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2015 Badminton World Championship: Singles final men's vs women's behaviours

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ABSTRACT

The purpose of the current study was to identify players' behaviours and to assess differences between genders at final singles matches of 2015 Badminton World Championship, focusing on time events, shots and court movements. Final men's (MS) and women's (WS) singles matches of 2015 Yakarta World Championship were analysed (150 points and 967 actions). Official videos from Badminton World Federation were used to carry out the post-event analysis. Variables analyzed were: 'timing factors', type of 'shots' and players' trajectories executed during the match. Descriptive (mean and % of distribution) and comparative analysis between gender and result of events (successful vs. unsuccessful) were carried out. Generally speaking, time-related variables show higher figures in the men's final than in the women's. Smash, net and lob shots occur more frequently in the men's final, whereas clear, drop and drive shots are used more often in the women's final. The hitting of the shuttlecock without any previous movement redominates over the rest or movements for both genders. In the training field, these findings may be used by coaches in order to improve athletes' performance. In research field, it could be a new way to obtain information that had not been previously taken into account. **Key words**: BADMINTON, RACKET SPORTS, OBSERVATIONAL METHODOLOGY, PERFORMANCE FACTORS, NOTATIONAL ANALYSIS.

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INTRODUCTION

Badminton is a game consisting in hitting the shuttlecock across the other side of the court over the net, trying to send it to the area in the opponent's side where is hardest for them to hit it back (Cabello, 2000). In terms of effort, badminton is an intervallic sport with short-term and high intensity explosive actions which take place between recovery phases happening in an unpredictable pattern. Players have to move from the defensive position described by Gibbs (1988) to any area of the court sufficiently in advance to hit the shuttlecock back (Huber, 1999). The different shots have been classified according to their effectiveness by some authors like Cabello & González-Badillo (2003); Cabello, Serrano, & García (1999); Faude et al. (2007); Hernández (1989).

The analysis of technical factors -known as performance factors- can be used to determine the most effective actions in a sport. To achieve this aim, the methodology used must be able to register players' behaviours in the context of competition in an objective way. Observational methodology allows to analyse gestures and behaviours specific to the particular sport (Anguera, 1990, 1993) without interfering in the competition and/or the training. It also allows to identify the motor patterns – considered as players' usual or preferred behaviours – which constitute relevant information not only for coaches, who can use it to improve their players' performance, (Sánchez-Algarra & Anguera, 2013) but also for players themselves, who can use it as an advantage to gain control over the match (Losada, Casal, & Ardá, 2015).

The purpose of the current study was to identify players' behaviours and to assess differences between genders at final singles matches of 2015 Badminton World Championship, focusing on time events, shots and court movements.

MATERIALS AND METHOD

Sample

Singles men's and women's finals were evaluated (N= 150 points and 967 actions) and compared in order to identify differences between them. The register and subsequent codification were done by an expert observer, who has also been a coach and a player for more than 10 years.

Official videos from Badminton World Federation (BWF) were used to carry out the post-event analysis. According to the Belmont Report (Belmont, 1978) the use of public images for research purposes does not require informed consent.

Materials

The data register and analysis were done through the software indicated below: LINCE (Gabin, Camerino, Anguera, & Castañer, 2012) was used for registering the data obtained with the Badminton Observational Tool (BOT). This tool has been validated in a previous study (Valldecabres, de Benito, Casal & Pablos, 2017). KINOVEA was used to register court movements and IBM SPSS Statistics v.23 (SPSS Inc., Chicago IL) for the statistical processing.

Variables

Variables within 'time' and 'shot' categories were analysed using the classification suggested by Abián, Castanedo, Feng, Sampedro, & Abián-Vicén (2014); Fontes, Chiminazzo, Dobránszky, & Marque de Moraes (2014); Chen, Wu, & Chen (2011) and Pearce (2002). Thus, in 'timing factors' category the variables studied were as follows: *match duration*, *real time played*, *percentage of real time played*, *rally time*, *shots per rally*, *rest time*, *rest time at point 11*, *work density*, *shot frequency*, *rest between games* and *shots per game*. 'Shots' category contains the following variables: *short serve, deep serve*, *smash*, *clear*, *drop*, *net* (which includes net drop, push, kill and brush), *drive* and *lob*.

The category 'result of event' was added in order to consider the performance delivered by the player as a result of the shot. The following variables were established: *sucessful shot* (a shot with which the player executing it obtains a point) and *unsuccessful shot* (a shot that goes out of the court, into the net or that is returned by the opponent, that is to say any shot which does not grant a point to the observed player).

Regarding the description of 'court movements' these are defined as Valldecabres, de Benito, Casal and Pablos (2017): *longitudinal* (L), *transverse* (T), and *diagonal* (D). The option *no movement* is also considered (NM) for those shots hit without moving to a different area in the court. The distance covered by the sportspeople in the movements can be *short* (S) or *long* (L). Movement direction is also taken into account as follows: *forward* (F), *backward* (B), *to the right* (R) and *to the left* (L), (in the last two, considering the position of the player in relation to the net).

Statistical Analysis

A descriptive (mean) and comparative analysis of absolute and relative frequencies (% of distribution) of the different variables in both genders were carried out. Likewise, 'shot' and 'court movement' categories were analysed according to the 'result of the event'.

