



Statistical Comparison of Singles Badminton Matches at the London 2012 and Rio De Janeiro 2016 Olympic Games

by

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The aim of this study was to analyse statistical differences in men's and women's singles badminton competitions at the London and Rio Olympic Games. Forty-five matches (128 sets in total) played at the 2012 and 2016 Olympics in badminton were analysed. Variables related to the match (6) and each set (13) were determined. The results show the longest rally in sets 1 and 3, the biggest come back to win the game in set 2, and that the duration of set 3 for men was longer in Rio than in London. All of the women's sets had longer duration, and the rally length and the number of strokes per rally was also longer in Rio versus London. In conclusion, the timing factors of badminton singles were dissimilar in London 2012 and Rio 2016 for both men and women. This information may help players and coaches manage different workout types or, more specifically, competition schedules that are adapted to suit modern badminton's characteristics.

Key words: racket sport, notational analysis, elite performance.

Introduction

Performance indicators are constantly being analysed in racket sports today (Cui et al., 2017; Girard et al., 2007; Torres-Luque et al., 2015) in which badminton is a modality characterised by actions of short and high intensity with brief rest periods (Phomsoupha and Laffaye, 2015).

Badminton-related research has grown exponentially since 2006 with introduction of a new "rally-point scoring" system that has triggered efforts to analyse and determine the differences between scoring systems (Chen and Chen, 2008, 2011), technical aspects (Li et al., 2017), types of strokes (Valdecabres et al., 2017), performance indicators between winners and losers (Barreira et al., 2016) or temporal structure (Abdullahi and Coetzee, 2017), all studied with respect to single players.

In this sense, greater analysis has occurred at the international level such as the Badminton Championships (Abdullahi and Coetzee, 2017; Valdecabres et al., 2017) or world-class competition (Gawin et al., 2015), with special attention paid to the Olympic Games (Abian-Vicen et al., 2013; Abián et al., 2014; Laffaye et al., 2015) in singles modalities. It is noted that badminton has been an Olympic sport since 1992 and the game system for this competition has also been changed (Phomsoupha and Laffaye, 2015).

Laffaye et al. (2015) comparatively analysed singles games at the Barcelona 1992 and London 2012 Olympic Games and concluded there was high intensity in the exchange of strokes, reaching even 1.26 strokes per second, together with a longer resting time and shorter

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effective game time due to the gradual lengthening of the time in which the game remained intense.

To date, in singles games, the Beijing 2008 and London 2012 Olympic Games are the last for which data are available regarding the temporal structure (Abian-Vicen et al., 2013; Abián et al., 2014). Studies show the set time was longer, with longer points and more strokes played at the London than the Beijing Games (Abian-Vicen et al., 2013; Abián et al., 2014). Namely, coaches must consider the need for continuous and ongoing change while preparing their players, although here not as much information is available for singles women's badminton. Furthermore, little research has compared male with female players, which seems of interest given that in Beijing 2008 evidence showed that male players played more games, scored more points and had longer rest periods than female players, male players also completed more strokes per point compared to female players (Abian-Vicen et al., 2013).

Therefore, we believe it is appropriate to continue such research into the temporal structure of singles badminton modalities at the Olympic Games, differentiating between males and females, and observing the specific characteristics of each set.

This study's purpose was to compare the notational structure of world-level badminton in men's and women's singles games played at the London and Rio de Janeiro Olympic Games to observe how this sport developed from 2012 to 2016.

Methods

Sample

The sample for analysis included 128 sets (45 matches) played at the 2012 and 2016 Olympic Games in badminton, with the distribution shown in Table 1.

The data were collected from the Olympic Games' official website (London 2012, Rio 2016). All matches were played according to the current badminton rules where the first player winning the best of 3 games of 21 points was the winner (BWF, 2017). The sample represents 100% of the matches played. The characteristics of the competition show the players were the world's best at the time.

Procedures

Data were collected from the International Olympic Committee's official website <https://www.olympic.org> and, more specifically, at <https://library.olympic.org/> using the same methodology as in previous studies (Ortega et al., 2009; Sánchez-Pay et al., 2015; Torres-Luque et al., 2017). The Badminton World Federation together with the Organisation Committee selected and trained the observers under our supervision with an appropriate level of reliability. The analysed variables are shown in Table 2.

A specifically designed spreadsheet (Microsoft Excel) was used to collect the statistics on winning and losing players in the different modalities which were then exported to IBM SPSS version 21.0 (IBM Corp., Armonk, NY, USA).

