Journal of Human Kinetics volume 70/2019, 235-243 DOI: 10.2478/hukin-2019-0046
Section IV – Behavioural Sciences in Sport

DE GRUYTER OPEN

In Search For Volleyball Entertainment: Impact of New Game Rules on Score and Time-Related Variables

by

Antonio García-de-Alcaraz[1,2], Miguel A. Gómez-Ruano[3], Sophia D. Papadopoulou[4]

The aim of this research was to analyse the impact of various game structures on score and time-related variables in elite volleyball. A total of 114 male matches and 76 female matches (38 matches for each tournament) were analysed in under-23 world championships. An observational design was implemented to measure match duration, points scored per match and set, set point differences, tournament phase, match balance, and set tendencies in various game structures (set to 21, to 25 or to 15 points) in male and female categories. Standardised differences in mean values showed that a 15-point set game structure led to shortest matches and smallest time variability in match duration, the largest number of points per match, and greatest equality in terms of set score differences in both the male and the female category. The use of various game structures in training may be useful to coaches and conditioning specialists when planning training schemes and sessions, by introducing different game structures to manage volume and intensity in training more effectively. These results may also be useful to local and/or national volleyball federations willing to attract new young players, to promote learning and to render volleyball a fun activity, by implementing S15 at initial stages. In addition, they could be useful to international federations or committees, so as to attract larger audiences and sponsors interested in more appealing matches with high levels of competitiveness and entertainment.

Key words: *net sports, rule modifications, performance analysis, competition management.*

Introduction

Game rules (GR) in any sport constitute a framework which constrains the type of behaviours allowed, leading to a particular sport performance. Thus, changes in GR promote new affordances that influence players' or teams' behaviours and/or performances (McGarry et al., 2002). Such changes are usually introduced in youth categories to promote skill learning, but may also be implemented in professional categories, so as to reduce risk of injuries (Williams et al., 2005) or increase levels of entertainment that attract larger audiences, sponsors and the media (Eaves et al., 2008).

Historically, GR changes in volleyball may be divided into three stages: (a) an initial stage, defined by basic features of the game (the number of players in the court, the number of time-outs, coach's behaviour, etc.), (b) a second stage in which volleyball is described as a competitive sport, with special focus on game continuity due to the superiority of the attack phase over the dig phase (touch types: over and under knees, block technique: hands in the opponent's area, three touches allowed after block contact, introduction of the libero player, etc.) and (c) a current stage with special focus on rendering volleyball entertaining (rally-point system: one rally allows a point for any team, technical time-out that enables advertisements, etc.) with the aim of attracting wider audiences and more sponsors (Kovacs, 2009).

Focusing on volleyball as a means of entertainment, the introduction of the rally-point

[1] - *Faculty of Education. University of Almeria, Almeria, Spain.*
[2] - *LFE Research Group. Faculty of Physical Activity and Sport Sciences-INEF. Universidad Politécnica de Madrid, Madrid, Spain.*
[3] - *Faculty of Physical Activity and Sport Sciences-INEF. Universidad Politécnica de Madrid, Madrid, Spain.*
[4] - *Faculty of Physical Education & Sports Sciences. Aristotle University of Thessaloniki, Thessaloniki, Greece.*

Authors submitted their contribution to the article to the editorial board.
Accepted for printing in the Journal of Human Kinetics vol. 70/2019 in December 2019.

system has led to little variability in match duration and greater balance in scores, in both volleyball (Fellingham et al., 2009) and beach volleyball (Giatsis, 2003). To sign television agreements, little time variability is crucial (Fellingham et al., 1994; Giatsis, 2003). In addition, the International Volleyball Federation (FIVB) has introduced new GR changes in the game structure (the number of points played per sets and the number of sets played per match) at under-23 world championships in the last years (Stankovic et al., 2017), presumably to render volleyball more attractive to larger audiences. Thus, effective GR features should be accurate and give the way to little variability in terms of minimum score differences between teams at the end of a game (Fellingham et al., 1994). However, no studies have been found on the impact of rule changes on team performance and coaching implications, or which may raise interest or increase uncertainty and excitement in an audience. This type of information would prove essential in ensuring that volleyball becomes a new game under the new rule systems, as well as an entertainment that attracts fans while match duration fits media demands. Hence, a new approach from a long-term teaching and learning process would be needed while new competition structures may lead to a more exciting sport with changes in physical, technical and tactical factors. Thus, the aim of this study was to analyse the impact of different game structures on score and time-related variables in volleyball. Due to the fact that there were no previous studies focused on this issue, practical applications of the current findings may give some new insights for coaches and federations to ensure better training programs and management of competitions.

