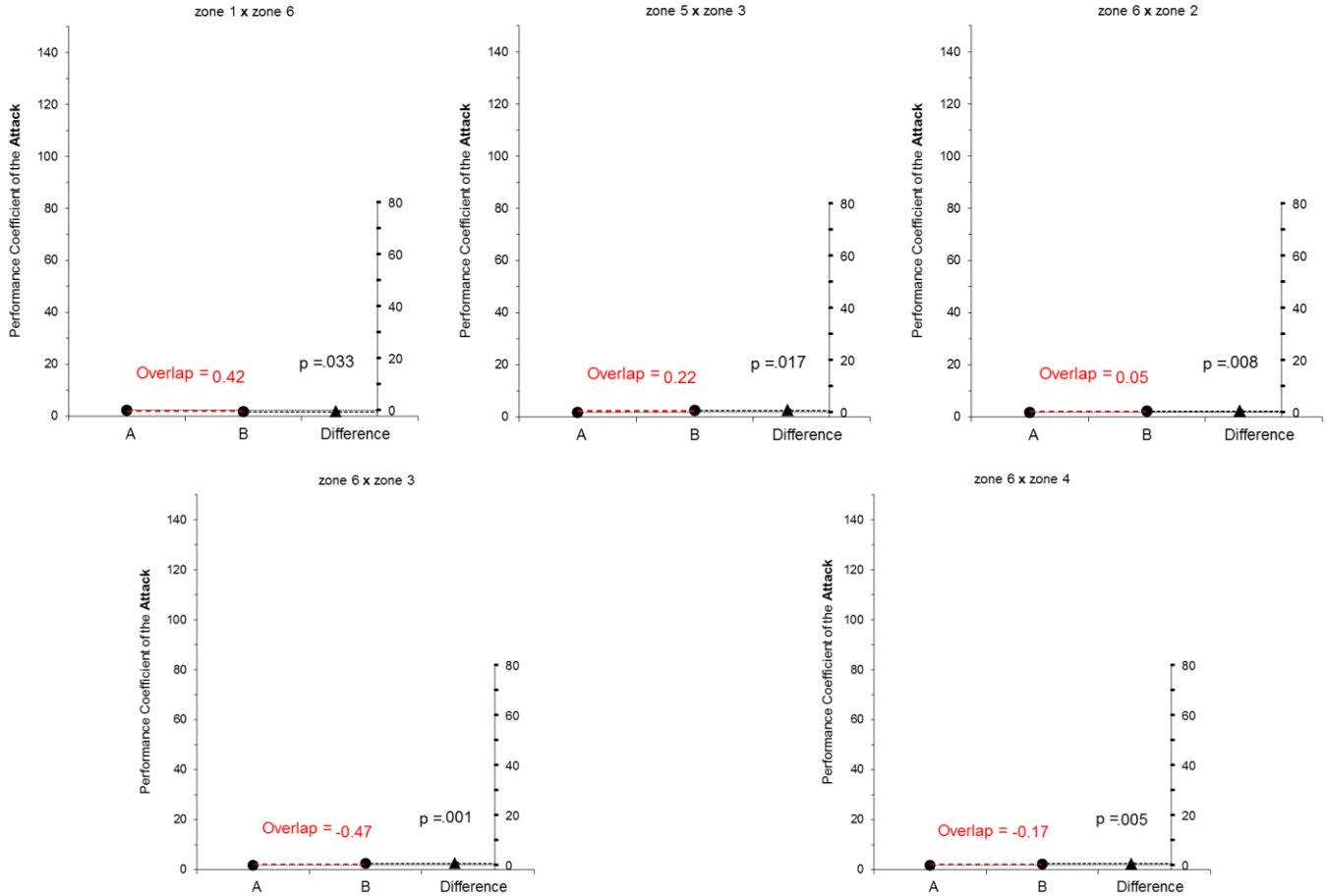

Figure 20 - Result of the statistical difference of the attack of each court zone.

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Table 15 - Performance of the reception in each court zone.

Zone	Reception	Min and Max	IC 95%	ES and Classification
1 (back zone)	2.39 ± 0.66 (high)	0 and 3	2.24 to 2.53	zone 1 and zone 2 = **0.60** (**medium**) zone 1 and zone 3 = 0.43 (small) zone 1 and zone 4 = 0.14 (very small) zone 1 and zone 5 = 0.08 (very small) zone 1 and zone 6 = 0.02 (very small)
5 (back zone)	2.31 ± 0.06 (high)	0 and 3	2.16 to 2.46	zone 5 and zone 2 = **0.68** (**medium**) zone 5 and zone 3 = **0.51** (**medium**) zone 5 and zone 4 = 0.22 (small) zone 5 and zone 6 = 0.06 (very small)
6 (back zone)	2.37 ± 0.65 (high)	0 and 3	2.23 to 2.51	zone 6 and zone 2 = **0.62** (**medium**) zone 6 and zone 3 = 0.45 (small) zone 6 and zone 4 = 0.16 (very small)
2 (front zone)	3 (high)	3 and 3	3 to 3	zone 2 and zone 3 = 0.14 (very small) zone 2 and zone 4 = 0.43 (small)
3 (front zone)	2.83 ± 0.40 (high)	2 and 3	2.40 to 3.26	zone 3 and zone 4 = 0.28 (small)
4 (front zone)	2.53 ± 0.87 (high)	0 and 3	2 to 3.06	-