RESULTS

The comparative results concerning the category 'timing factors', presented in table 1, show higher figures for the men's final (MS) than for the women's final (WS) in the following variables: *match duration, real time played, percentage of time played, rally time, shots per rally, rest time, rest time at point 11* and *shots per match*. However, WS show higher *work density, shot frequency* and *rest time between game 1 – 2* than MS.

Table 1. 'Time' and 'shot' variables: MS vs. WS by games

	WS	MS
Match duration (s)	3680.178	4047.408
Total real time played (s)	772.564	880.473
% time played	20.993	21.754
Mean rally time (s)	10.033	12.061
Shots per rally (mean)	5.403	6.452
Mean rest time (s)	36.591	45.550
Mean rest time at point 11 (s)	97.862	106.626
Work density (mean)	0.274	0.265
Shot frequency (mean)	0.538	0.535
Rest time between game 1-2 (s)	163.320	152.424
Shots per game (total)	416	471

Figures 1 and 2 show the percentage distribution in the category 'shot' according to gender. These figures show that both in men and women the most used serve is the *short serve* (approximately 7%) and the most widely used shot is *net* (36.09% for men and 28.13% for women). MS shows a higher percentage in the use of *smashes* (11.46%) and *lob* (22.08%), whereas WS show higher figures in *clear* (13.70%), *drive* (8.89%) and *drop* (12.02%).

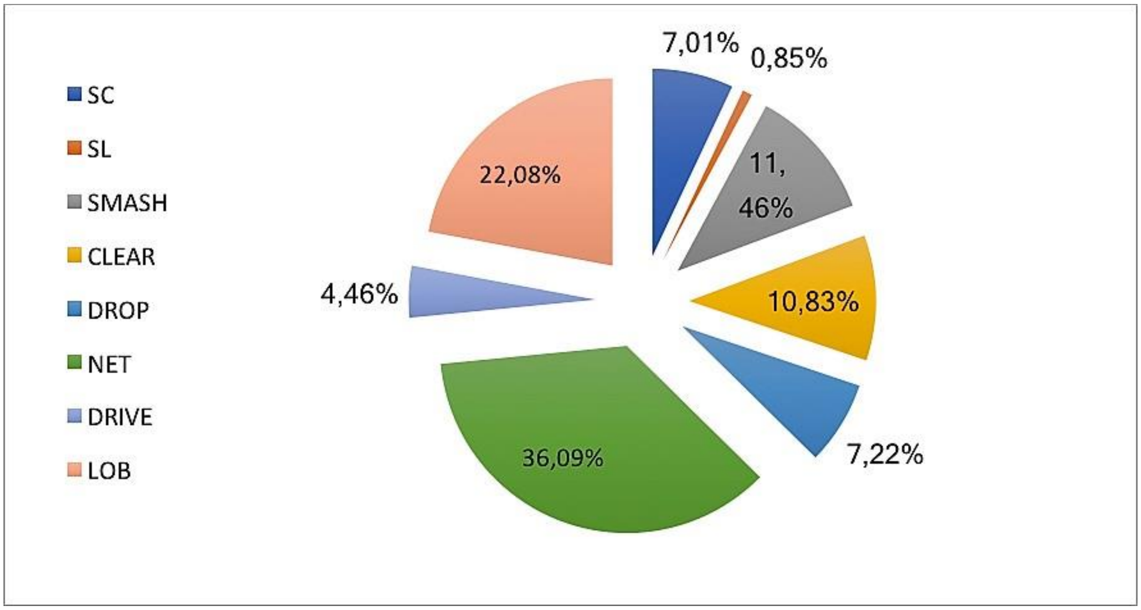

Figure 1. Percentage of shots taken in the men's single final.