Statistical analysis

The IBM SPSS version 21.0 (IBM Corp., Armonk, NY, USA) statistical program for analysis was used. First, a descriptive analysis of the data (means and standard deviation) was performed. Second, a univariate (Mann-Whitney U) test (non-parametric) was conducted to analyse differences at the two Olympic Games (London 2012 and Rio 2016) given that the assumptions of normality and homogeneity of variance were not satisfied. Uncompleted matches were excluded from the database. Significance was established at $p < 0.05$.

Results

Table 3 shows variables related to the match and three different sets in men's singles badminton matches.

The results show the longest rally was in sets 1 and 3 ($p < 0.01$), the greatest come back to win the game was made in set 2 ($p < 0.05$) and set 3 ($p < 0.01$) was longer in duration in Rio than in London.

Table 4 shows variables related to the match and three different sets in women's singles badminton matches.

The women's results show the length of a rally in a match was at a more average level ($p < 0.05$) in Rio than in London; furthermore, longer duration of all sets ($p < 0.05$) and a higher number of strokes per rally ($p < 0.05$) were observed at the Rio than the London Olympics.

Discussion

Competition in sport has attracted growing analysis interests (Gomez-Ruano, 2017). Badminton has seen regulatory changes and important developments ever since being included in the Olympic Games in 1992, in turn generating great interest in changes made to the sport between the Olympic Games. In this study, differences in competition statistics between the last two Olympic Games are presented and broken down by set to offer particularly useful information for both players and coaches.

While observing general game statistics, it may seem there were no differences between the London and Rio Olympic Games in men, with the only differences being found in the variable “average rally” in women. Following regulation changes in 2006 and taking the differences between Beijing and London into account, this implies that it is only now that the variables are experiencing stabilisation at the general level. It should also be noted that males have been analysed more thoroughly (Laffaye et al., 2015), with the present study being one of the first to analyse females in any more exhaustive way.

In addition, one of the most useful analyses proposed considers information per set,

where the set duration in men’s badminton is around 21–23 min in the first and second sets with no significant difference in the Olympic Games studied below, yet with a statistically significant difference in the third set (29 min in Rio vs. 25 min in London). This is interesting because the set duration remained the same between the Beijing and London Olympic Games at around 18–19 min (Abian-Vicen et al., 2013; Abián et al., 2014). Other authors have established set-duration values of 18–25 min (Abdullahi and Coetzee, 2017; Cabello-Manrique and Gonzalez-Badillo, 2003). This difference of a tendency for a longer third set must be considered during specific training since it will influence the game’s duration and other variables. Moreover, since it comes at the end, it is obvious the player will face greater fatigue. For males, a close relationship is seen with the number of shuttlecocks used, where the stroke that tends to damage the shuttlecock is the smash and, while not analysed in this study, the number of smashes was observed to stabilise at London Olympic Games (Abián et al., 2014; Laffaye et al., 2015), which might play a role.

Table 1
Number of matches and sets analysed at the London 2012 and Rio de Janeiro 2016 Olympic Games

| | Rio – 2016 | London – 2012 | Total |
|---------------|--------------|---------------|---------------|
| Singles Men | 13 (31 sets) | 16 (37 sets) | 29 (68 sets) |
| Singles Women | 12 (26 sets) | 14 (32 sets) | 26 (58 sets) |
| Total | 25 (57 sets) | 30 (69 sets) | 45 (128 sets) |

Table 2
Variables analysed in the double’s badminton competition

| Group of variables | Game statistics |
|--------------------------------|--|
| Variables related to the match | Duration of the match, longest rally (s), longest rally (strokes), average rally (s), average rally (strokes), shuttles used |
| Variables related to the set | Match points, set points, duration of the set, total points won, longest rally (s), longest rally (strokes), average rally (s), average rally (strokes), shuttles used, points scored without a service, points scored with a service, biggest lead, biggest come back to win the game |

Table 3

Difference in statistics for men's singles badminton matches at the London and Rio Olympic Games

