The Journal of Physiology

LETTER TO THE EDITOR

Comment on the paper by Gibala, Little, Macdonald and Hawley entitled Physiological adaptations to low-volume, high-intensity interval training in health and disease

We have read with great interest the article of Gibala *et al.* 2012 published recently in *The Journal of Physiology* and their important review on physiological mechanisms of skeletal muscle and cardiovascular adaptations to high-intensity interval training (HIT) in apparently healthy subjects and patients with cardiovascular risk and/or heart disease. From a clinical perspective, and in agreement with the authors, we consider the use of Wingate-based HIT not possible in patients with cardiovascular (CV) risks or/and diseases due to major safety issues of this extremely demanding form of exercise. In their article, the authors report previous studies in patients with CV risks or/and cardiac diseases referring to the Norwegian high-intensity interval exercise (HIIE) protocol (Wisloff *et al.* 2007) and also present their own new practical HIIE model (10 × 60 s work bouts at 80–90% maximal heart rate or 60% of peak power) (Hood *et al.* 2011). For the Norwegian HIIE protocol, we have previously discussed their potential limitations (Guiraud *et al.* 2010). With respect to their valuable published work, we have several comments on the new HIIE model proposed by the authors. Firstly, exercise intensity at 60% of peak power cannot be considered as high intensity; secondly, the superiority of this HIIE protocol on physiological responses and/or adaptations compared with other existing HIIE or even moderate-intensity continuous exercise (MICE) needs to be demonstrated. Also, the use of heart rate for prescription and length of exercise interval (60 s) particularly in cardiac patients could be an important limitation of this model (Guiraud *et al.* 2010, 2011; Meyer *et al.* 2012). Regarding HIIE use in patients with cardiovascular risk and particularly with cardiac diseases, acute physiological responses (i.e. at cardiac, pulmonary, vascular and/or skeletal muscles levels) during different HIIE protocols as well as patient's safety, tolerance and comfort should be tested before their implementation into training programs (Guiraud *et al.* 2010, 2011; Meyer *et al.* 2012). A consistent number of studies performed previously on physiological responses during different HIIE protocols in cardiac patients are available, including those of Meyer *et al.* in the late 1990s (Meyer *et al.* 1996). Their HIIE protocol used was 30 s of cycling at 50% of maximal short-time exercise capacity (MSEC) alternating with 60 s at 10 W (Meyer *et al.* 1996). However, the questionable safety of the steep ramp test that has never been widely implemented in cardiac rehabilitation is a significant limitation of these studies. We have therefore developed an optimized HIIE protocol for stable patients with coronary heart disease and heart failure that consists of repeated short bouts (15 or 30 s) of exercise at 100% of peak power output interspersed with passive recovery intervals of equal duration (Guiraud *et al.* 2010; Meyer *et al.* 2012). Relative to longer intervals with active recovery, short 15–30 s exercise/recovery intervals with passive recovery were associated with a longer total exercise time, similar time spent near $\dot{V}_{O_2peak}$, a lower rating of perceived exertion, better patient comfort and a higher likelihood of completing the prescribed exercise sessions (Guiraud *et al.* 2010; Meyer *et al.* 2012). Furthermore, we also showed that compared with MICE, this optimized HIIE protocol is not only an efficient exercise modality, but also safe, and does not induce significant arrhythmias, myocardial injury in stable coronary and heart failure patients (Guiraud *et al.* 2011). Since September 2009, this optimized HIIE protocol has been incorporated into our clinical program in our centre, addressed to obese and coronary patients. We have showed that a 9 month lifestyle intervention using this optimized HIIE was superior to MICE to improved body composition, abdominal obesity, cardiometabolic profile, cardiovascular risk, metabolic syndrome prevalence, maximal exercise capacity and muscular endurance in viscerally obese subjects (Gremeaux *et al.* 2012). Optimized HIIE performed twice a week appeared feasible, safe and time-efficient in this obese population. In conclusion, validated models of HIIE specially addressed to patients with CV risks and/or cardiac diseases are available in the literature and can also be used in future exercise training research and/or clinical studies.

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