Methods

Participants

A total of 114 male matches (38 matches played in each under-23 men world championships in 2013, 2015 and 2017), and 76 female matches (38 matches played in each under-23 women world championship in 2015 and 2017) were analysed. Accordingly, a total of 469 sets and 16.001 points in male, and 326 sets and 10.770 points in female volleyball were considered in this study.

Best 12 teams worldwide participated in each tournament. In the 2013 and 2015 tournaments, a team would win a match when winning three out of five sets, while in 2017, a team would win a match when winning four out of seven sets, in both the male and the female category. In 2013, each male set had 21 points, except for the fifth which had 15 points (during this year, the female tournament was played in the same way as in 2015). In 2015, each male and female set had 25 points, except the fifth set which had 15 points (common rally-point system). In 2017, all male and female sets had 15 points. According to the net sport rules, a team wins a set when it scores two points more than its opponent (FIVB, 2017).

Design and procedures

An observational design was implemented (Anguera, 2003) and the variables analysed were as follows:

a) *Gender*: *male* or *female* category.
b) *Game structure*: *S21* (a match is won when winning three out of five sets. The first four sets had 21 points while the last set had 15 points); *S25* (a match is won when winning three out of five sets. The first four sets had 25 points and the last set had 15 points); and *S15* (a match is won when winning four out of seven sets. All sets had 15 points).
c) *Match duration*: match length measured in minutes.
d) *Match* and *set points scored*: amount of points scored by both teams per match or set.
e) *Set difference*: average of point differences scored in all sets played in a match.
f) *Tournament phase*: *group phase* or *eliminatory round* (5^{th} to 8^{th} place, semi-finals and matches for medals).
g) *Match balance*: in terms of quality of opposition, there were *balanced matches* (teams of similar quality) or *unbalanced matches* (teams of dissimilar quality). A *K*-means cluster analysis (Schwartz's Bayesian) using sets and points won and lost by each team was used to classify teams ability (García-de-Alcaraz and Marcelino, 2017).
h) *Set trend*: tendency to win or lose a set following the previous set result.

Data were downloaded from official

tournament websites (www.fivb.org) and recorded in an ad-hoc excel spreadsheet. To ensure the quality of the process, an Intra-Class Correlation reliability test was conducted and the final values were over .99, using 30% of the sample for this process. Then, the teams' ability was examined. The best teams reached the first eight places of the ranking regardless of the competition system and gender. Finally, match data and set points scored were normalised according to the competition system.

Statistical Analysis

Data were analysed using descriptive and inferential analyses. Inferential tests used were: Kolmogorov-Smirnov, ANOVA with Bonferroni post-hoc (or U-Mann Whitney) and Chi-Square ($p < .05$). Also, magnitude change was calculated by effect size (ES) at 95% confidence intervals (CIs) using standardised differences in mean (SDMs) (Hopkins, 2007). The magnitude threshold was set at 0–0.2 trivial, > 0.2–0.6 small, > 0.6–1.2 moderate, > 1.2–2 large and > 2 very large (Hopkins et al., 2009). Data were analysed with SPSS v.21 (Statistical Package for the Social Sciences, SPSS Inc) and represented graphically with Prism 7.0. (GraphPad Software, Inc).

Results

Matches in S25 in the male category (Table 1) were statistically significantly longer and had greater variability in match duration than S21 ($Z = 5.247$, $p = .001$) and S15 ($F = 3.784$, $p = .001$). There were no statistically significant differences between S21 and S15 in terms of match duration. According to total match points scored, although descriptive data showed more points as the game structure allowed for more points per set, the normalization of data presented a statistically significant increase in points in S15 ($F = 6.116$, $p = .001$ and $Z = 5.813$, $p = .001$) when compared to S25 and S21, respectively. In addition, S25 exhibited a statistically significant increase in points ($Z = 2.270$, $p = .023$) when compared to S21. Regarding points scored per set, only the fifth set showed a statistically significant increase in points in S15 when compared to S25 ($F = 2.257$, $p = .032$). In the female category (Table 1), a statistically significant increase in match duration ($F = 4.043$, $p = .001$) and points scored in third sets ($F = 2.359$, $p = .021$) was found when S25 was compared to S15. However, S15 had a statistically significant increase in match points scored ($F = -5.813$, $p = .001$) when compared to S25. Finally, differences between teams' points scored per set (set difference variable) were statistically significantly smaller in S15 when compared to male's S21 ($F = 3.586$, $p = .001$), male's S25 ($F = 4.579$, $p = .001$) and female's S25 ($F = 3.303$, $p = .002$).

