

Quantification of the competition load of the sets in high-level volleyball in the year 2021

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Abstract:

Many different factors can affect the performance of athletes in competitions and condition the analysis of technical and tactical performance. One of these factors is the so-called competition load of the set, understood as the difference in points at the end of the set. The main objective of the present study was to investigate the competition load of volleyball sets, to establish reference values that will allow classifying the sets as balanced or unbalanced for the male and female categories. A total of 2368 sets were collected from the main international volleyball team competitions in 2021, for a total of 1357 male sets, and 1011 female sets. A K-means clustering analysis was performed, allowing the classification of the sets as balanced when the difference was ≤ 6 for the male category, and ≤ 7 for the female one; and unbalanced when these values were higher. To study how the rest of the variables analyzed affected the percentage of balanced and unbalanced sets, a Pearson's chi-square (χ^2) analysis was performed, obtaining significant differences on the percentage of balanced and unbalanced sets as a function of the number of sets in the game in both categories. In the female category, the variable of competition analyzed also showed significant differences. Lastly, a CHAID analysis showed that the variable number of sets per game was the main predictor variable for classifying the sets, allowing for the correct classification of 60.4% of the sets in the male category, and 62.7% in the female one. In conclusion, the competition load was associated with the total number of sets per match and the tie-breaker set; and it was only related with the competition analyzed in the female category. The competition load was not significantly related with the competition phase analyzed in any of the two categories. These results can be taken into account by coaches in order to study how the balance in the sets affects the performance of technical indicators, and the variability in the systems or game strategies.

Key Words: Balanced set, unbalanced set, competition, context, performance.

Introduction

Sports performance results from adaptive and dynamic behaviors from the combination between the contextual variables of the sport and the individual characteristics of the athlete (García De Alcaraz et al., 2022). In relation with this, team sport studies have centered part of their research on contextual variables that affect the performance of teams in competitions, considering the existence of associations between these contextual variables and the performance ones (Rocha et al., 2021).

In the case of volleyball, these studies could provide answers to some concerns of elite coaches, who perceive that contextual variables, such as the degree of opposition, the competitive load of the set, or the critical moments of the set, can be relevant on the individual performance of the players and their assessment (López-Serrano et al., 2022).

Among Match Analysis studies in volleyball, special attention has been paid to how the contextual variables that stress the quality of the opposition or the confrontation, influence the technical or team performance. Thus, the competitive level of the teams or the competition phase, has been addressed by different studies as criteria for the selection of homogeneous research sample, selecting a decisive moment in the competition such as the matches in the Olympic Games, the third phase of the World Championships or World League (Araújo et al., 2020; Dutra et al., 2021; González-Silva et al., 2021; Kitsiou et al., 2020; Rocha et al., 2021; Sánchez-Moreno et al., 2018), or samples belonging to the final phases of different world competitions (Giatsis et al., 2022; López et al., 2021; Molina-Martín et al., 2022; Sotiropoulos et al., 2021). On the other hand, other studies have used a high-level sample selection that did not limit their analysis to a specific phase of the competition, but instead studied how the final classification in the tournament and the quality of the opposition

affected technical or tactical performance. Thus, different studies with a female sample showed differences in the efficiency of the technical actions between those who were classified between the 1st and 4th places, and the 13th and 16th places in the European Championships between 2013 and 2017 (Ciemiński, 2018); a higher rate of scoring from finishing or blocking plays, with a lower error rate in serving, receiving, and defense among the best teams from the 2016 World Club Championships (Mulazimoglu et al., 2021); a better performance in the indicators of performance of the best-qualified teams in the 2012 Olympic games (Ramos et al., 2017); and better setting conditions of the finalist teams with respect to the teams in the 2019 Nations League Finals (Martins et al., 2021). While for the male teams, a study provided information on a greater efficacy of the attack after the reception and after the defense in the better-qualified teams in the 2019 European Championship (Drikos et al., 2021). However, the technical indicators were not affected by the quality of the opposition during the men's 2007 World Cup; although the tactical indicators were affected, as shown by the modifications of the team strategies, and taking on more risks during the serve when facing teams with a greater quality of opposition (Marcelino et al., 2011, 2012). Nevertheless, it is possible that the classification of the teams for these studies, into different group levels, created some problems in their analysis (Přidal & Priklerová, 2018), as less differences could exist in the classification between 2 teams in different groups, than between 2 teams in the same group. For example, in a grouping that divides the teams between the 1st to 4th, and 5th to 8th classifications, the differences between the 4th and 5th, belonging to different categories, is less than that between the 1st and 4th teams classified, who belong to the same category. Following this logic, it could be more adequate to compare the teams based on the specific differences in positions in the final classification, although the final classification of a team may not reflect its general performance in the competition.