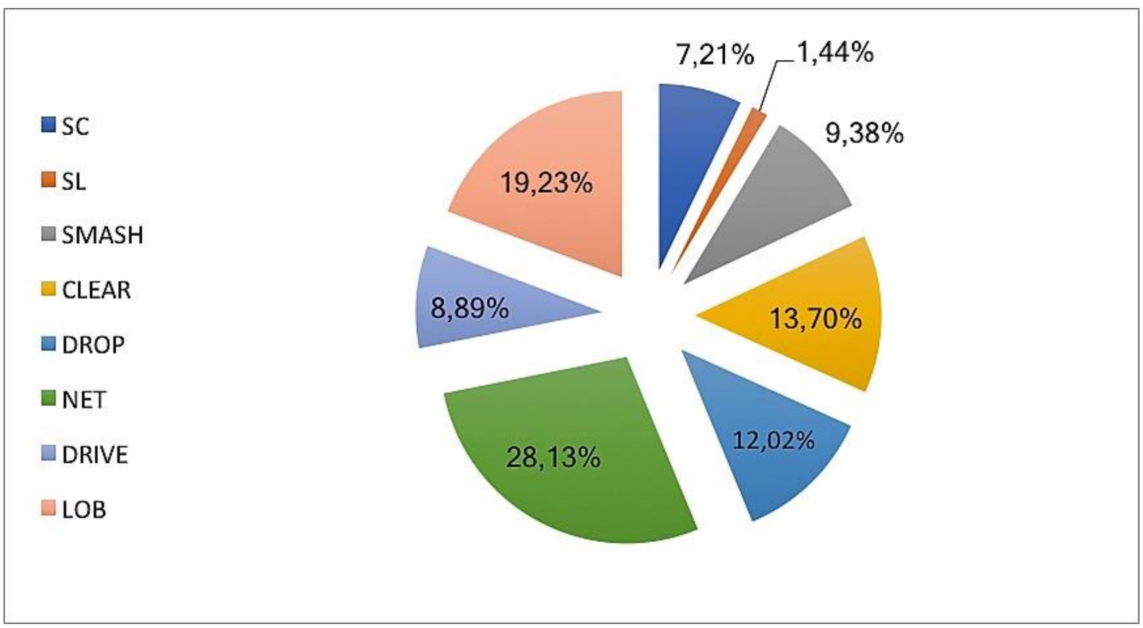

Figure 2. Percentage of shots taken in the women's single final.

Figures 3 and 4 display the success patterns in the category 'shot' (considering the kind of shot and the result obtained with it). It can be observed that both genders show similar behaviour patterns, it is the case that *smash* is the most successful shot and *net* the least successful one.

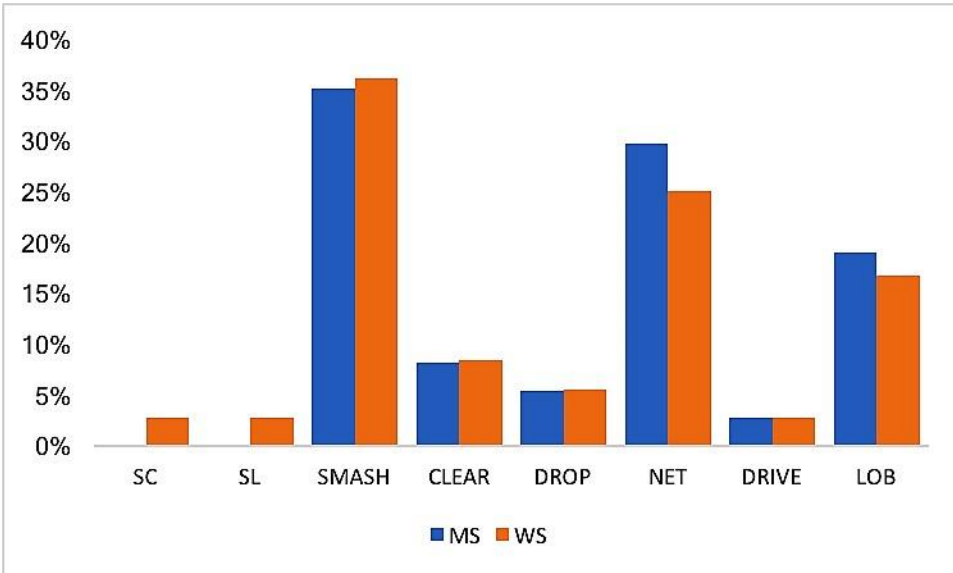

Figure 3. Percentage of successful shots according to gender.

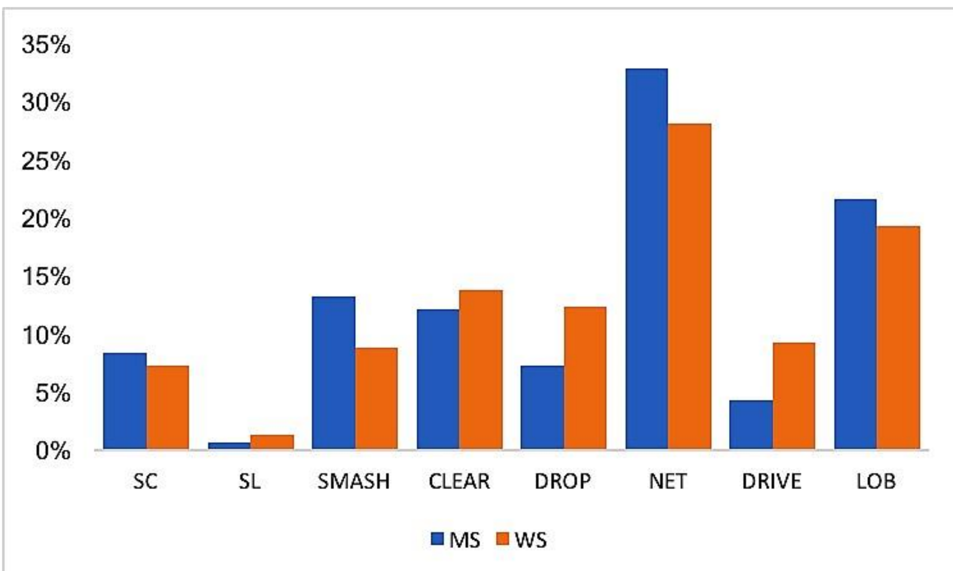

Figure 4. Percentage of unsuccessful shots according to gender.

The distribution, in percent, of players' court movements is presented in figure 5. The action *no movement* shows to be the most frequent for both genders.