| | Rio – 2016 M±SD | London – 2012 M±SD | <i>p</i> |
|-----------------------------------|--------------------|-----------------------|----------|
| <i>Variables related to match</i> | | | |
| Duration of the match (min) | 58.76 ± 18.75 | 55.87 ± 15.68 | 0.73 |
| Longest rally (s) | 45.30 ± 10.24 | 42.68 ± 12.06 | 0.24 |
| Longest rally (strokes) | 42.76 ± 9.04 | 42.00 ± 9.88 | 0.68 |
| Average rally (s) | 10.23 ± 1.88 | 10.12 ± 2.29 | 0.82 |
| Average rally (strokes) | 8.92 ± 1.57 | 8.25 ± 1.70 | 0.19 |
| Shuttles used | 22.92 ± 11.38 | 26.56 ± 6.61 | 0.07 |
| <i>Set 1</i> | | | |
| Match points | -- | -- | -- |
| Set points | 1.92 ± 1.38 | 1.35 ± 0.78 | 0.11 |
| Duration of the set | 21.61 ± 5.37 | 21.40 ± 5.15 | 0.59 |
| Total points won | 17.46 ± 4.78 | 17.81 ± 4.17 | 0.90 |
| Longest rally (s) | 42.30 ± 11.44 | 35.31 ± 10.50 | 0.02 |
| Longest rally (strokes) | 37.69 ± 10.44 | 34.50 ± 9.55 | 0.28 |
| Average rally (s) | 10.30 ± 2.34 | 10.56 ± 2.58 | 0.13 |
| Average rally (strokes) | 8.84 ± 2.11 | 8.62 ± 1.68 | 0.72 |
| Shuttles used | 9.30 ± 3.76 | 11.00 ± 3.04 | 0.13 |
| Points scored without a service | 8.46 ± 3.00 | 9.12 ± 2.21 | 0.24 |
| Points scored with a service | 9.00 ± 4.34 | 8.68 ± 3.71 | 0.85 |
| Biggest lead | 5.65 ± 4.31 | 5.14 ± 3.64 | 0.71 |
| Biggest come back to win the game | 2.40 ± 1.64 | 2.25 ± 1.48 | 0.83 |
| <i>Set 2</i> | | | |
| Match points | 1.87 ± 0.64 | 1.45 ± 0.68 | 0.14 |
| Set points | 1.60 ± 0.89 | 2.40 ± 3.13 | 0.70 |
| Duration of the set | 23.84 ± 6.41 | 22.18 ± 4.54 | 0.54 |
| Total points won | 17.76 ± 3.89 | 17.00 ± 4.47 | 0.61 |
| Longest rally (s) | 37.30 ± 8.18 | 40.50 ± 11.95 | 0.38 |
| Longest rally (strokes) | 36.53 ± 8.24 | 38.93 ± 9.52 | 0.33 |
| Average rally (s) | 10.23 ± 1.60 | 10.06 ± 2.31 | 0.97 |
| Average rally (strokes) | 9.00 ± 1.74 | 8.43 ± 1.60 | 0.38 |
| Shuttles used | 8.53 ± 4.24 | 12.00 ± 2.40 | 0.00 |
| Points scored without a service | 9.57 ± 2.24 | 9.03 ± 1.55 | 0.24 |
| Points scored with a service | 8.19 ± 3.76 | 7.96 ± 4.36 | 0.92 |
| Biggest lead | 5.70 ± 3.72 | 5.76 ± 4.19 | 0.85 |
| Biggest come back to win the game | 2.14 ± 0.89 | 1.30 ± 0.48 | 0.04 |
| <i>Set 3</i> | | | |
| Match points | 2.20 ± 1.09 | 1.20 ± 0.44 | 0.06 |
| Set points | -- | -- | -- |
| Duration of the set | 29.40 ± 3.80 | 25.60 ± 2.63 | 0.00 |
| Total points won | 18.80 ± 3.39 | 17.30 ± 4.90 | 0.50 |
| Longest rally (s) | 48.00 ± 7.74 | 39.80 ± 12.70 | 0.02 |
| Longest rally (strokes) | 47.00 ± 4.26 | 44.40 ± 7.79 | 0.28 |
| Average rally (s) | 12.20 ± 1.81 | 10.40 ± 3.74 | 0.16 |
| Average rally (strokes) | 10.80 ± 1.39 | 9.60 ± 1.95 | 0.06 |
| Shuttles used | 13.20 ± 6.94 | 11.40 ± 3.02 | 0.87 |
| Points scored without a service | 10.30 ± 2.35 | 9.30 ± 2.98 | 0.46 |
| Points scored with a service | 8.50 ± 2.95 | 8.00 ± 4.44 | 0.67 |
| Biggest lead | 4.11 ± 2.47 | 5.62 ± 4.43 | 0.73 |
| Biggest come back to win the game | 2.75 ± 0.95 | 2.00 ± 1.00 | 0.35 |

