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26th of March 2019

To the editor-in-chief,

High Intensity Interval Training and Left Ventricular Mechanics

The influence of exercise on the mechanical function of the heart has become a topic of considerable interest over recent decades. In a recent issue of *Medicine and Science in Sports and Exercise*, Huang *et al.* (2) published a study that investigated the effects of high intensity interval training (HIIT) on echocardiographic-derived indices of left ventricular (LV) mechanical function in young, sedentary but otherwise healthy men. We believe that this study has the potential to further our understanding on how the heart responds to exercise, and it ultimately fits within the current knowledge on exercise-induced cardiac adaptation in health and disease (4). However, given the proposed conclusions, we would appreciate additional details from the authors on the methodology used that may have contributed to some unusual results. Specifically, this letter serves to highlight our concerns regarding the two most notable findings reported in the paper by Huang *et al* (2), namely 1) the unusually large increase in cardiorespiratory fitness following the HIIT intervention, and 2) the exceptionally low values derived from speckle tracking echocardiography.

Firstly, it is surprising that a 6-week HIIT program in healthy, young individuals induced a rise in VO_2max by an average of 11.1 mL/min/kg (32%), in the presence of no change in total body weight. The highest average effect reported in a relatively recent meta-analysis of the relevant literature was half of what was reported by Huang *et al* (2), namely a 5.5 ml/kg/min increase in response to HIIT after 13-weeks (3). Why would healthy individuals such as those included in the study by Huang *et al* (2) experience such a large increase?

Secondly, the mean values for the main echocardiographic parameters (LV twist, untwisting rate, circumferential strain and longitudinal strain) are significantly lower than those reported in a recent comprehensive review article (4). The drastically low values that Huang *et al* (2) have reported in their study for baseline LV twist (6.18 to 7.52 degrees), untwisting rate (-27 to -32

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degrees/s), circumferential strain (-12.5 to -15.3%) and longitudinal strain (-13.5 to -14.1%) could be considered those of cardiac patients with markedly impaired contractile function (4). Yet, ejection fraction appears to have been normal (61 – 64%), suggesting a healthy population. How can this be explained?

Additionally, since the main aim of the study was to compare the effect of exercise training at two different intensities on the heart's dynamic responses to acute exercise, we would appreciate more detail on the following key points: 1) the methods of standardisation employed by the authors to ensure that workload and energy expenditure were similar between the training groups during their respective exercise training, and 2) the rationale for why LV mechanical function was assessed during a fixed absolute exercise intensity, despite previous reports recommending that LV mechanics be assessed during exercise at a relative intensity (1).

We acknowledge the effort that is required in undertaking exercise training studies and the personnel that is required to perform the echocardiographic assessments. For this, the authors need to be commended on their preparation and execution of such a study. At present, however, we are concerned about the accuracy and generalizability of the findings of Huang *et al*. (2). Further insight into the above methodological considerations may assist with the interpretation of the current results and ultimately provide the foundation for further research in this area of interest.

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1. Armstrong C, Samuel J, Yarlett A, Cooper SM, Stembridge M, Stöhr EJ. The Effects of Exercise Intensity vs. Metabolic State on the Variability and Magnitude of Left Ventricular Twist Mechanics during Exercise. *PLoS One*. 2016;11(4):e0154065.
2. Huang Y-C, Tsai H-H, Fu T-C, Hsu C-C, Wang J-S. High-Intensity Interval Training Improves Left Ventricular Contractile Function. *Med Sci Sports Exerc*. 2019;In press.
3. Milanovic Z, Sporis G, Weston M. Effectiveness of High-Intensity Interval Training (HIT) and Continuous Endurance Training for VO2max Improvements: A Systematic Review and Meta-Analysis of Controlled Trials. *Sports Med*. 2015;45(10):1469-81.
4. Stöhr EJ, Shave RE, Baggish AL, Weiner RB. Left ventricular twist mechanics in the context of normal physiology and cardiovascular disease: a review of studies using speckle tracking echocardiography. *Am J Physiol Heart Circ Physiol*. 2016;311(3):H633-44.