This could be due to the structure of tournaments with a group stage and an elimination round or that the team with the best performance in the different game actions, or who scores more points on average per set in a match or tournament, might not be the winner (Drikos et al., 2021; López-Serrano et al., 2022; Mulazimoglu et al., 2021). As a result of this, it is possible that the final classification or the disputed tournament phase, is not an ideal indication of the performance of the teams, or the quality of the confrontation (Drikos et al., 2021). Thus, some researchers have created their own classification of the teams analyzed to compare their performance, considering variables such as the ratio of the matches, sets and points scored and lost; and the non-final classification in the tournament (Marcelino et al., 2011, 2012). Other indicators put forward in relation to the quality of the match have been the number of sets disputed per game. Although there could be close final result in 3-2 sets, this does not imply that the result in each of the sets was balanced and the competitive load high (Lima et al., 2021).

This last concept of competition load of a set has been raised as the difference in the points scored at the end of the set (Sánchez-Moreno et al., 2018). In fact, some studies established a reference value >5 points to classify the sets as high, low, and/or balanced or unbalanced competition load, through K-means clustering analysis and grouping (Drikos & Kontouris, 2014; Drikos & Vagenas, 2011). However, these studies were conducted in the male European Championship, without considering the differentiating effect of the competition analyzed, and the gender of the participants (Sánchez-Moreno et al., 2018).

Comparing sets in which the competition load is similar could be highly important. It seems that the differences in points in the scoreboard in each set is related with significant indicators of technical performance, so that the indicators are reduced, as the difference in points per set becomes equal (Drikos & Kontouris, 2014), although the performance of the finishing attack becomes more decisive (Drikos & Vagenas, 2011). Also, the technical-tactical behaviors of the teams could be altered, either due to the competition load of the set (Drikos & Vagenas, 2011), as well as the state of the scoreboard or the critical moment in the set.

Thus, it seems that teams take on more risks when the scoreboard or sets are unbalanced, either when having an advantage or disadvantage in the scoreboard (Drikos & Vagenas, 2011; Marcelino et al., 2011); while the critical moments of the set and a scoreboard without little differences in scores, are associated with simpler blocking strategies and a lower level of risk related with the serve (Marcelino et al., 2011, 2012). As for the state of the match, Ramos et al. (2017) with a high-level female sample, did not find differences in the tactical performance as a function of the state of the match. In addition, Marcelino et al. (2009), with a sample of male World League teams, did not find significant differences that would allow them to establish a correlation between the final result of the set, and the following one.

Therefore, the independence between the sets in a match could be assumed, in other words, the score in a set did not influence the result of the following one (Drikos & Kontouris, 2014; Drikos & Vagenas, 2011; Marcelino et al., 2010, 2012). Thus, volleyball consists of three, four, or five micro games per match (Marcelino et al., 2010). As the main objective of the work, we sought to study the differences in the competition load as a function of the classification of the sets as balanced or unbalanced, differentiating them according to gender and competition context in the main competitions of male and female international teams in 2021.

Material & methods

Participants

The data was collected from the main international teams that participated in world and continental games played in 2021: Olympic Games, Nations League, European Championship, Asian Championship, South

American Championship, NORCECA Championship and African Championship. The results from 2368 sets (1357 male sets, and 1011 female sets) were collected.

Design and procedure

The study planned was developed through an observational methodology with interpretation objectives. A specific, independent and allospective observation was planned, based on facts, structured and with a null degree of reactivity, and with a nomothetic criterion (Anguera et al., 2018).

