Physiological and metabolic responses of parabadminton athletes to field simulated effort according to functional classification and court size

Authors: Saulo Fernandes Melo de Oliveira[a], José Igor Vasconcelos Oliveira[b], Marcelo de Castro Haiachi[c], Hanno Felder[d]

Affiliations: [a]Federal University of Pernambuco, Recife. Brazil/PE (correspondence author: saulo.fernandesmelo@ufpe.br); [b]University of Campinas, Campinas/SP, Brazil; [c]Federal University of Sergipe, Aracajú/SE, Brazil; [d]Olympic Training Center Rhineland Palatinate/Saarland, Hermann Neuberger Sportschule, Saarbrücken, German

Introduction and purpose: Parabadminton (PBd) is an intermittent sport, dominated by aerobic actions interspersed with moments of explosion. With the recent entry into the Paralympic Movement, several sports scientists have sought answers to deepen the level of knowledge about the specificity of the sport. Understanding that the functional classes (FCs), the types of disability and the size of the court can interfere in the physiological and metabolic responses of the athletes, the present investigation aimed to identify the physiological and metabolic responses in PBd athletes, according to functional classification and court size.
Material and methods: For such 47 volunteers performed a simulated effort protocol, consisting of two tasks of change of direction and two rallies. Data were collected in official competitions organized by the Brazilian Badminton Confederation (CBBd) and by the World Badminton Federation (BWF). All athletes were recruited through the help of the organization of the events and by signing the informed consent form. Initially, all athletes had demographic and anthropometric characteristics collected, in addition to all the guidelines for the experiment. A protocol consisting of two identical blocks of direction changes following a rally were conducted. During the entire exercise protocol, heart rate, oxygen consumption and CO2 production were continuously monitored using a cardiac monitor and a portable metabolic analyzer, both controlled by Bluetooth telemetry, allowing to collect the following variables: maximum and average oxygen consumption (VO2max and VO2med), maximum, percentage and average heart rate (HRmax, %HRmax and HRmed), percentage of carbohydrates and lipids (%CARB and %FAT) and average and total energy expenditure (EEmed and EEtotal). Data were compared between protocol stages, functional classes (FCs) and court size. Multivariate analyzes of covariance (MANCOVAS) were used to verify the effect of the type of disability on physiological and metabolic responses.
Results: Differences were found between the stages of the protocol in VO2max ($p=.0008$), VO2med ($p=.0004$); HRmax ($p<.0001$); %HRmax ($p=.0001$), HRmed ($p=.0001$), %CARB

(p=.0001), %FAT (p=.0001), EEmed (p=.0002) and EEtotal (p=.008). Among FCs, statistically significant differences were observed for VO2max (p=.075), VO2med (p=.022), EEmed (p=.011) and EEtotal (p=.022), between FCs WH1 and SL4. Between the short and long courts, significant differences were identified for VO2max (p<.001), VO2med (p<.001), %HRmax (p=.032), HRmed (p=.018), %CARB (p=.022), %FAT (p=.022), and EEmed (p=.016). Finally, there was a significant influence of the type of disability in the comparisons between FCs (p<0.005) and the dimensions of the court (p<0.0001).

Discussion: The innovation behind the present investigation resides both in the methodological character of the application of the collection procedures and in the analysis of the data. From the methodological point of view, this was the first study that promoted the execution of a field effort protocol, with continuous monitoring of physiological and metabolic variables in a considerable sample of PBd athletes. In terms of data analysis, the considerable number of evaluated athletes allowed complementary analyzes of the effect of the type of disability on the responses found. In turn, the findings found in the present study allow conjecturing some very particular effects on these athletes. Such results demonstrate the specificity of responses in PBd athletes, and these findings can be explained by the intermittent nature of the modality[1–3], by the biological individuality related to the deficiencies and by the FC available.

Conclusion: It is concluded that PBd athletes respond similarly to Olympic athletes according to the intermittent demand of the sport. PBd athletes belonging to superior FCs and who run greater distances on the court are influenced by the type of disability on the physiological and metabolic responses presented.

References

1. Phomsoupha M, Laffaye G. The Science of Badminton: Game Characteristics, Anthropometry, Physiology, Visual Fitness and Biomechanics. *Sports Medicine*. 2015;45(4):473-495. doi:10.1007/s40279-014-0287-2
2. Faude O, Meyer T, Rosenberger F, Fries M, Huber G, Kindermann W. Physiological characteristics of badminton match play. *European Journal of Applied Physiology*. 2007;100(4):479-485. doi:10.1007/s00421-007-0441-8
3. Oliveira SFM, Oliveira JI V., Haiachi M, Felder H. Heart rate, oxygen uptake, and energy expenditure response of an SL3 class parabadminton athlete to a progressive test and simulated training session: a case study. *Applied Physiology, Nutrition and Metabolism*. 2022;47(8):883-887. doi:10.1139/apnm-2022-0126