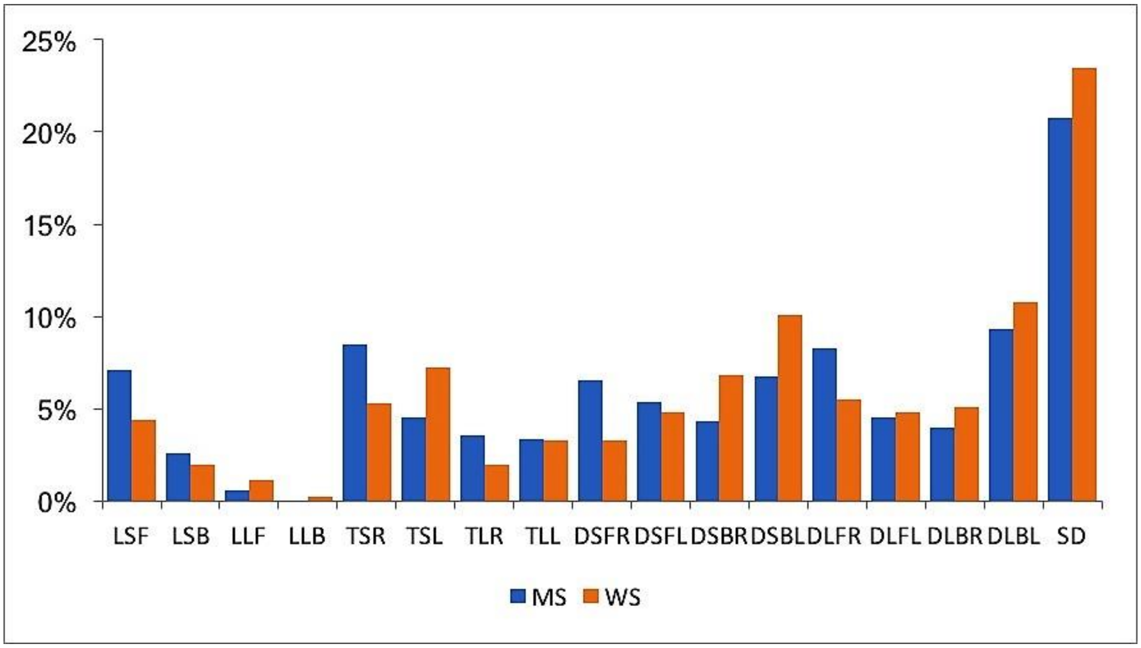

Figure 5. Players' court movements.

LSF: longitudinal short forward; LSB: longitudinal short backward; LLF: longitudinal long forward; LLB: longitudinal long backward; TSR: transverse short right; TSL: transverse short left; TLR: transverse long right; TLL: tranverse long left; DSFR: diagonal short forward right; DSFL: diagonal short forward left; DSBR: diagonal short backward right; DSBL: diagonal short backward left; DLFR: diagonal long forward right; DLFL: diagonal long forward lef; DLBR: diagonal long backward right; DLBL: diagonal long backward left; NM: No movement.

If results are organized according to movement direction (figure 6), *diagonal* movements constitute nearly 50% in both sexes, followed by shots with *no movement* with over 20%, then by *transverse* ones, which are under 20%, and finally, the least common are *longitudinal* ones, which present a percentage under 10.3%.

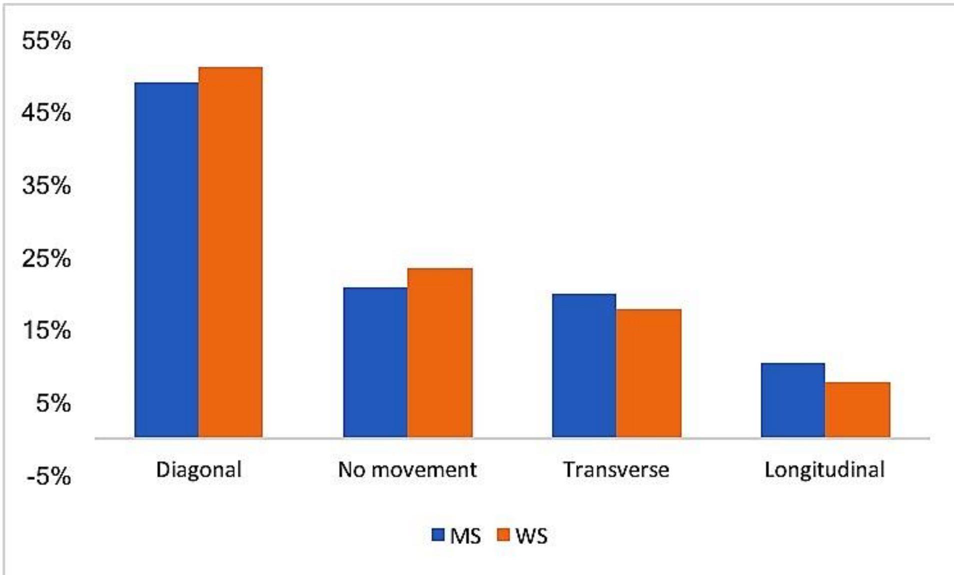

Figure 6. Percentage of gathered ‘court movements’ according to gender.