The variables used in this study were: Gender of the competition (male and female); Competition: Olympic Games, Nations League, European Championship, Asian Championship, South American Championship, NORCECA Championship and African Championship. Phase of the competition: final phase (the semi-final and finals including the third-place match), group stage-type system of matches to determine continuation to the next round or final classification of the team (round of 16, quarter finals, or matches to determine the last positions, starting with 5th place), previous classifying round through a group stage, competition system through a group stage in the entire championship; Total sets per match: number of sets played per match (3-5); Game set analyzed (1-5); Point difference per set (2-25).

The data were obtained from the public and open access results found in the official websites of the Fédération Internationale de Volleyball (FIVB) and the Continental Confederations that organized each tournament.

This study was approved by the research committees from the participating universities.

Statistical analysis

In first place, a descriptive analysis was performed of the different variables object of study. In second place, an exploratory analysis of the data was conducted, as well as a study of assumptions that must be met before the application of the statistical tests to be used (Klecka, Iversen & Klecka, 1980; Rost, 1995; Rubio-Hurtado & Vilà-Baños, 2016). More specifically, as a result of the statistical tests to be applied, the normality assumptions (Kolmogorov-Smirnov) and the multivariate normality, and the Independence of variables, were verified. In light of the results obtained, and considering the sample size ($n > 100$), it was assumed that the different variables had a normal distribution (Aguayo & Lora, 2013).

Likewise, the similar size of the samples and their dimensions, as shown in the data obtained in the descriptive results, indicated that the violation of normality for some of the variables did not have important consequences on this type of analysis. On the other hand, for the of the univariate outliers, a cut-off point of $z = \pm 3$ was utilized, with all of the cases in the sample analyzed found to be within this interval (Gil et al., 2001).

In second place, after this comparison, the inferential statistical tests were applied, with the first being a K-means clustering analysis (Drikos & Vagenas, 2011; Rost, 1995; Sampaio et al., 2010). This analysis was utilized to identify the cut-off points and to classify, based on these results, the performance of each team analyzed, according to the differences in the final score obtained after the end of the match. This categorization allowed us to classify the matches according to this difference in scores into two groups; for female games: i) balanced games, with score differences ≤ 7 points, and ii) unbalanced games, in which the score differences were ≥ 8 points; while for the male games, the classification was: i) balanced games, with score differences ≤ 6 points, and ii) unbalanced games, where the point differences were ≥ 7 points.

In third place, a Pearson's Chi-square (χ^2) analysis was performed with a post-hoc comparison of 2xn tables through the use of the contingency coefficient, to obtain the possible differences between each of the variables studied according to the categorization of the sets as balanced or unbalanced, for both the male and female categories.

Next, according to the classification based on the differences in points, an analysis was conducted through the use of hierarchal segmentation technique, defined by decision trees, the chi-square automatic identification detection (CHAID) analysis. More specifically, the exhaustive growth method was utilized, through which it is possible to generate a multivariate visual and analytical tool to support the decision (Berlanga et al., 2013; Escobar, 1998; Sánchez-Moreno et al., 2018). This type of statistical test is the recommended method for the combined treatment during the analysis of different variables (Berlanga et al., 2013; Escobar, 1998).

On the other hand, its application is not dependent on meeting the normality criteria. Lastly, for the development of the statistical test, a cross-validation method was selected, where the general prediction values were 62.7% and 60.4% for the female and male categories, respectively.

Lastly, this prediction capacity was 61.4% when the CHAID analysis was performed in a general manner for the entire sample object of study.

For the statistical test, the SPSS v.24 program was utilized, with a significance level of $p = 0.05$.

Results

Next, table 1 shows more details of the descriptive characteristics of the sample studied, for both the female and male categories, classified as a function of the difference in scores for the categories of balanced and unbalanced sets.