In terms of standardised differences in mean (Figure 1), there was a large difference in match duration between S25 and S21, and a moderate difference between S25 and S15 in both male and female categories, where matches in S25 were the longest. Also, in all categories there were large differences in match points scored in S15 when compared to S21 or S25. Furthermore, there was a large difference in points scored in the fifth set in the male category between S25 and S15, with the largest number of points scored in S15. Finally, only moderate differences in set points differences were found between S21 and S15, and between S25 and S15 in the male category, where the smallest set points differences were found in S15.

Table 2 presents descriptive data of the three game structures when tournament phases in male and female categories were analysed. Comparison between systems was only made by standardised mean differences (Figure 2). There were large differences in match duration in group and eliminatory phases between S25 and S21, and moderate differences between S25 and S15 in the group phase in both categories, while there were large differences in the eliminatory phase in the female category. The longest matches were always found in S25. In terms of points scored per match, S15 exhibited large differences (a greater number of points) when compared to S21 or S25 in all tournament phases and categories. In the male category, results revealed moderate differences in points scored in set 2 at the eliminatory phase when comparing S21 with S25, large differences in points scored in set 4 at the eliminatory phase when comparing S21 with S15, and moderate differences in points scored in set 5 at the group phase when comparing S25 with S15. In all three comparisons, the largest number of points was scored in the system with fewest points in their structure.

Table 1

Match duration, points scored by set and match, and set differences according to game structure and gender

		System-21 (S21)		System-25 (S25)		System-15 (S15)	
		Mean	Sd	Mean	Sd	Mean	Sd
Male							
Total match duration		70.68[b]	18.48	101.53[ac]	25.46	79.41[b]	24.50
Total match points		127.47[bc]	29.28	166.89[ac]	31.60	126.71[ab]	20.47
	Set 1	37.63	5.63	45.58	4.32	26.79	3.83
	Set 2	36.97	4.16	44.50	4.54	26.74	4.45
	Set 3	37.92	5.72	45.08	5.89	27.92	7.78
Total points by set	Set 4	37.67	2.42	46.17	3.46	27.63	4.10
	Set 5	29.00	5.77	24.00[c]	2.28	27.92[b]	4.04
	Set 6	-	-	-	-	27.71	4.03
	Set 7	-	-	-	-	25.43	2.64
Set differences		5.48[c]	2.05	5.66[c]	1.73	4.11[ab]	1.16
Female							
Total match duration		-	-	94.63[c]	22.79	74.55[b]	20.45
Total match points		-	-	153.39[c]	32.28	130.03[b]	35.33
	Set 1	-	-	43.92	5.17	26.11	4.57
	Set 2	-	-	43.11	5.06	24.95	3.56
	Set 3	-	-	44.39[c]	5.64	24.92[b]	2.97
Total points by set	Set 4	-	-	44.50	3.69	26.89	3.45
	Set 5	-	-	24.60	1.82	26.70	4.43
	Set 6	-	-	-	-	28.31	6.38
	Set 7	-	-	-	-	26.00	8.15
Set differences		-	-	6.81[c]	3.22	4.94[b]	1.37

Note. a: $p < .05$ according to S21; b: $p < .05$ according to S25; c: $p < .05$ according to S15.