Table 4

Difference in statistics for women's singles badminton matches at the London and Rio Olympic Games

| | Rio – 2016 M±SD | London – 2012 M±SD | <i>p</i> |
|-----------------------------------|--------------------|-----------------------|----------|
| <i>Variables related to match</i> | | | |
| Duration of the match | 50.66 ± 13.75 | 48.92 ± 14.62 | 0.46 |
| Longest rally (s) | 38.50 ± 7.37 | 31.71 ± 13.15 | 0.10 |
| Longest rally (strokes) | 34.16 ± 9.22 | 32.07 ± 7.26 | 0.35 |
| Average rally (s) | 10.50 ± 1.74 | 8.71 ± 2.94 | 0.05 |
| Average rally (strokes) | 7.58 ± 1.28 | 7.07 ± 1.30 | 0.51 |
| Shuttles used | 14.83 ± 6.22 | 14.00 ± 5.49 | 0.65 |
| <i>Set 1</i> | | | |
| Match points | -- | -- | -- |
| Set points | 1.25 ± 0.62 | 2.00 ± 1.30 | 0.07 |
| Duration of the set | 21.58 ± 4.32 | 18.78 ± 2.93 | 0.01 |
| Total points won | 17.79 ± 4.43 | 18.00 ± 3.28 | 0.95 |
| Longest rally (s) | 33.83 ± 6.78 | 27.21 ± 10.58 | 0.14 |
| Longest rally (strokes) | 31.00 ± 9.99 | 26.71 ± 5.85 | 0.18 |
| Average rally (s) | 10.58 ± 1.93 | 9.07 ± 3.20 | 0.31 |
| Average rally (strokes) | 7.83 ± 1.43 | 7.50 ± 1.42 | 0.62 |
| Shuttles used | 6.91 ± 2.48 | 5.71 ± 1.86 | 0.06 |
| Points scored without a service | 9.04 ± 2.34 | 9.39 ± 1.22 | 0.37 |
| Points scored with a service | 8.75 ± 3.91 | 8.75 ± 3.03 | 0.83 |
| Biggest lead | 5.35 ± 4.09 | 5.29 ± 3.43 | 0.88 |
| Biggest come back to win the game | 2.28 ± 1.97 | 1.90 ± 1.37 | 0.78 |
| <i>Set 2</i> | | | |
| Match points | 1.90 ± 1.10 | 2.00 ± 1.41 | 0.94 |
| Set points | 2.50 ± 2.12 | 1.85 ± 1.21 | 0.62 |
| Duration of the set | 22.83 ± 3.84 | 20.28 ± 4.22 | 0.02 |
| Total points won | 17.70 ± 4.12 | 18.46 ± 4.28 | 0.34 |
| Longest rally (s) | 34.16 ± 6.98 | 29.35 ± 13.34 | 0.18 |
| Longest rally (strokes) | 28.33 ± 6.57 | 30.00 ± 8.42 | 0.76 |
| Average rally (s) | 10.66 ± 2.01 | 9.00 ± 3.03 | 0.08 |
| Average rally (strokes) | 7.75 ± 1.56 | 7.50 ± 1.71 | 0.73 |
| Shuttles used | 7.33 ± 3.57 | 6.57 ± 3.23 | 0.43 |
| Points scored without a service | 8.58 ± 2.20 | 9.21 ± 1.68 | 0.32 |
| Points scored with a service | 9.12 ± 3.92 | 9.11 ± 4.12 | 0.85 |
| Biggest lead | 5.75 ± 3.58 | 4.73 ± 3.36 | 0.29 |
| Biggest come back to win the game | 2.28 ± 1.11 | 2.77 ± 2.10 | 0.86 |
| <i>Set 3</i> | | | |
| Match points | 1.50 ± 0.70 | 1.25 ± 0.50 | 0.57 |
| Set points | -- | -- | -- |
| Duration of the set | 26.50 ± 5.19 | 21.00 ± 1.51 | 0.03 |
| Total points won | 16.75 ± 5.31 | 18.12 ± 3.22 | 0.71 |
| Longest rally (s) | 41.00 ± 6.92 | 30.00 ± 3.46 | 0.00 |
| Longest rally (strokes) | 36.00 ± 5.77 | 25.75 ± 2.05 | 0.00 |
| Average rally (s) | 13.00 ± 2.30 | 9.75 ± 1.38 | 0.02 |
| Average rally (strokes) | 10.50 ± 1.73 | 6.75 ± 0.46 | 0.00 |
| Shuttles used | 3.50 ± 1.73 | 6.00 ± 1.69 | 0.08 |
| Points scored without a service | 8.00 ± 1.15 | 9.33 ± 1.58 | 0.15 |
| Points scored with a service | 8.75 ± 5.12 | 9.00 ± 3.08 | 1.00 |
| Biggest lead | 8.50 ± 3.53 | 5.00 ± 2.58 | 0.23 |
| Biggest come back to win the game | -- | 1.50 ± 0.70 | -- |