Table 1. Descriptive characteristics of the sample

	Male				Female			
	Balanced	Unbalanced	χ^2	p	Balanced	Unbalanced	χ^2	p
	M+SD (n=941)	M+SD (n=416)			M+SD (n=674)	M+SD (n=337)		
Competition								
OG	3.44±1.22 (74.00%)	9.07±1.91 (26.00%)	9.51	.147	4.15±1.71 (66.40%)	10.62±2.34 (33.60%)	19.65	.001**
NATL	3.60±1.50 (71.60%)	8.76±2.02 (28.40%)			3.93±1.76 (71.40%)*	10.31±2.24 (28.60%)*		
EUCH	3.44±1.47 (67.30%)	9.17±1.98 (32.70%)			3.98±1.72 (66.20%)	10.75±2.33 (33.80%)		
ASCH	3.61±1.47 (68.90%)	9.52±2.29 (31.10%)						
SOCH	3.85±1.31 (58.80%)	9.07±2.20 (41.20%)			4.05±1.81 (64.70%)	11.42±3.31 (35.30%)		
NOCH	3.49±1.41 (74.7%)	9.00±2.70 (25.30%)			4.21±1.86 (48.30%)*	11.68±3.40 (51.70%)*		
AFCH	3.87±1.41 (62.50%)	9.78±2.39 (37.50%)			4.41±1.91 (50.90%)*	11.15±2.60 (49.10%)*		
Competition Phase								
F. Phase	3.35±1.29 (67.40%)	8.30±1.12 (32.60%)	5.68	.128	4.00±1.92 (62.00%)	10.07±1.90 (38.00%)	1.03	.794
Cruces	3.47±1.36 (75.70%)	9.54±2.15 (24.30%)			3.85±1.65 (64.80%)	11.24±2.95 (35.20%)		
P. Phase	3.61±1.47 (68.70%)	9.18±2.21 (31.30%)			4.02±1.75 (67.30%)	10.68±2.46 (32.70%)		
Group Stage Comp. Syst.	3.85±1.31 (58.80%)	9.07±2.15 (41.20%)			4.05±1.81 (64.70%)	11.42±3.32 (35.30%)		
Total sets per match								
3	3.81±1.46 (61.30%)*	9.53±2.38 (38.70%)*	36.96	.000**	4.32±1.76 (54.20%)*	11.09±2.62 (45.80%)*	62.69	.000**
4	3.49±1.45 (70.40%)	8.80±1.78 (29.60%)			3.80±1.76 (76.40%)*	10.58±2.30 (23.60%)*		
5	3.41±1.38 (80.60%)*	8.73±1.93 (19.40%)*			3.84±1.70 (79.20%)*	9.20±1.39 (20.80%)*		
Tie-break								
1	3.60±1.47 (66.30%)	9.23±1.06 (33.70%)	13.76	.008**	4.03±1.76 (67.50%)	10.98±2.56 (32.50%)	17.99	.001**
2	3.49±1.36 (70.10%)	8.91±2.09 (29.90%)			4.03±1.78 (62.50%)	10.67±2.73 (37.50%)		
3	3.67±1.48 (67.60%)	9.37±2.39 (32.40%)			3.99±1.76 (63.90%)	10.77±2.38 (36.10%)		
4	3.66±1.46 (70.40%)	9.11±1.98 (29.60%)			3.93±1.72 (70.50%)	10.06±1.77 (29.50%)		
5	3.30±1.47 (88.20%)*	8.38±1.85 (11.80%)*			4.00±1.74 (91.80%)*	9.25±2.50 (8.20%)*		

Note: M=mean; SD= standard deviation; p=significance; *=p<0.05; **=p<0.01; %=percentage; OG=Olympic Games; NATL=Nations League; EUCH=European Championship; ASCH=Asian Championship; SOCH= South American Championship; NOCH=NORCECA Championship; AFCH=African Championship.

As shown in table 1, for the male category, significant differences were only observed for the balanced and unbalanced sets in the variables total sets per match and tie-breaker set analyzed ($p<0.05$; $CC=0.16$). When analyzing the total sets per match ($p=0.000$), the matches disputed in 3 sets obtained a percentage that was lower than that expected for balanced sets (61.30%), and higher than that for unbalanced sets (38.70%), with respect to the expected mean statistical values. While for the matches played in 5 sets, these obtained a higher percentage of balanced sets (80.60%) and a lower one of unbalanced sets (19.40%).

On the other hand, when studying the percent distribution as a function of the tie-breaker set, it was observed that the fifth set showed significant differences ($p=0.008$; $CC=0.10$), obtaining, in the case of a re-adding of the sets, a higher than expected percentage of balanced sets (88.20%), and a lower than expected unbalanced ones (11.80%).