Table 2

Match duration, points scored by set and match, and set differences according to game structure and tournament phase in male and female categories

		Male						Female			
		System-21 (S21)		System-25 (S25)		System-15 (S15)		System-25 (S25)		System-15 (S15)	
		Mean	Sd	Mean	Sd	Mean	Sd	Mean	Sd	Mean	Sd
Group Phase											
Total match duration		70.07	18.31	97.07	21.37	75.34	23.55	89.37	20.93	74.07	21.08
Total match points		125.03	27.84	167.17	33.54	123.97	20.61	146.40	31.31	128.53	36.80
Total points by set	Set 1	36.97	4.94	45.57	4.72	26.60	43.37	43.37	5.68	25.50	4.79
	Set 2	36.40	4.21	45.07	4.91	27.20	42.60	42.60	5.20	24.83	3.60
	Set 3	37.47	5.39	43.97	5.35	28.13	43.80	43.80	5.74	24.93	3.06
	Set 4	37.56	2.65	46.28	3.51	26.43	44.90	44.90	3.57	26.60	3.11
	Set 5	29.33	7.02	24.00	2.28	27.53	25.00	25.00	2.83	27.67	3.24
	Set 6	.	.	.	.	28.00	.	.	.	27.80	6.71
	Set 7	.	.	.	.	26.60	.	.	.	26.75	9.22
Set difference		5.75	2.11	5.80	1.90	4.21	1.22	7.33	3.36	5.03	1.51
Eliminatory Phase											
Total match duration		73.00	20.23	123.83	34.21	94.13	23.51	114.38	19.09	76.38	19.08
Total match points		136.63	34.66	165.88	24.82	137.00	17.38	179.63	21.17	135.63	30.70
Total points by set	Set 1	40.13	7.55	45.63	2.56	27.50	4.14	46.00	1.20	28.38	2.77
	Set 2	39.13	3.31	42.38	1.60	25.00	3.07	45.00	4.24	25.38	3.58
	Set 3	39.63	6.95	49.25	6.30	27.13	1.46	46.63	4.93	24.88	2.80
	Set 4	38.00	2.00	45.80	3.63	32.13	5.51	43.83	4.12	28.00	4.57
	Set 5	28.00	.	.	.	28.86	4.85	24.33	1.53	23.80	6.50
	Set 6	.	.	.	.	26.67	2.31	.	.	30.00	6.00
	Set 7	.	.	.	.	22.50	.71	.	.	23.00	.
Set difference		4.46	1.49	5.15	.78	3.76	.84	4.87	1.61	4.61	.52

Table 3

Match duration, points scored by set and match, and set differences according to game structure and match balance in male and female categories

		Male						Female			
		System-21 (S21)		System-25 (S25)		System-15 (S15)		System-25 (S25)		System-15 (S15)	
		Mean	Sd	Mean	Sd	Mean	Sd	Mean	Sd	Mean	Sd
Balanced matches											
Total match duration		74.23	19.91	114.75	23.31	85.59	26.70	103.09	22.04	73.23	20.32
Total match points		135.00	29.90	179.18	27.20	129.14	19.63	163.45	29.97	129.64	33.79
Total points by set	Set 1	39.18	6.54	46.64	4.99	26.55	3.07	45.36	4.63	26.55	2.82
	Set 2	37.91	2.47	44.55	4.30	27.23	4.06	43.55	4.39	25.41	3.30
	Set 3	38.36	4.87	47.73	6.01	26.36	2.08	45.50	5.04	25.09	3.57
	Set 4	37.33	2.50	46.29	3.74	28.95	4.54	45.25	3.77	27.09	4.00
	Set 5	31.33	4.16	24.75	2.22	27.56	3.63	24.00	1.41	25.73	4.67
	Set 6	.	.	.	.	28.27	4.31	.	.	28.00	4.38
	Set 7	.	.	.	.	25.50	2.88	.	.	27.50	8.58
Set difference		4.65	1.22	4.81	1.14	3.82	1.07	5.81	2.10	4.72	.98
Unbalanced matches											
Total match duration		65.81	15.63	85.00	17.30	70.33	18.04	83.00	18.74	76.38	21.15
Total match points		117.13	25.81	150.00	30.01	123.38	21.77	139.56	30.97	130.56	38.47
Total points by set	Set 1	35.50	3.14	44.13	2.70	27.13	4.77	41.94	5.35	25.50	6.29
	Set 2	35.69	5.57	44.44	4.99	26.06	5.00	42.50	5.94	24.31	3.89
	Set 3	37.31	6.84	41.44	3.24	30.06	11.61	42.88	6.21	24.69	1.96
	Set 4	38.67	2.31	45.83	2.79	25.81	2.56	42.25	2.63	26.63	2.60
	Set 5	22.00	.	22.50	2.12	28.63	4.96	27.00	.	27.89	4.04
	Set 6	.	.	.	.	25.67	2.08	.	.	28.57	8.08
	Set 7	.	.	.	.	25.00	.	.	.	20.00	.
Set difference		6.62	2.42	6.84	1.75	4.52	1.17	8.20	3.98	5.24	1.77

