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ORIGINAL ARTICLE

Perceived exertion responses and performance of two mode of propulsion in the multistage field test with wheelchair basketball players

Perception de l'effort et performances de deux modes de propulsion lors d'un test de terrain effectué par des joueurs de basketball en fauteuil roulant

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Summary
Purpose. — This study aims to comparing, performance and perceived exertion of the synchronous versus asynchronous mode of wheelchair propulsion within the framework of a progressive aerobic field test.
Materials and method. — Eight highly trained wheelchair basketball players have performed an incremental multistage field test in two separate sessions (synchronous and asynchronous). The number of exercise levels performed, maximal aerobic velocity, rating of perceived exertion and arm frequency were measured.
Results. — The number of exercise levels performed and maximal aerobic velocity are significantly increased in the synchronous mode ($P < 0.05$) and arm frequency is significantly higher in synchronous versus asynchronous at 100% maximal aerobic velocity. There is a significant

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correlation between both modes of propulsion for the number of exercise levels performed ($r^2 = 0.80$). However, normalized rating of perceived exertion values at each maximal aerobic velocity percentage shows no significant difference whatever the mode of propulsion, even if the absolute value of rating of perceived exertion tends to be higher in asynchronous versus synchronous at each stages.

Conclusion. — Synchronous mode provides better performance than asynchronous, in terms of number of exercise levels performed and maximal aerobic velocity. Arm frequency could restrict athletes' performance in asynchronous propulsion during the final stage. It would be interesting for futures studies to assess both physiological and biomechanical parameters simultaneously.

MOTS CLÉS
Test de terrain ;
Modes de propulsion ;
Basketball en fauteuil roulant ;
Stratégie de poussée

Résumé

Objectifs. — Cette étude vise à comparer les performances et la perception de l'effort lors de la propulsion en fauteuil roulant manuel en mode synchrone versus asynchrone dans le cadre d'un test de terrain progressif.

Matériels et méthode. — Huit joueurs de basketball en fauteuil roulant manuel ont effectué le Multistage Field Test selon les deux modes de propulsion (synchrone et asynchrone). Le nombre de paliers atteint, la vitesse maximale aérobie, l'évaluation de l'effort perçu et la fréquence de poussée ont été mesurés.

Résultats. — Le nombre de paliers atteint et la vitesse maximale aérobie sont significativement supérieurs en mode synchrone ($p < 0,05$) et la fréquence de poussée est significativement plus élevée en synchrone à 100 % de la vitesse maximale aérobie. Il existe une corrélation significative entre les deux modes de propulsion pour le nombre de paliers atteint ($r^2 = 0,80$). Cependant, les valeurs normalisées de l'effort perçu à chaque pourcentage de vitesse maximale aérobie ne montrent pas de différence significative, quel que soit le mode de propulsion, même si les valeurs absolues de l'effort perçu ont tendance à être plus élevées en asynchrone à chaque palier du test.

Conclusion. — Le mode synchrone fournit de meilleures performances que le mode asynchrone, en termes de nombre de paliers atteint et vitesse maximale aérobie. La fréquence de poussée pourrait limiter la performance des athlètes en asynchrone pendant les derniers paliers. Il serait intéressant d'évaluer simultanément les paramètres physiologiques et biomécaniques lors de prochaines études.

1. Introduction

Many authors [1—3] have reported that wheelchair basketball players' aerobic fitness was highly correlated to wheeling tasks. Weissland et al. [3] have shown that the Maximal aerobic velocity (MAV) is a functional indicator of the wheelchair-user combination. Moreover, the peak of oxygen uptake (VO_{2peak}) and the wheelchair basketball player's game level are correlated [4]. Lastly, assessment of aerobic fitness is essential for coaches because this data can be used directly to plan and individualize physical preparation and training.

Vanderthommen et al. [5] have developed a simple indoor Multistage Field Test (MFT), that can be applied to a mixed group of wheelchair users and established an equation to predict the VO_{2peak} appearing during the test. This MFT takes into considerations variables related to individual characteristics, mechanical wheelchairs, wheelchair propulsion technique and physiological performance.

Goosey-Tolfrey and Kirk [6] have described two main propulsion strategies in manual wheelchair propulsion: the synchronous (SYN) and asynchronous (ASY) modes. The SYN is used when both arms work together, applying force on the hand-rim simultaneously. Conversely, the ASY is used when both arms work alternately, force being applied on the hand-rim by only one arm at a time. If the SYN propulsion is the most prevalent for acceleration and linear displacement, some players use the ASY propulsion to handle the manual wheelchair more precisely.

Heart rate (HR) and oxygen consumption (VO_2) responses were assessed during manual wheelchair propulsion strategies (SYN vs ASY) [6—9]. During a submaximal test with an ergometer, Lenton et al. [9] found no physiological differences between the SYN and ASY modes of propulsion. On the contrary, various studies have demonstrated that the SYN mode appears to be more efficient than the ASY mode [6,8]. Glaser et al. [7] have shown significantly greater efficiency with ASY versus SYN.

In contrast, Faupin et al. [10] have found that the SYN leads to better performance, in terms of maximal propulsion velocity during sprint test, than ASY. In fact, the SYN propulsion allows reaching higher maximum speed and push frequency compared to the ASY.

To our knowledge, no study has yet focused on measuring wheelchair players' performance in the SYN versus ASY within a field test. But, in wheelchair basketball, some

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