On the same table, when examining the results obtained for the female category, differences were found in the distribution of balanced or unbalanced sets when comparing the results as a function of the competition ($p=0.001$; $CC=0.14$), total sets of the match ($p=0.000$; $CC=0.24$) and tie-breaker set ($p=0.001$; $CC=0.13$). In the case of the variable competition, the matches from the Nations League recorded a higher than expected percentage of balanced sets (71.40%), and a lower percentage of unbalanced ones (28.60%). The results showed an opposite trend in the NORCECA Championship (NOCH) and the African Championship (AFCH), with a lower than expected percentage of balanced sets (NOCH: 48.30%; AFCH: 50.90%), and higher than expected unbalanced ones (NOCH: 51.70%; AFCH: 49.10%).

In the variable total sets per match, a higher than expected percentage was found for the balanced sets, and a lower one for the unbalanced sets in 4-set (balanced: 76.40%; unbalanced: 23.60%) and 5-set (balanced: 79.20%; unbalanced: 20.80%) matches. Meanwhile, a contrary tendency was found for 3-set matches, with a lower than expected percentage of balanced sets (54.20%), and a higher one of unbalanced sets (45.80%).

Lastly, when studying the tie-breaker set, significant differences were found in the fifth set, with a higher than expected percentage of balanced sets (91.80%) and a lower one of unbalanced sets (91.80%), with respect to the expected mean values.

Figure 1 shows the results obtained after the CHAID analysis for the male category. Among the possible predictor variables introduced in the model for the male category, it was found that the best predictor for the classification of the matches as balanced and unbalanced, as a function of the differences in points, was total number of sets per match. The resulting classification tree had a depth of 1, and a total of 4 nodes, of which nodes 1, 2, and 3 were terminal.

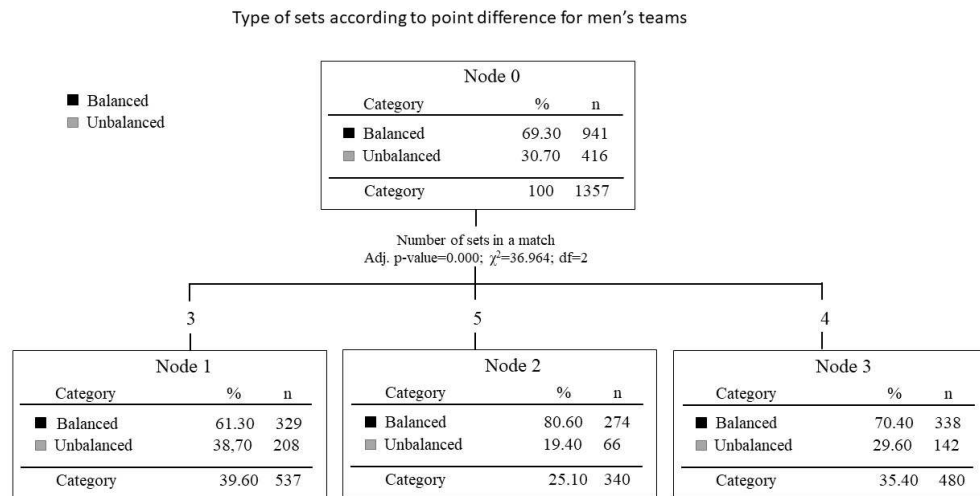


Fig 1. Tree diagram for the match classification model for male volleyball teams

When analyzing node 0, it was observed that 69.3% of the matches played for the male category were framed within the balanced set classification. However, for the unbalanced games, only 30.7% (n=416) of the total sets played were classified as such. In this sense, the existence of a greater probability that the sets were balanced in games consisting of 5 sets was verified (80.6%; node 2). When considering nodes 1 and 3, defined as matches played in 3 and 4 sets, it was observed how the probability of the sets in the match being balanced decreased to 61.3% and 70.4%, respectively. When looking at these same nodes, the results obtained allowed us to verify how this trend was opposite for the classification in the number of unbalanced sets, so that for 3-set matches (node 1), the percentage of unbalanced sets was higher as compared to the rest, with a value of 38.7%.

As for the goodness-of-fit of this general model of analysis for the volleyball matches analyzed, the results allowed us to verify how the CHAID analysis correctly classified 60.4% of the sets, with the percentage for the balanced set category being 65%, and 50% for the category of unbalanced sets.