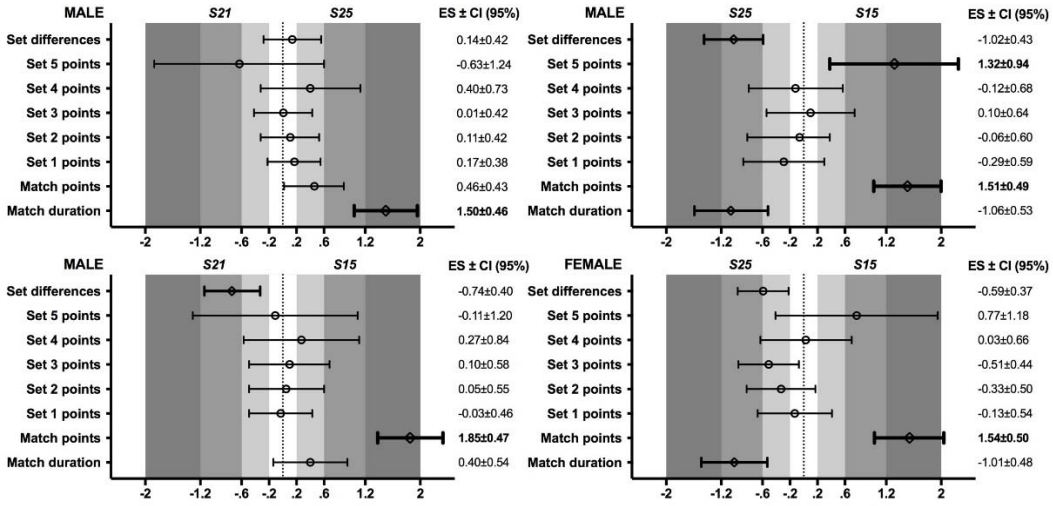

Figure 1.

Standardized means differences among game structures (ES ± CI)

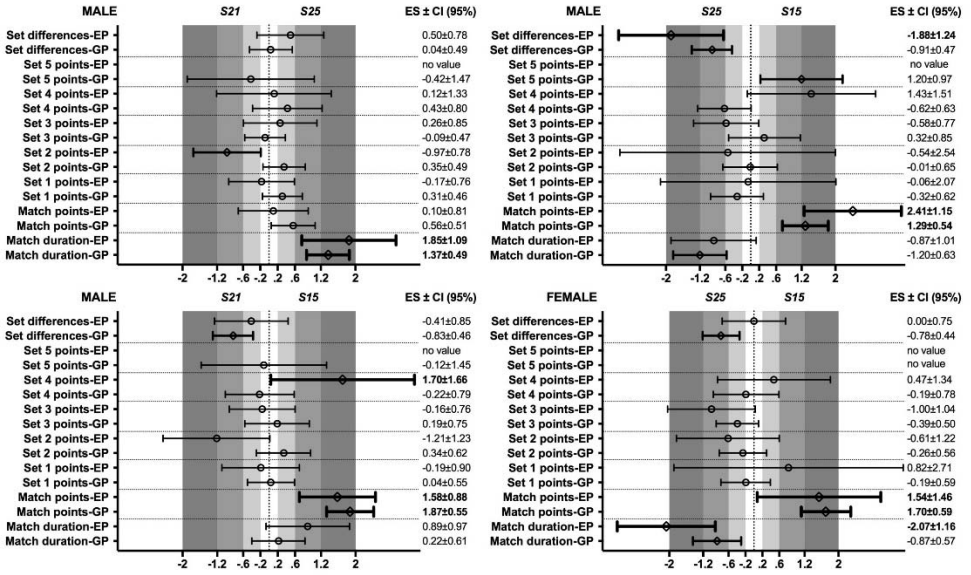

Figure 2.