Legend: Classification of the PC: 0 to 1 (low), 1.1 to 2 (medium) and 2.1 to 3 or more (high).

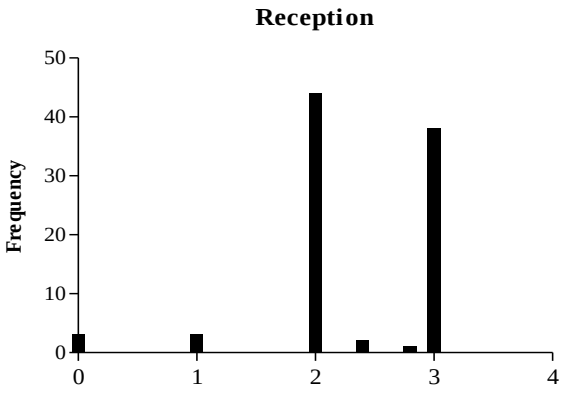

Figure 21 - Histogram.

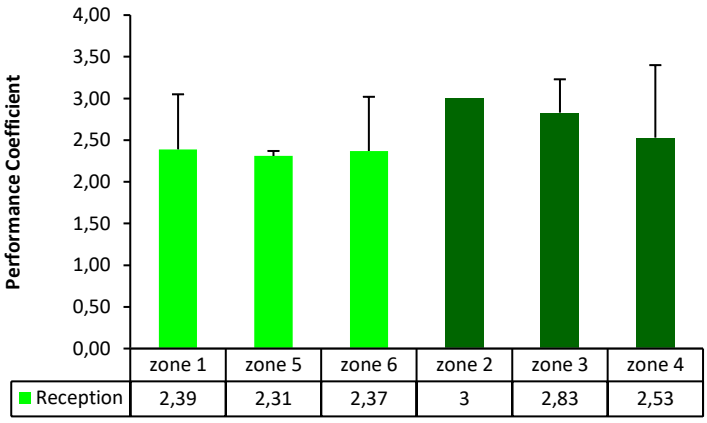

Figure 22 - Performance coefficient of the reception of each court zone (15 matches or 34 sets).

Table 16 - Results of the new statistic of the reception of each court zone.

Reception	Overlap	p	Reception	Overlap	p	Reception	Overlap	p
zone 1 x zone 2	-7,10	0,08	zone 5 x zone 3	0,17	0,04*	zone 2 x zone 3	0.01*	0,43
zone 1 x zone 3	0,55	0,11	zone 5 x zone 4	0,83	0,28	zone 2 x zone 4	-0,07*	0,31
zone 1 x zone 4	0,86	0,59	zone 5 x zone 6	2	1	zone 3 x zone 4	1,34	0,40
zone 1 x zone 5	1,23	0,27	zone 6 x zone 2	-8,75	0,04*			
zone 1 x zone 6	1,24	0,28	zone 6 x zone 3	0,55	0,11			
zone 5 x zone 2	-9,01	0,04*	zone 6 x zone 4	0,85	0,28			

Legend: n = 10 or more: Overlap of 0,50 or less* and p≤0,05* (statistical difference).

Therefore, the significance p and new statistic detected statistical difference during the attack of the zone 6 (back zone) versus the zone 3 (front zone). Then, the study detected only statistical difference in one comparison.

The data of the performance coefficient (PC) of the reception of each court zone were presented in table 15.

The Kolmogorov Smirnov test detected data not normal of the performance coefficient of the reception in each court zone that the volleyball player practiced the skill. The histogram illustrates the data not normal of the reception.

Kruskal Wallis Anova did not identify statistical difference of the performance coefficient of the reception of each court zone that the volleyball player practiced the skill, H (5) = 9.44, p = 0.09. The figure 22 illustrates the results.

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The new statistic did not identify statistical difference of the performance coefficient of the reception of each court zone. The table 16 shows the results.