On the other hand, the results obtained in Figure 2 allude to the confrontations and matches of the female competitions. Just as with the male competitions, it was observed that the best predictor for the classification of the matches as balanced or unbalanced, as a function of the differences in points, was the total number of sets per match. The resulting classification tree had a depth of 1, with a total of 3 nodes, of which nodes 1 and 2 were terminal.

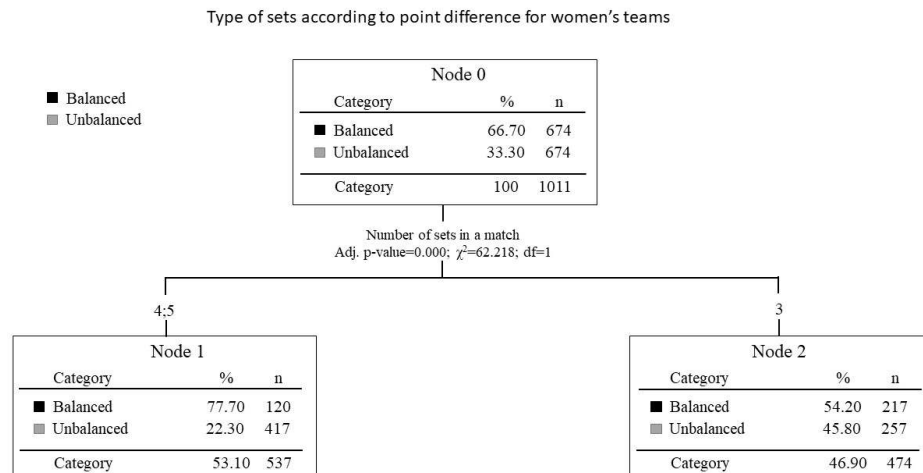


Fig 2. Tree diagram for the match classification model for female volleyball teams

When examining node 0, it was verified that 66.7% of the matches played in the female category were found to have balanced sets. However only 33.3% ($n=337$) of the matches were classified as unbalanced. Thus, it was verified that there was a greater probability that the sets were balanced in the matches in which a fourth or fifth set was played (77.7%; node 1), as compared to the matches played in 3 sets. For the matches played in 3 sets, the probability of balanced sets was reduced to 54.2%. When analyzing these same nodes, the results obtained allowed verifying that this trend was the opposite for the number of unbalanced sets, so that for the 3-set matches, the number of unbalanced sets was higher, as compared to the rest, with a percentage of 45.8%.

As for the goodness-of-fit of this general analysis model for the female volleyball matches analyzed, the results allowed us to verify that the CHAID analysis correctly classified 62.7% of the sets, with a percentage of 64.4% for the balanced sets, and a 61.9% for the unbalanced ones.

Lastly, a CHAID analysis was performed for the total sample analyzed (Figure 3). Among all the possible predictor variables introduced in the model, it was observed that similar to the previous analysis according to gender, the best predictor for the classification of the matches as balanced or unbalanced, as a function of the point difference per set, was the total number of sets played per match. The results obtained showed a classification tree with depth of 2 and a total of 6 nodes, of which nodes 2, 3, 4, and 5, were terminal.