Standardized means differences among the game structure and tournament phases in male and female categories (ES ± CI)

Note. GP: group phase; EP: eliminatory phase

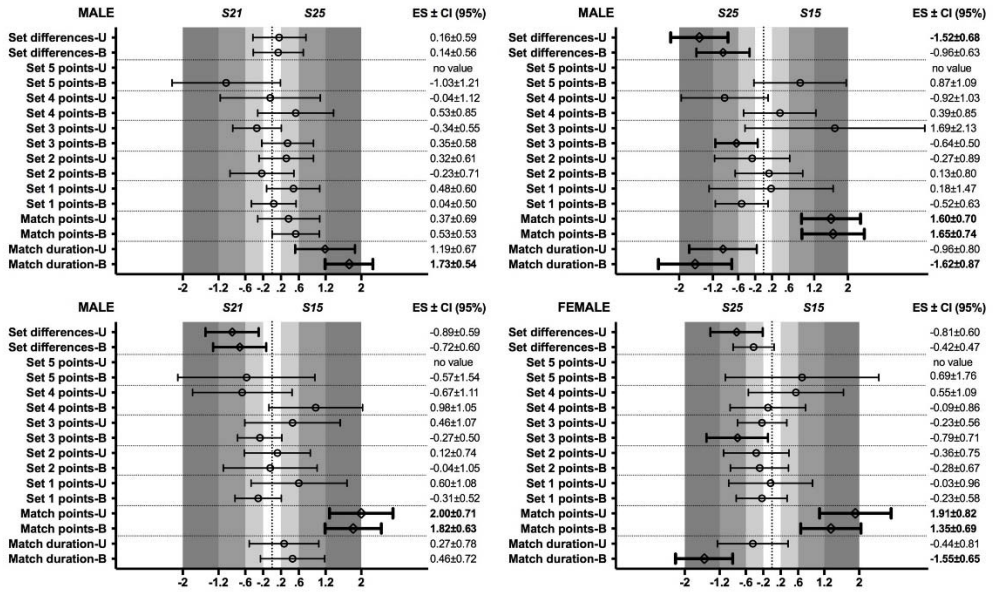

Figure 3.

Standardized means differences among the game structure and tournament phases in male and female categories (ES ± CI)
Note. B: balanced matches; U: unbalanced matches

Finally, there were moderate differences in set differences in the group phase in both categories between S21 and S15, and between S25 and S15; and large differences in the eliminatory phase between S25 and S15 only in the male category. These results indicate larger point differences in those systems where more points had to be scored (S21 and S25).

Table 3 presents descriptive data of the three game structures in terms of match balance in male and female categories. Comparison between systems was only made by standardised mean differences (Figure 3). There were large differences in match duration in balanced matches in both categories when comparing S25 with S21, and S25 with S15; and moderate differences in unbalanced matches between S25 and S21, as well as between S25 and S15 in the male category. In all these cases, the longest matches were always found in S25. In terms of points scored per match, S15 showed large differences when compared to S21 and S25 in both balanced and unbalanced matches and both categories. Also, in balanced matches, there were moderate differences in set 3 in S25 when compared to S15 in both categories. Finally, there were both large and moderate differences in balanced and unbalanced matches when comparing S15 to S21, and S15 to S25, with smaller score difference in matches in the S15 system.

The chance of winning or losing a set related to the previous set outcome was calculated. No statistically significant relationships (p > .05) were found between winning a set and having won the previous one (or losing a set and having lost the previous one) in S25 and S15 in both male and female categories. However, in the male category in S21, there was a statistically significant relationship between set 1 outcome and set 2 outcome ($\chi^2_{(1,38)}$ = 14,903, p = .001), as well as between set 2 outcome and set 3 outcome ($\chi^2_{(1,38)}$ = 6,446, p = .011).

Discussion

The aim of this study was to analyse the impact of different game structures on score and time-related variables in volleyball. This is the first attempt to measure the effect of rule

modifications on match and team performance. In fact, results found showed that S15 was the match structure with the shortest matches and the smallest time variability in match duration, the largest number of points scored per match and the greatest equality of set score differences in both male and female categories. Therefore, current results highlight performance variations under the new rule system which has an impact on match duration, scoring development and competitive balance. Thus, current findings are of great relevance for coaches and managers when facing new constraints of the new rule systems.

In match duration, the longest matches with the greatest time variability were found in S25 in both male and female categories regardless of the tournament phase or match balance. Thus, systems such as S15 or S21 may reduce match length and variability, which in turn leads to greater control over time and more highly structured games in tune with media requirements. Although rally-point systems reduce time variability (Fellingham et al., 1994; Kovacs, 2009), recent game structures (S21 and S15) pose a step forward in controlling match duration more effectively (less time variability). Moreover, a reduction in match duration leads to less predictable matches as suggested by Fellingham et al. (1994).