DISCUSSION

The male master volleyball of the category 35 years or more had the reception and the attack with high performance coefficient during the three sets – see table 1. Then, the skills were the best techniques practiced by players. The study had similar result of the article of Marques Junior (2017) about the male master volleyball, the best skill were the attack and the reception. The second best skill was the set, the result was with high (1st and 2nd set) and medium (3rd set) performance coefficient. Only article about the male master volleyball of the category 35 year or more detected the same result (Marques Junior, 2017).

However, the best skills (attack, reception and set) of the male master volleyball of the category 35 years or more had similar result during the sets because the significance p and the new statistic did not identify statistical difference. Other result, of the effect size – see table 1, evidenced very small or small effect of the performance coefficient of the reception, of the set and of the attack during the sets. These results confirmed similar performance coefficient of these three skills (attack, reception and set) during the sets.

Coleman (2002) informed about the performance coefficient of the serve, of the block and of the defense this study was with a bad performance because the result was 1.87 to less – see table 1. However, the result of the performance coefficient of 1.1 to 2 of the male master volleyball of the category 35 years or more was classified with medium (Marques Junior, 2017).

The worst skills of the male master volleyball were the serve, the block and the defense. These results confirmed the relation between these skills (Mesquita and collaborators, 2013). A bad serve causes a bad block because the opponent`s attack is good. Then, the bad block causes a bad defense because the attack is very strong. However, the relation between the skills had only a statistical difference (serve x block, p = 0.003), but the R was of 0.18, this result was very low second Gaya (2008). The other results did not have statistical difference and this study did not show the relation between the volleyball skills. Maybe it is the statistic model because the studies about this theme use the chi-square (Costa and collaborators, 2017a; Costa and collaborators, 2016).

The worst skills of all matches (15 matches) or of all sets (34 sets) were the defense (performance coefficient or PC of 1.48 ± 1.02), the block (1.72 ± 0.91) and the serve (1.82 ± 0.61) – see table 3 and figure 4. The classification of the performance coefficient of these skills was medium. Then, the coach needs to train more the serve, the block and the defense.

The performance of the court zone was studied. The serve (see table 5 and figure 9) and the block (see table 7 and figure 11) had similar performance of the skill in each court zone. But the defense, back zone (zone 1, 5 and 6) had worse performance than the front zone (zone 2, 3 and 4). The results were similar to the volleyball studies (Marques Junior and Arruda, 2015; Palao and Ibarra, 2015). However, zone 1 (PC of 1.35 ± 1) and zone 5 (PC of 1.20 ± 1.06) (back zone) had worse performance of the defense. Perhaps this defense problem of the zone 1 and 5 can be through of the use of three players in zone 1 or 5 when the attack is of the zone 4 or 2 (Marques Junior, 2017b). The France men`s volleyball team was champion of the World League of 2017 with three volleyball players in zone 1 or 5 during the defense when the attack was of the zone 4 or 2.

The best skills of all matches (15 matches) or of all sets (34 sets) were the set (PC of 2.13 ± 0.68), the attack (2.29 ± 1.15) and the reception (2.37 ± 0.67) – see table 3 and figure 4. The classification of the performance coefficient of these skills was high. Then, the coach needs to train do maintenance training for the set, the attack and the reception.

The study detected the best set of the zone 2 (PC of 2.21 ± 0.87) and of the zone 3 (PC of 2.34 ± 0.57). The zone 2 and 3 is in front zone and this zone facilitates the set. The study detected statistical difference ($p \leq 0.05$ and new statistic) only in two comparisons of the front zone versus the back zone (zone 2 versus the zone 1 and 5). This result was found in other studies, the zone 2 and 3 had the best set (Marques Junior and Arruda,

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2015; Marques Junior, 2017). Therefore, the coach needs to prescribe more training in the other court zones.

The best performance of the attack was practiced in front zone (zone 2, 3 and 4) and in only back zone (zone 1) – see table 13 and figure 13. These results were similar to the only study about the master volleyball (Marques Junior, 2017). However, the medium performance of the attack was in the back zone 5 and 6, the master volleyball player needs of more training in these zones.

The reception was the best skill of the master volleyball because the performance coefficient was high in all court zones. However, the reception was worse in the zone 5 (PC of 2.31 ± 0.69), so the players needs of more training in this zone.

The study had limitations because the researcher did not use sophisticated technology for match analysis of the volleyball skills (Marques Junior, 2010).

CONCLUSION

The match analysis of the skills of the male master volleyball (category 35 year or more) determined the worst skill (serve, block and defense) and the best skill (reception, set and attack). Then, these results are important for the coach prescribe the training.

In conclusion, match analysis is an important “tool” for the master volleyball.

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Revista Brasileira de Prescrição e Fisiologia do Exercício
ISSN 1981-9900 ***versão eletrônica***

Periódico do Instituto Brasileiro de Pesquisa e Ensino em Fisiologia do Exercício

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Recebido para publicação 24/11/2017
Aceito em 01/01/2018