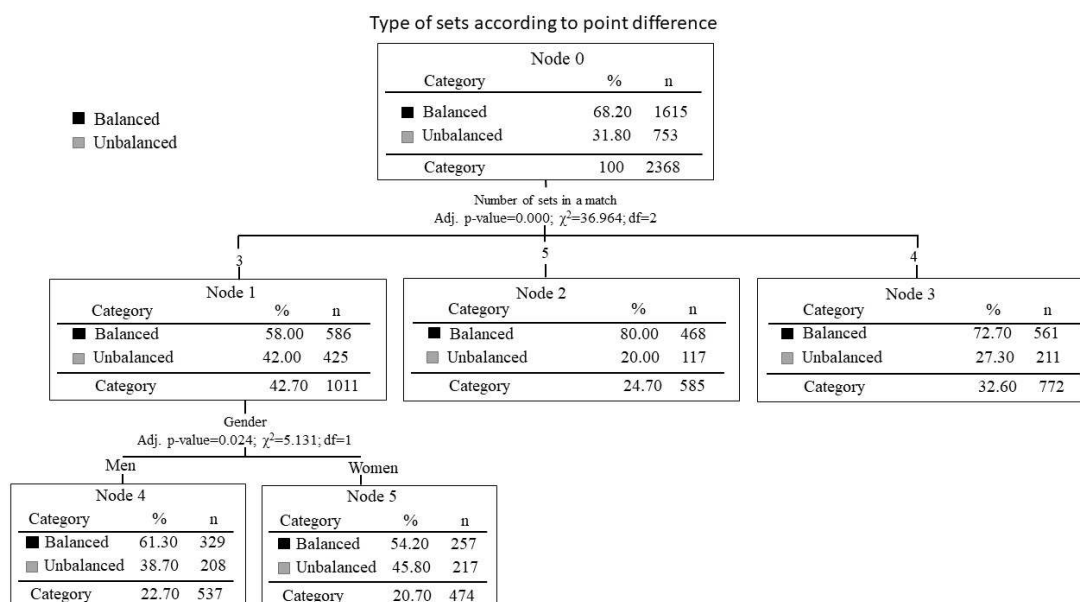


Fig 3. Tree diagram for the match classification model for both genders

The analysis of node 0 of the tree model showed that 68.2% of the total sets played, in general, were framed within the classification of balanced sets. In the meantime, for the unbalanced sets, only 31.8% ($n=753$) of the sets played were classified as such. Of the 3 classification possibilities obtained in the tree, the one identified with 3-set matches (node 1) obtained the highest percentage of unbalanced sets (42%), while this number decreased for the 4-set (27.3%) and 5-set (20%) matches. Lastly, the decision tree showed the existence of interaction between the dimensions gender and number of total sets per match when predicting the classification of the sets played per match, as a function of the existing differences in points per set. This interaction allowed the forecasting that in 3-set matches, the female gender had a higher probability (45.8%) of obtaining unbalanced sets (node 5). On the other hand, the male teams that played 3-set matches obtained a lower probability of unbalanced sets (38.7%), while the balanced sets increased in percentage to 61.3% (node 4).

As for the goodness-of-fit of this general model of analysis for all the volleyball matches analyzed, the results allowed us to verify that the CHAID analysis correctly classified 61.4% of the sets, with the percentage for the category of balanced sets being 63.7%, and 56.4% for the unbalanced sets.

The main objective of the present work was to study the differences in the competition load as a function of the classification of the sets as balanced or unbalanced, differentiating them according to gender and competitive context, in the main competitions of male and female international teams in 2021.

Discussion

The main objective of the present study was to analyze the competition load of the sets, in order to establish reference values that will allow for the classification of the sets as balanced or unbalanced, of high level international male and female volleyball teams in 2021.

With respect to this objective, a discriminatory value was found to consider a set as being balanced based on the competition load. For females, this was a ≤ 7 points difference for females, while for males, this was ≤ 6 points. The result found for the male category was 1 point higher than that indicated by previous studies

with a sample from the European Championship in 2009, which also utilized a K-means clustering analysis (Drikos & Kontouris, 2014; Drikos & Vagenas, 2011). In these studies, three groups were established as a function of the final differences found: 2 points (ambivalent), 3-5 points (safe), >6 points (unbalanced). It is possible that this difference was due to the high level of performance of the 16 male European teams in 2009, resulting in more equalized matches and a greater competitive equilibrium in the sets that in the 24 team format in 2021.

The present study did not find significant differences in the competition load of the sets between the male competitions analyzed in 2021. However, in the female competitions, differences were found in the competition load of the sets as a function of the competitions, which could indicate a lower competitive balance in this category. The Nations League obtained a significantly higher number of balanced sets (71.60%) and a lower percentage of unbalanced ones (28.40%), while the NORECA Championship and the African Championship obtained a significantly lower number of balanced sets (48.30%; 50.90%), and a higher number of unbalanced sets (51.70%; 49.10%). The Nations League is one of the main competitions in the world, in which 16 teams compete. Based on these results, it seems that the Nations League possesses a greater competitive balance with respect to the other championships NORCECA and the African Championships, in which matches could be played between national teams with more differentiated levels of performance. The finding of significant differences in the competition load of the set as a function of international female volleyball competitions, re-enforces the idea that it is necessary to have in mind the differentiating effect of gender and the competition analyzed (Sánchez-Moreno et al., 2018).

