Title: Performance structure analysis of the men´s and women´s badminton doubles matches in the Olympic Games from 2008 to 2016.

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Extended abstract:

Introduction: Badminton is one of the most practised sports in the world. In official competition there are five events each with different temporal and notational characteristics (Gawin, Beyer, & Seidler, 2015; Liddle, Murphy, & Bleakley, 1996). Temporal and notational badminton studies performed to date have been focused on the singles events (Abian-Vicen, Castanedo, Abian, & Sampedro, 2013; Abián, Castanedo, Feng, Sampedro, & Abian-Vicen, 2014; Laffaye, Phomsoupha, & Dor, 2015); however information is lacking on the badminton match structure in doubles events. The purpose of this study was to compare the timing factors and notational structure of top world level badminton in men's and women's doubles matches in the Olympic Games in Beijing, London and Rio to observe the evolution of this sport between 2008 and 2016.

Methods: All the matches from the quarterfinals to the final of the men's doubles and women's doubles events from the 2008 Beijing Olympics Games, 2012 London Olympic Games and 2016 Rio Olympic Games were analysed (48 matches, 114 games and 4119 rallies). All of them were retrieved from the Olympic Multimedia Library supplied by the International Olympic Committee Studies Centre and analysed using a timing structure and with a notational approach. A two way ANOVA 2x3 was used to establish the differences in the variables between the two events (men's doubles and women's doubles) and among the three Olympic Games (Beijing, London and Rio).

Results: Match duration was higher in Rio than Beijing ($P = 0.001$) and London ($P = 0.001$). Real time played, total points played, shots per match and rest time between points were higher in Rio than London and Beijing ($P<0.05$). The women's doubles modality showed higher real time played in Beijing (diff = 289.4 s, $P = 0.005$) and Rio (diff = 297.3 s; $P = 0.004$) than the men's doubles modality. The percentage of time played, shots per rally, rally time and work density were higher and shot frequency was lower in the women's doubles modality than the men's doubles modality ($P<0.05$) in all the Olympics analysed. The most frequently occurring rallies in all the matches lasted between 0 and 6 s accounting for 56.4 % of the rallies. With regard to the rest intervals, 72.6 % of the breaks lasted between 12 and 30 s. Men's doubles recorded a higher number of shorter intervals and women's doubles recorded a higher number of longer intervals; moreover the intervals increased from 2008 to 2016.

Discussion: Badminton matches in the doubles modalities became longer from 2008 to 2016 due to the increase in the real time played but mainly to the increase in the rest time between points. Possibly the increase in the intensity of the badminton matches in recent years has made the players

try to rest as much as possible between points, and the inclusion in Rio 2016 of Hawk-Eye generated longer rest intervals. The Badminton World Federation should try to optimise Hawk-Eye to reduce the waiting time as much as possible. The Badminton Wold Federation is currently considering a change in the scoring system to reduce the duration of the matches and make them more attractive to the public. The men's doubles and women's doubles have evolved similarly from Beijing 2008 to Rio 2016, but the timing factors in the women's doubles matches were different from the men's doubles due to the female players' ability to defend against the opponent's attacks which are equal to their male counterparts, although the velocity of their offensive strokes is lower.

Conclusion: Badminton in the men's and women's doubles events evolved from the 2008 Beijing Olympics to the 2016 Rio Olympics towards longer matches with greater rest intervals pushing the limits of the badminton regulations. The evolution has been similar in the men's and women's doubles, however the timing structure between them was different. The women's doubles showed longer points with greater real time in the matches while the men's doubles showed greater intensity. The differences observed in the timing factors of the doubles badminton matches between different Olympics and modalities may help players, coaches and federations to manage types of workouts or competition schedules more specifically to adapt to the current characteristics of badminton.

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