With regard to females, the data are very revealing. First, there are considerably fewer studies of women's badminton and they indicate set-duration values of around 13 min (Abian-Vicen et al., 2013). In fact, at the Beijing Olympics it was observed that the second set was significantly longer than the first, although there were no data on the third set. At the analysed Olympic Games, duration of 18–21 min was observed, while at the Olympic Games in Rio this value was significantly higher (21–26 min), suggesting the continuous development of women's badminton and the need to continue researching the game's dynamics. These figures are the highest values when taking all competitive levels and even the type of score into account (Phomsoupha and Laffaye, 2015), with the differences being significant in all sets, just like for males, where the last set was longest. Although more work is needed to expand on women's notational analysis, in this case shuttlecock use is not a determinant, which might translate into stabilisation of the gestural structure. However, as already noted, this falls outside the scope of the present study.

Obviously, these set-duration findings hold direct implications for other variables. The rally duration in this study was 10 s for male players with a slight difference only in the first set (10.50 \pm 1.74 s in Rio versus 8.71 \pm 2.94 s in London). These figures are generally higher than for previous Olympic Games of around 9 s (Abian-Vicen et al., 2013; Abián et al., 2014), although at the Barcelona 1992 Olympic Games 12 s was established using the old scoreboard (Laffaye et al., 2015). Compared to our study, these figures are close to those found for the third set, thereby revealing the sport's continuous growth and greater specialisation. This implies that strokes per point have stabilised at between 8 and 10 and, although it is not significant between Olympic Games, they are similar values to those found in other studies (Abian-Vicen et al., 2013; Abián et al., 2014; Laffaye et al., 2015), suggesting it is a variable that tends to stabilise over time for males. However, for female players, and despite the small number of studies, it seems the average duration of a point has increased from 7–8 s as evidenced in the literature (Abian-Vicen et al., 2013) to 10.5 s as reported in this study. At the same time, there is already a statistically

significant difference in this variable from 8.7 s at the London to 10.50 s at the Rio Olympic Games. Another strength of this study is the analysis it provides by set, for which the data are very revealing. In both genders, there is a rise in the duration of a point and thus in the number of strokes in the third set (12 s in boys and 13 s in girls), namely, the highest values anywhere in the literature (Abian-Vicen et al., 2013; Abián et al., 2014; Laffaye et al., 2015). This shows that badminton continues to develop, with Rio showing the highest values for the tail end of the match, bringing a direct impact by way of fatigue and calling for specific physical preparation for such moments. In this study, shot frequency was not analysed although the data suggest a ratio of around 0.7–0.8 in both genders, which again shows a faster game in Rio than found to date (Abian-Vicen et al., 2013; Abián et al., 2014; Phomsoupha and Laffaye, 2015).

One variable attracting little attention in the literature is the longest rally in seconds and the number of strokes. In the current study, a tendency is apparent of an increase in the longest point in Rio compared to London, although it is only statistically significant in the third set in both men (48 s) and women (41 s); the average duration of the longest rally is 45 s and 42 strokes in males and 38 s and 34 strokes in females. Badminton is again shown to be continuously developing since different studies reveal that around 10–20% of points lasted more than 18 s in men, namely longer in London than in Beijing, albeit without statistical significance (Abián et al., 2014; Laffaye et al., 2015). Despite knowing that badminton rallies last around 10 s in both genders, coaches are aware that some rallies even last 40–50 s and that they were longer in Rio than in London, stressing the importance of the need to specifically train and prepare for the final part of the game. In particular, this is because the intensity of badminton can reach 90% of the maximum HR in male and female players (Bisschoff et al., 2016; Cabello-Manrique and Gonzalez-Badillo, 2003; Ramos Alvarez et al., 2016). While situations in the third set in Rio reached very high values for duration and the number of strokes, what is missing is understanding of how many of these points are developed as key points, and which are critical to success. More research is required to further

develop this sport's continuous growth.

Conclusion

In conclusion, when looking at general game statistics one may observe there are no differences between Rio versus London in males, and only in the variable "average rally" in women. However, the analysis by set conducted for males shows the set duration, rally time or number of strokes per rally were higher in set 3 in Rio than in London. For females, it is concluded that the set duration is longer in Rio than in

London for all sets. In turn, the data concerning set 3 are very revealing, pointing to the longer point duration, higher average number of strokes, and longer duration of the longest rally in Rio compared to London.

This study can help players and coaches manage their workout type or competition schedule more specifically to suit the characteristics of badminton at the Olympic Games.

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