As for the phase of the competition, different studies have tried to obtain a high competition load and a homogenous level of performance by choosing the final phases of the championships as the sample (López-Serrano et al., 2022). However, in this study, we did not find significant differences when relating the phase of the competition and the competition load of the sets. In fact, the competition phase does not seem to affect the performance of the attack as a relevant indicator of the result (Araújo et al., 2020). Based on the above, it can be considered that the phase of the competition is not relevant, as attributed in previous studies.

When analyzing the variable number of sets per match, the model created allowed the correct classification of 60.4% of the sets in the male category, 62.7% in the female one, and 61.4% of the total sets without differentiating according to gender. The present study found a significantly higher percentage of balanced sets, and a lower percentage of unbalanced ones, when the matches lasted 5 sets in the male category, and 4 or 5 sets in the female one. On the contrary, the number of balanced sets decreased, while the unbalanced sets increased, when the matches were played in 3 sets for both categories. Based on these results, the total number of sets per match was related with the competitive balance of the sets; with the total number of sets per match thus being the best predicting variable of the competitive balance of the sets. And although it could be considered a linear relationship, the tree nodes indicated that for both categories, the percentages of balanced sets increased, and the unbalanced ones decreased, when the matches were played in 4 sets (balanced: 72.7%; unbalanced: 27.3%) and 5 sets (balanced: 80.0%; unbalanced: 20.0%) as compared to the matches played in 3 sets (balanced: 58.0%; unbalanced: 41.0%). Similarly, Lima et al. (2019) assessed the competitive balance of the 1st Division Portuguese league, finding that a greater number of sets per match was related with a greater balance in the final score in the match. Also, a greater number of sets played could affect the predictive technical actions of performance. In a study conducted with a high-level male category, the authors found that the spike was the best predictor of success of the team in matches played in 3 or 4 sets, while the block and serve were the best predictors in matches played in 5 sets (Giatsis et al., 2022).

When each set was analyzed individually, it was found that each set of the match could have a differentiating effect on the behavior of the players, especially on physical and psychological stress, affecting the level of risk assumed and even the performance in some game actions (Males et al., 2006; Marcelino et al., 2009, 2012). And this was true even if the accumulated fatigue from the previous sets did not seem to affect physical indicators of performance; as indicated by the lack of significant differences in the jump height between sets in male volleyball players (Lima et al., 2019), or the fact that high-level male Polish players significantly covered more distance in the court in the final sets, with the distance covered in the fourth set being significantly longer than in the third set (Mroczek et al., 2014). Another study conducted with young volleyball players showed that repeated short-term physical exercise did not affect the level of effectiveness of basic techniques in volleyball (Cieśluk, 2022). However, after analyzing the competitive balance of the sets as a function of the set in the game in the present study, significant differences were only found in the fifth set both categories, as shown by a higher percentage of balanced sets. With the fifth set being the match tie-breaker, it is played for a maximum of 15 points instead of 25 points as in the rest of the sets. It seems logical to find less differences in the score and a higher number of balanced sets when playing for a smaller number of points in the fifth set. As for the differential behaviors per set recorded in other studies, it is possible that the similar behaviors of both teams did not significantly affect the competitive balance.

Conclusions

As the conclusions of the study, we can state that the competition load was associated with the total number of sets per match and the tie-breaker set; and it was only related with the competition analyzed in the

female category. The total number of sets per match was the best predictor for the classification of the matches as balanced or unbalanced. On the contrary, the competition load was not significantly related with the competition phase analyzed in any of the two categories.

As the practical application of the study, we consider that the inclusion of the competition load of the sets is important as a variable in future studies; this would allow for the study of how the balance in the sets affects the performance of technical indicators and the variability in the systems or game strategies. Also, there is a possibility of the selection of the sample in future studies based on the competition load of the sets, to presumably create a more homogenous sample with respect to their performance, due to the selection of balanced sets, as compared to that provided by other criteria based on the final classification or the phases of the competition. In both practical applications, the values provided here, for the definition of balanced or unbalanced sets in the male and female categories, could become reference values in high-level volleyball.

Conflicts of interest. The authors declare that there is no conflict of interest.

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