Those apples don't taste like oranges!

Why 'equalising' HIIT and MICT protocols does not make sense

Niels B.J. Vollaard[1*] & Richard S. Metcalfe[2]

[1] *Faculty of Health Sciences and Sport, University of Stirling, Stirling, FK9 4LA, UK*

[2] *Applied Sports, Technology, Exercise and Medicine Research Centre (A-STEM), Swansea University, Swansea, SA1 8EN, UK*

[*] *Correspondence: n.vollaard@stir.ac.uk*

Keywords: high-intensity interval training; sprint interval training; moderate-intensity continuous training

Vollaard N & Metcalfe R (2021) Those Apples Don't Taste Like Oranges! Why 'Equalising' HIIT and MICT Protocols Does Not Make Sense. *Trends in Endocrinology and Metabolism*. https://doi.org/10.1016/j.tem.2020.12.002

We read with interest the recent article by Andreato, entitled 'High-Intensity Interval Training: Methodological Considerations for Interpreting Results and Conducting Research' [1]. We applaud the author's call for greater clarity in defining and reporting high-intensity interval training (HIIT) protocols; this is much needed to move the field forward. On the other hand, we dispute the author's principal claim that to avoid bias when comparing HIIT to moderate-intensity continuous training (MICT), it is necessary to 'equalise' (match) sessions for energy expenditure (or workload performed, as a proxy for energy expenditure). Upon reading the article we failed to find any sound justification for this assertion.

The premise of the argument by Andreato appears to be based on the (unsupported) assumption that the expenditure of energy is somehow the key stimulus driving adaptations to exercise, with greater energy expenditure directly relating to more pronounced adaptations. A simple argument to refute this notion involves a comparison with energy expenditure at rest. Energy expenditure during any exercise protocol can be matched to a period of seated rest; for example, 1 hour of exercise at 3 METs is the equivalent of 3 hours of rest at 1 MET. Nonetheless, comparing exercise with rest is a false equivalence: 1 hour of exercise at 3 METs is expected to elicit adaptation whilst, despite a matched 'stimulus' (i.e. energy expenditure), 3 hours of seated rest is not.

A second argument is more relevant to HIIT. We have provided strong evidence against the possibility that energy expenditure is a driver of adaptations to sprint interval training (SIT; a sub-category of HIIT involving 'all-out' sprints): in a meta-analysis of 34 SIT studies we observed that the improvement in maximal aerobic capacity ($\dot{V}O_2max$) with SIT is not attenuated with fewer sprint repetitions in a training session (i.e. with lower energy expenditure), and possibly even enhanced [2]. Furthermore, Gillen *et al.* [3] demonstrated *similar* improvements in $\dot{V}O_2$max, body composition, and insulin sensitivity when comparing SIT and MICT protocols that involved a >5-fold difference in total work (60 vs. 310 kJ/session). The disruption in homeostasis with SIT (and HIIT) compared with MICT is substantially different, and although the molecular mechanisms underpinning adaptations to training remain elusive, the above studies provide clear evidence that they have little to do with exercise energy expenditure. It has to be understood that HIIT and SIT are not 'MICT but harder'; like resistance training they are separate types of exercise, likely with distinct mechanisms of adaptation.

The author does acknowledge that "*in some studies the purpose is not to compare certain outcomes based on matched protocols, but to investigate whether time-efficient HIIT can produce similar/superior health or performance improvement despite lower time/energy expenditure*". This is correct. It is important to highlight that in 11 out of 13 studies used by the author as examples of studies that *should* have matched HIIT and MICT for energy expenditure, time-efficiency is clearly mentioned as either the main aim or at least a key characteristic of HIIT. This reflects the primary aim of the field of HIIT research, which is to develop time-efficient exercise interventions that can be implemented as alternatives to MICT to overcome the common perceived barrier to exercise of lack of time [4]. Inherent to achieving this aim is the reduction of total training time, and a concomitant reduced total energy expenditure compared to effective MICT protocols. Comparisons to MICT are made to investigate whether the health benefits of a volume of MICT reflective of current exercise recommendations can be matched (or exceeded) by a time-efficient alternative HIIT intervention. The only valid way to do this is by allowing unequal energy expenditure.

To provide a final example based on our own research: we have developed a time-efficient SIT protocol consisting of 10-minute exercise bouts involving low-intensity cycling interspersed with 2 x 20-second ‘all-out’ cycle sprints, performed 2 or 3 times per week (termed ‘reduced-exertion high-intensity interval training’; REHIT [5]). We have shown this protocol to be efficacious at improving the key health marker of $\dot{V}O_2$max in lab-based studies [6], and to be effective and acceptable in a ‘real-world’ workplace-based setting [7]. In one study we directly compared the effects of REHIT (30 min/week) and MICT (90 min/week) on a range of health markers [8]. To match the workload of REHIT and MICT sessions as proposed by Andreato [1], we would have had to reduce the volume of MICT to ~21 min/week, far below recommended exercise levels and unlikely to elicit adaptations. Thus, to do so would actually bias HIIT by comparing it to something that is unlikely to work. Alternatively, we would have had to more than quadruple the volume of REHIT each week, completely negating the key intervention characteristic of time-efficiency.

Taken together, we contend that there is no justification for matching HIIT and MICT protocols for energy expenditure.

Disclaimer Statement

The authors report no relationships that could be construed as a conflict of interest.

References

1. Andreato, L.V. (2020) High-Intensity Interval Training: Methodological Considerations for Interpreting Results and Conducting Research. Trends Endocrinol Metab.

2. Vollaard, N.B.J. et al. (2017) Effect of Number of Sprints in an SIT Session on Change in V˙O2max: A Meta-analysis. Med Sci Sports Exerc 49 (6), 1147-1156.

3. Gillen, J.B. et al. (2016) Twelve Weeks of Sprint Interval Training Improves Indices of Cardiometabolic Health Similar to Traditional Endurance Training despite a Five-Fold Lower Exercise Volume and Time Commitment. PLoS One 11 (4), e0154075.

4. Gillen, J.B. and Gibala, M.J. (2014) Is high-intensity interval training a time-efficient exercise strategy to improve health and fitness? Appl Physiol Nutr Metab 39 (3), 409-12.

5. Metcalfe, R.S. et al. (2012) Towards the minimal amount of exercise for improving metabolic health: beneficial effects of reduced-exertion high-intensity interval training. Eur J Appl Physiol 112 (7), 2767-75.

6. Metcalfe, R.S. et al. (2016) Changes in aerobic capacity and glycaemic control in response to reduced-exertion high-intensity interval training (REHIT) are not different between sedentary men and women. Appl Physiol Nutr Metab 41 (11), 1117-1123.

7. Metcalfe, R.S. et al. (2020) Time-efficient and computer-guided sprint interval exercise training for improving health in the workplace: a randomised mixed-methods feasibility study in office-based employees. BMC Public Health 20 (1), 313.

8. Ruffino, J.S. et al. (2017) A comparison of the health benefits of reduced-exertion high-intensity interval training (REHIT) and moderate-intensity walking in type 2 diabetes patients. Appl Physiol Nutr Metab 42 (2), 202-208.