Figures 7 and 8 show the success patterns for ‘court movement’ category, (taking into account the kind of court movement previous to the shot and the result obtained with the shot). Both genders show similar behaviour patterns: the most successful court movement is *DSBL* with 16.22% in MS and 19.44% in WS. On the contrary, the least successful pattern is *NM* which presents a total of 15.79% for the category MS and 14.76% for WS.

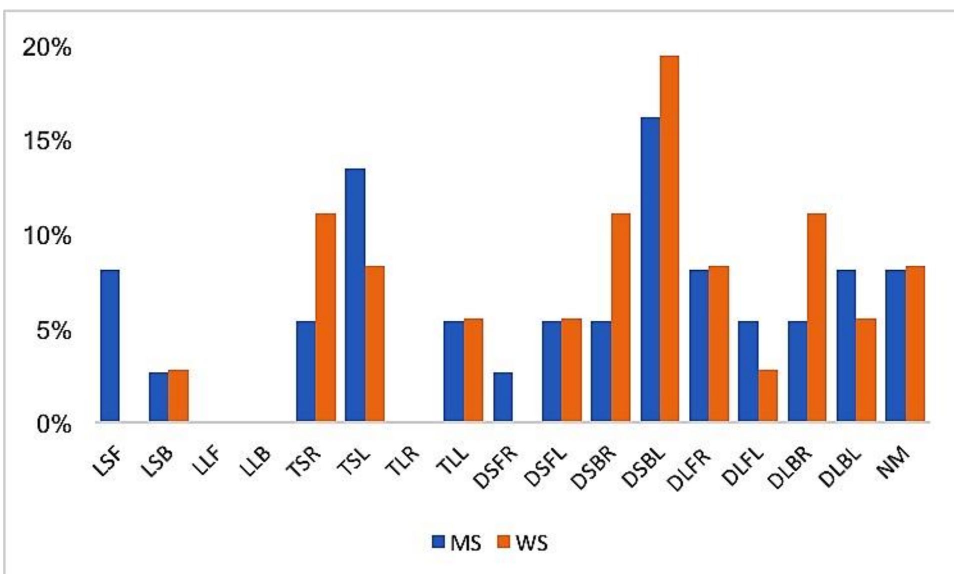

Figure 7. Percentage of successful ‘court movements’ according to gender.

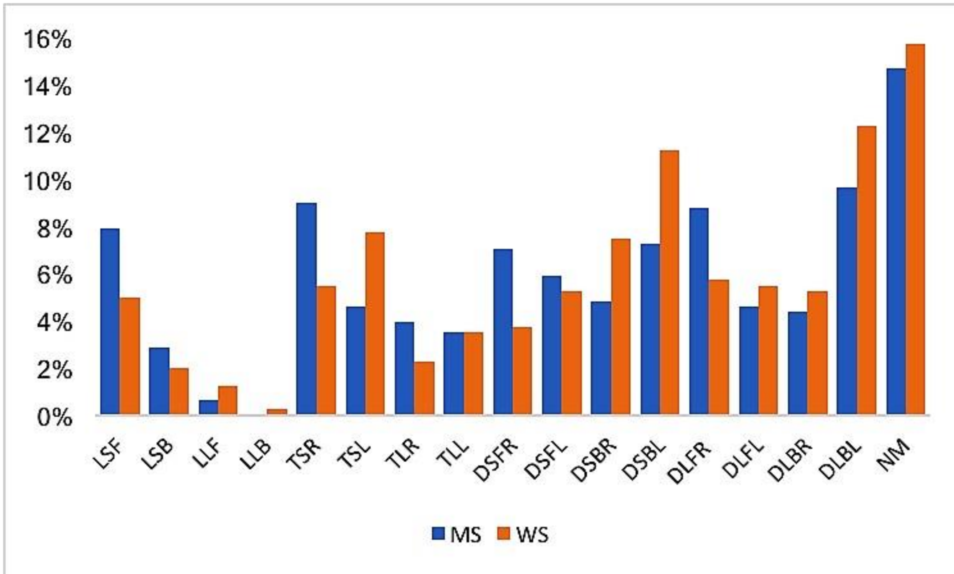

Figure 8. Percentage of unsuccessful 'court movements' according to gender.

In the same way, if 'court movements' are considered according to movement direction in order to check the success pattern, *diagonal* court movements account for the most successful patterns (figure 9), whereas *longitudinal* court movement is the least successful one for both genders.