In addition, S21 resulted in shorter matches compared to S15, in which there were more sets, and therefore, more rest-times between sets. Hence, federations or organisers should bear in mind these features to reduce match duration or to use rest-times for specific purposes. Indeed, coaches and strength and conditioning specialists should consider new time demands when adapting their training methodologies, particularly physical training. Game duration, especially in a rally, is not only related to game structures, but also to game speed which increases according to fast tempo attack strategies (Bergeles and Nikolaidou, 2011) and the team performance level (García-de-Alcaraz et al., 2017).

As well as match length, points scored and differences in the score constitute crucial features for enhancing levels of excitement and interest. Thus, S15 is the game structure in which the most points in a match were scored regardless of the tournament phase and the type of a match in both male and female categories. Moreover, S15 allows the smallest set score differences, and hence, the greatest equality between teams and greatest uncertainty and excitement in the game, thus its increasing spectacularity. These differences in S15 were smaller in the male category, in eliminatory phases, and in balanced matches because teams' performance between counterparts was more similar in the last two situations. This result matches those of Marcelino et al. (2011) who found that the more similar teams' scores were, the higher their performance level. Also, shorter score differences at the end of a set involve new considerations for match status analysis, and hence, originate changes in performance of technical-tactical actions related to the set or match outcome (Drikos and Vagenas, 2011). Studies on other net sports such as table tennis evidence greater score equality linked to shorter and more intensive matches, especially during the final rounds (Leite et al., 2017). Finally, the results are stable across all tournament phases and the type of matches, thus ensuring the accuracy of this game structure. Indeed, S15 is an accurate, equal system where there is little variability, all of which are key factors in the design of effective rules in volleyball (Fellingham et al., 1994) linked to higher levels of excitement and entertainment.

Regarding crucial match periods, S15 had the largest number of points scored in the fifth set compared to S25 only in the male category, which further confirms that S15 is the most exciting game structure in terms of competitiveness. Some studies have indicated the impact of game periods on the final match outcome (Ruano et al., 2016) and on levels of entertainment, as suggested in the present study. A final argument for the implementation of S15 is that there are fewer chances of predicting a set outcome based on previous sets performances. Little predictability leads to greater equality and competitiveness between teams, thus promoting entertainment.

Despite the results obtained, this research has some limitations such as the fact that the duration of each point/rally and the real work-rest time per set was unknown, meaning that further investigation is required. In addition, technical-tactical performance indicators as well as physiological loads should be further analysed in future studies. Many studies have revealed the impact of changes in GR in areas such as

physiological loads (Cormery et al., 2008; Giatsis, 2003; Hill-Haas et al., 2010), technical-tactical performance indicators (Giatsis and Tzetzis, 2003) or time features of the game (Eaves et al., 2008; Giatsis and Papadopoulou, 2003; Williams et al., 2005). In contrast, there are only few studies on the influence of different GR on variables linked to the design of proper sport-competition scenarios that attract fans and the media. International federations or committees may consider developing new rules in top-level competitions. In this sense, future studies should be implemented in order to test the effects of these GR on media broadcast variables such as audience, sponsors investment, etc. In light of prior research, the present study contributes to expanding existing knowledge which may help coaches train their teams for competitions, and federations and organisations to manage competitions making use of relevant findings such as those of this study.

Practical implications

The use of various game structures in training may be useful to coaches when planning training programs and sessions. For training purposes, volleyball coaches may introduce different game structures to manage volume and intensity more effectively.

For competition purposes, new game structures promote game changes. If new game structures such as S15 are still in use in the future, new match analysis and performance profiling in tournaments will be needed to examine players' demands. Indeed, coaches ought to reconsider selecting players-line-up at the beginning of sets, and managing time-outs and substitutions during the game.

Finally, the results of this study may also be useful to local and/or national volleyball federations wishing to attract new young players, to promote learning and to render volleyball a fun activity.