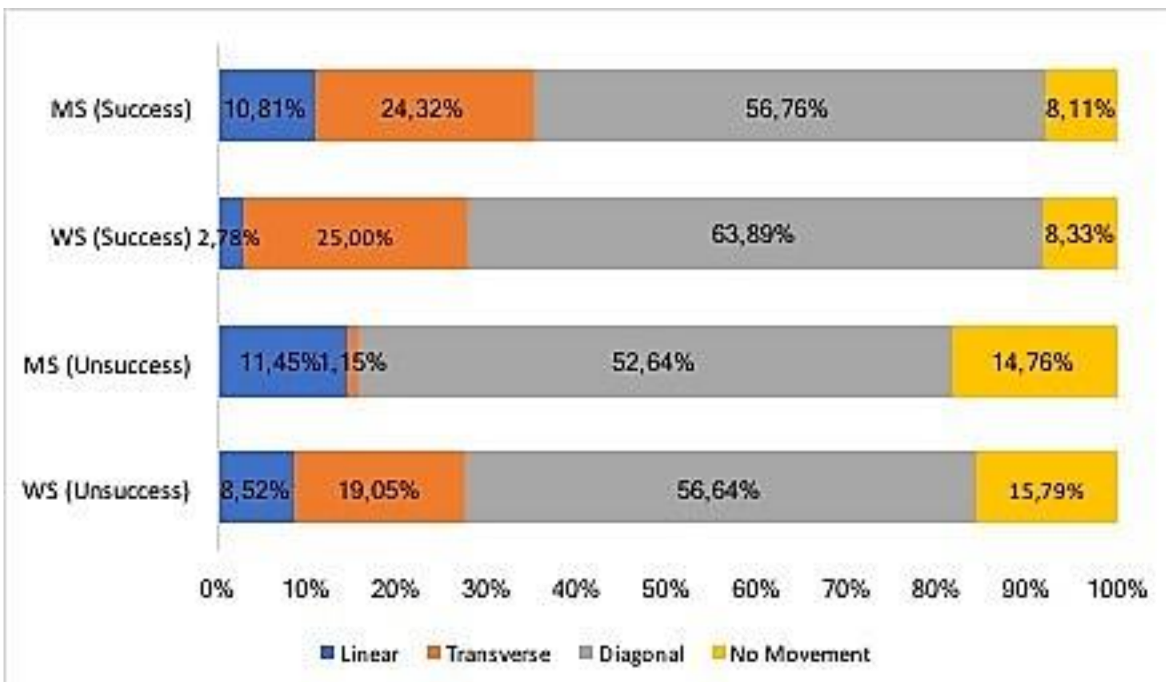

Figure 9. Percentage of court movements according to subcategory and gender and classified as successful and unsuccessful.

DISCUSSION

The purpose of the present study is to identify the technical actions executed by badminton players during the competitions and, then, to do a comparative analysis of these actions between genders. Men's and women's final single matches of 2015 Badminton World Championship were used as samples.

The results obtained for the category *match duration* (MS 4047.408s, WS 3680.178s, $\bar{X}$ 3863.793s) show higher figures than those provided by Cabello & González-Badillo (2003) ($\bar{X}$ 1689.33s), Chen & Chen (2008) (MS 1282s), Chen et al. (2011) (MS 1715s), Abián-Vicén, Castanedo, Abián, & Sampedro (2013) (MS 2378s, WS 1696s) and Abián et al. (2014) (MS Beijing 1124.6s, MS London 1260.3s).

Exactly the same comparison can be applied to the results in the category *real time played* (MS 880.473s, WS 772.654s, $\bar{X}$ 826.564s) showing higher figures than those in studies by Cabello & González-Badillo (2003) ($\bar{X}$ 548.75s), Chen & Chen (2008) (MS 649s), Chen et al. (2011) (MS 630s), Abián-Vicén et al. (2013), (MS 613s, WS 493s) and Abián et al. (2014) (MS Beijing 306.9s, MS London 354.7s).

Focusing on these results, matches tend to last longer since the implementation of the rally points scoring system in 2006, which forces players to take less risk in shots, which, in turn, results in longer matches.

The increase in the matches' total duration can account for the fact that the variable *% time played* observed in the present study (MS 21.754s, WS 20.993s, $\bar{X}$ 21.374s) shows lower figures than those in the study by Abián-Vicén et al. (2013) (MS Beijing 27.7s, MS London 28.0s) and those by Abián et al. (2014) (MS 26.0s, WS 29.0s).

The results obtained for the *rally time* category (MS 12.061s, WS 10.033s, $\bar{X}$ 11.047s) are higher than those obtained by Cabello & González-Badillo (2003) ($\bar{X}$ 6.4s), Faude et al. (2007) ($\bar{X}$ 5.5s), Ming, Keong, & Ghosh (2008) (MS 4.6s, WS 4.1s), Chen et al. (2011) (MS 9.5s), Abián-Vicén et al. (2013) (MS 9.1s, WS 7.9s) and Abián et al. (2014) (MS Beijing 9.0s, MS London 10.4s).

Moreover, the results obtained for the *rest time* category (MS 45.550s, WS 36.591s, $\bar{X}$ 41.071s) are higher than those by Cabello & González-Badillo (2003) ($\bar{X}$ 12.93s), Faude et al. (2007) ($\bar{X}$ 11.4s), Ming et al. (2008) (MS 9.7s, WS 10.5s), Chen et al. (2011) (MS 6.0s), Abián-Vicén et al. (2013) (MS 24.7s, WS 17.9s) and Abián et al. (2014) (MS Beijing 24.7s, MS London 26.7s).

The reason for the above mentioned results could lie on the samples used for the different studies. The four best players in the world in their categories at the moment are analysed in the present study. Therefore, longer matches are played and consequently, longer rests are needed as compared to other matches. Results are also higher to those presented by Laffaye, Phomsoupha, & Dor (2015) who compare information from the mens' single finals in 6 Olympic Games (OG-92 22.0s, OG-96 14.8s, OG-00 22.6s, OG-04 21.6s, OG-08 30.3s y OG-12 33.5s).

The figures shown for *mean rest time at point 11* (MS 106.626s, WS 97.862s, $\bar{X}$ 102.244s) are higher than those provided by Abián-Vicén et al. (2013) (MS 69.8s, WS 72.6s) and Abián et al. (2014) (MS Beijing 69.8s, MS London 79.6s). Numbers for *rest time between games* (MS 152.424s, WS 163.320s, $\bar{X}$ 157.872s) are also higher than those supplied by Abián-Vicén et al. (2013) (MS 128.7s, WS 130.9s) and by Abián et al.

(2014) (MS Beijing 128.7s, MS London 145.2s), due, possibly, to the sample chosen for the analysis, as it was pointed out above.

The present study produces results for *work density* (MS 0.265, WS 0.274, $\bar{X}$ 0.270) lower than those by Cabello & González-Badillo (2003) ($\bar{X}$ 0.49), Faude et al. (2007) ($\bar{X}$ 0.51), Ming et al. (2008) (MS 0.47, WS 0.40), Chen et al. (2011) (MS 0.57), Abián-Vicén et al. (2013) (MS 0.37, WS 0.45) and Abián et al. (2014) (MS 0.37, WS 0.39), due to the high figures in *rest time*, which reduces the players' work density on court.

Regarding the *shots per rally* variable, (MS 6.452, WS 5.403, $\bar{X}$ 5.928), the results observed are similar to those by Cabello & González-Badillo (2003) ($\bar{X}$ 6.06), higher than those by Faude et al. (2007) ($\bar{X}$ 5.1), Ming et al. (2008) (MS 4.74, WS 3.48) and Fontes et al. (2014) (MS 2.91, WS 2.45) and lower to those obtained by Chen & Chen (2008) (MS 6.9), Abián et al. (2014) (MS Beijing 9.8, MS London 11.1) and Laffaye et al. (2015) in 5 of the 6 Olympic Games analysed (OG-92 12.3, OG-00 9.7, OG-04 9.8, OG-08 10.8 y OG-12 12.0). Despite the fact that the present study considers only the shots played by one of the players (the one who is next to the camera), whereas the rest of the studies analyse both players, it can be observed that rallies analysed in the present study, inasmuch as lasting longer, show a higher number of shots than previous studies reviewed here. This could be caused by the change in the scoring system described above, which impels the players not to take any risks in their shots trying to avoid a direct point by the opponent.

The variable *shots per game* (MS 471, WS 416, $\bar{X}$ 443.5), shows higher figures than those by Ming et al. (2008) (MS 331.3, WS 242.5), Abián et al. (2014) (MS 333.4, WS 384.9) and Fontes et al. (2014) (MS 265, WS 192), possibly due to the fact that the players observed in the present study are at the top category, and this results in hard-fought matches, and in more points being played. However, the results are lower to those by Cabello & González-Badillo (2003) ($\bar{X}$ 510.75), as a result of the old scoring system.

Concerning the *shot frequency* variable, the present results (MS 0.535, WS 0.538, $\bar{X}$ 0.537) are lower to those obtained by Chen et al. (2011) (MS 1.03), Abián-Vicén et al. (2013) (MS 1.09, WS 0.92), Abián et al. (2014) (MS 1.09) and Laffaye et al. (2015) ($\bar{X}$ 0.92), which can also be caused by the fact that in the previous studies, figures considered implied both players whereas in the present study only one of the players in each set is considered.

Regarding the comparative analysis between gender, the results displayed indicate that, generally speaking, the time-related variables show higher figures in the men's final than in the women's, except for the variables *rest time between games* and *work density*, (the second one is affected by the first one). Shot categories referring to time variables, *shots per rally* and *shots per game*, are higher in men, though the *shot frequency* variable is lower, due to the shorter duration of points, and the fact that in the women's final there were fewer shots per point during the match.

As for the shots executed by players in the course of the match, none of the reviewed articles takes into account the kind of serve performed, even though the different kinds of serve have been defined Pearce (2002). In this way, *short serve* is the most commonly used shot to start the game (MS 7.01%, WS 7.21% $\bar{X}$ 7.11), whereas the use of the *deep serve* is infrequent (MS 0.85%, WS 1.44% y $\bar{X}$ 1.15%).

For the *smash* category (MS 11.46%, WS 9.38%, $\bar{X}$ 10.42%) results are lower to those by Chen et al. (2011) (MS 17%), Ming et al. (2008) (MS 13%, WS 8%) and Pearce (2002) (MS 10%). They are also lower to those obtained by Laffaye et al. (2015) regarding the data supplied for the single men's final in OG-08 and OG-12

(≈14% in both), whose scoring system is the same as in the present study. These results suggest that, as a consequence of the new punctuation system, players decide to use this shot only when they are sure to get a direct point.