References

Anguera MT. Observational methods (general). In: Fernández-Ballesteros R, ed. *Encyclopedia of Psychological Assessment, 2.* London: Sage, 632-637; 2003

Bergeles N, Nikolaidou ME. Setter's performance and attack tempo as determinant of attack efficacy in Olympic-level male volleyball teams. *Int J Perform Anal Sport*, 2011; 11(3): 535-544

Cormery B, Marcil M, Bouvard M. Rule change incidence on physiological characteristics of elite basketball players: a 10-year-period investigation. *Br J Sports Med*, 2008; 42(1): 25-30

Drikos S, Vagenas G. Multivariate assessment of selected performance indicators in relation to the type and result of a typical set in men's elite volleyball. *Int J Perform Anal Sport,* 2011; 11(1): 85-95

Eaves JS, Lamb LK, Hughes DM. The impact of rule and playing season changes on time variables in professional in rugby league in the United Kingdom. *Int J Perform Anal Sport*, 2008; 8(2): 44-54

Fellingham GW, Collings BJ, McGown CM. Developing an optimal scoring system with a special emphasis on volleyball. *Res Q Exerc Sport*, 1994; 65(3): 237-243

FIVB. International Volleyball Federation. Official Volleyball Rules, 2017. Available at: http://www.fivb.org/EN/Refereeing-Rules/RulesOfTheGame_VB.asp; accessed on 02.10.2017

García-de-Alcaraz A, Marcelino R. Influence of match quality on men's volleyball performance at different competition levels. *Int J Perform Anal Sport*, 2017; 17(4): 394-405

García-de-Alcaraz A, Valadés D, Palao JM. Evolution of game demands from young to elite players in men's volleyball. *Int J Sports Physiol Perform*, 2017; 12(6): 788-795

Giatsis G. The effect of changing the rules on score fluctuation and match duration in the FIVB women's beach volleyball. *Int J Perform Anal Sport*, 2003; 3(1): 57-64

Giatsis G, Papadopoulou S. Effects of reduction in dimensions of the court on timing characteristics for men's beach volleyball matches. *Int J Volleyball Res*, 2003; 6(1): 6-9

Giatsis G, Tzetzis G. Comparison of performance for winning and losing beach volleyball teams on different court dimensions. *Int J Perform Anal Sport,* 2003; 3(1): 65-74

Hill-Hass SV, Coutts AJ, Dawson BT, Rowsell GJ. Time-motion characteristics and physiological responses of small-sided games in elite youth players: the influence of player number and rule changes. *J Strength Cond Res*, 2010; 24(8): 2149-2156

Hopkins WG. A spreadsheet to compare means of two groups. *Sportscience,* 2007; 11: 22-24

Hopkins WG, Marshall SW, Batterham AM, Hanin J. Progressive statistics for studies in sports medicine and exercise science. *Med Sci Sports Exerc*, 2009; 41: 3-13

Kovacs B. The effect of the scoring system changes in volleyball: a model and an empirical test. *J Quant Anal Sports*, 2009; 5(3): 1-12

Leite JVM, Barbieri FA, Miyagi W, Malta ES, Zagatto AM. Influence of game evolution and the phase of competition on temporal game structure in high-level table tennis tournaments. *J Hum Kinet*, 2017; 55(1): 55-63

Marcelino R, Mesquita I, Sampaio J. Effects of quality of opposition and match status on technical and tactical performances in elite volleyball. *J Sports Sci,* 2011; 29(7): 733-741

McGarry T, Anderson DI, Wallace SA, Hughes MD, Franks IM. Sport competition as a dynamical self-organizing system. *J Sports Sci*, 2002; 20(10): 771-781

Ruano MÁ, Serna AD, Lupo C, Sampaio JE. Effects of game location, quality of opposition, and starting quarter score in the outcome of elite water polo quarters. *J Strength Cond Res*, 2016; 30(4): 1014-1020

Stankovic M, Peric D, Ruíz-Llamas G, Quiroga-Escudero M. Effects of experimental volleyball rules quantified by type and number of jumps, hits and contacts. *Sport Mont*, 2017; 15(3): 9-16

Williams J, Hughes M, O'Donoghue P. The effect of rule changes on match and ball in play time in rugby union. *Int J Perform Anal Sport*, 2005; 5(3): 1-11

Corresponding author:

PhD Antonio García de Alcaraz Serrano.
Adjunct professor. Faculty of Education. University of Almeria.
Carretera Sacramento, s/n. Postcode: 04120, Almeria, Spain
Telephone: +34 659 269 473.
E-mail: antoniogadealse@gmail.com