Results for the *clear* category (MS 10.83%, WS 13.70%, $\bar{X}$ 12.27%) are higher than those by Laffaye et al. (2015) (<10% in OG 1996, OG 2004 y OG 2012). On the other hand, the results in the present study are lower than those by Pearce (2002) (MS 13%), Ming et al. (2008) (MS 16%, WS 23%), Chen et al. (2011) (MS 15%) and Laffaye et al. (2015) (>11% in OG 1992, OG 2000 y OG 2008). Such changeable data can be attributed to the fact that this type of shot makes it easier for the opponent to gain control over the shuttlecock (since it goes high when returned), as her or she has the chance to take an attacking initiative in the match obtaining a tactical advantage over the player who performed the shot.

The results obtained for the *drop* category (MS 7.22%, WS 12.02%, $\bar{X}$ 9.62%) are also lower than those by Pearce (2002) (MS 16%), Ming et al. (2008) (MS 13%, WS 22%) Chen et al. (2011) (MS 13%) and Laffaye et al. (2015) (MS >10%). This can be attributable to the fact that players may prefer to use a different shot, since this one is heavily affected by fatigue in the execution of the gesture, as it requires a high degree of accuracy so that the shuttlecock just clears the net.

Data obtained for the *net* category (MS 36.09%, WS 28.13%, $\bar{X}$ 32.11%) are lower than those reported by Chen et al. (2011) (MS 43%) and higher than those by Ming et al. (2008) (MS 17%, WS 14%) and Laffaye et al. (2015) (MS 25-35%). The reason for this increase in the use of *net* shots could be found in the fact that players prefer ‘net technical game’ to the old ‘run all over the court’ game.

Results obtained for the *drive* category (MS 4.46%, WS 8.89%, $\bar{X}$ 6.68%) are similar to those in the research by Laffaye et al. (2015) (MS ≈5%) confirming the assumption that its use is in decline, probably, due to the fact that it gives the opponent the opportunity to take an attacking initiative in the match.

The *lob* category (MS 22.08%, WS 19.23%, $\bar{X}$ 20.66%) shows similar results in men to those supplied by Ming et al. (2008) (MS 22%) and lower for WS (15%). Yet, they are lower to those obtained by Laffaye et al. (2015) (MS ≈25%). The cause for these differences can be the same as the ones provided for the shots commented above: the shift in the way players approach the game, going from a game at the back of the court to one near the net.

As for the gender comparison, *smash*, *net* and *lob* shots occur more frequently in the men’s final, whereas *clear*, *drop* and *drive* shots are used more often in the women’s final. These differences can be due to the physical characteristics of their distinctive game, which is more powerful in men, while in the women category more accuracy but less strength in execution is sought.

No studies have been found where player’s court movements are analysed, except for Kuntze, Mansfield, & Sellers (2010) where the ‘lunge’ gesture towards the net is analysed and defined as a gesture which allows the player executing it to move forward to hit and go back to the centre of the court (defensive position) getting ready for the following move and/or shot. The aforementioned research does not distinguish movement direction and concludes that the net gesture implies around 15% of the players’ movements (17% in the case of players playing at international competitions).

Players at the single men’s and women’s finals in the World Championship in 2015 hit the shuttlecock without doing any court movement (NM) in more than 20% of the occurrences (MS 20.75%, WS 23.46%), followed by DLBL (MS 9,29%, WS 10.75%). If grouped together according to trajectory, *diagonal* ones are the most executed (MS 49.01%, WS 51.10%) followed by *transverse* ones (MS 19.96%, WS 17.76%) and *longitudinal* ones (MS 10.28%, WS 7.68%).

If the outcome of the shot executed after the movement is born in mind, the DSBL is the most successful one (MS 16.22%, WS 19.44%), while on the contrary NM is the least successful one (MS 14.76%, WS 15.79%). Taken in groups, the most successful shots are diagonal ones in both genders (MS 56.76%, WS 63.89%).

The differences in gender regarding movement are small in relative data, since both finals show similar patterns.

Results shown here can be useful for coaches when it comes to analysing technical gestures executed in high level matches in depth (as in the sample in this study). As a result, more efficient training sessions can be planned: strengthening the execution of successful patterns, avoiding, in turn, unsuccessful patterns, and therefore enabling the scoring of points which allows players to win matches.

The sample used in the present study imposes a limitation on it, since only the finals of the World Championship 2015 are analysed, and the data may vary if the scope of the analysis is widened to the whole championship, which is a task that should be undertaken in the future.

CONCLUSIONS

The results of the present study show an increase in the physical demand required in both men's and women's single matches, due to the increase in the time participants play. Nevertheless, the matches' density has decreased due to the increase in the rest periods.

Players also show a shift regarding the variable shot, and the use of flat trajectories (such as *drop* or *clear*) is less frequent. The *net* shot is the most executed one, even though it proves to be quite ineffective, whereas *smash* is the least used one in spite of being the most effective.

Furthermore, the present study shows that more than 50% of the successful court movements correspond to *diagonal* ones and end up in a point for the player who hits the shuttlecock after performing that movement. Likewise, it has been shown that 20% of the times, players hit the shuttlecock without doing any previous movement (NM) which, in turn, is the least successful movement pattern in both finals.

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