

Comment on: Is high-intensity interval training more effective on improving cardiometabolic risk and aerobic capacity than other forms of exercise in overweight and obese youth? A meta-analysis

Danielle Lambrick^{1*}, Lee Stoner², Sean Ewings³, James Faulkner⁴

¹ Faculty of Health Sciences, University of Southampton, United Kingdom

² School of Sport and Exercise, Massey University, Wellington, New Zealand.

³ Southampton Statistical Sciences Research Institute, University of Southampton, United Kingdom

⁴ Department of Sport and Exercise, University of Winchester, United Kingdom

*Corresponding Author

Dr Danielle Lambrick

Faculty of Health Sciences,

University of Southampton

Highfield Campus

Southampton, UK

SO17 1BJ

Email: D.M.Lambrick@soton.ac.uk, Telephone: +44 (0)23 8059 5916, Fax: +44 (0)23 8059 3131

Word count: 749

Key Words: obesity; exercise; children; public health; implementation science

Running Head: Comment on high-intensity interval training meta-analysis.

Conflict of Interest: The authors declare that there is no conflict of interest.

Letter to the Editor

We commend the efforts of García-Hermoso and colleagues¹, whose recent meta-analysis concluded that high-intensity interval training (HIIT) is more effective for improving systolic blood pressure (SBP) and maximal oxygen uptake ($\dot{V}O_2\text{max}$) than other forms of exercise in overweight and obese youth. However, while this is a timely article, we feel that the conclusions need to be contextualized with regards to important methodological constraints. Considering that this meta-analysis may shape health practitioner practice and public health policy, we strongly feel that these limitations should be addressed.

The methodological constraints include: (i) Limited number of trials – only five trials reported SBP, and only six reported $\dot{V}O_2\text{max}$. Further, the authors admit that the quality of included trials was generally poor. (ii) Poorly characterized outcomes – for example, the six trials which reported $\dot{V}O_2\text{max}$ used a variety of measures, including differing exercise modalities and use of submaximal $\dot{V}O_2\text{max}$ estimation. (iii) Shifting baseline – the authors do not use a true control group, instead comparing the HIIT intervention to ‘other exercise’. The ‘other exercise’ groups vary widely in terms of exercise prescribed, with some ‘control’ groups arguably prescribed elements of HIIT, making it difficult to discern the true effect (and directionality) of HIIT prescription. Further, HIIT is loosely defined and dependent upon a seemingly infinite number of combinations of differing factors, including exercise modality, number of repetitions, work interval intensity and duration, among others. (iv) Inappropriate subgroup analysis – the authors do attempt to compensate for the lack of a true control group through sub-group analysis, comparing HIIT to different types of comparison exercise groups. However, only three trials were included in the $\dot{V}O_2\text{max}$ subgroup analysis. (v) Poor adherence to PRISMA (Preferred Reporting Items for Systematic reviews and Meta-Analyses) guidelines² – for example, simple summary data should be reported for each intervention and control group to enable the reader to infer directionality. Further,

additional analyses are poorly described; the meta-regression is poorly rationalized and difficult to interpret. The limitations of this study are alluded to but not explored. (vi) Poor participant inclusion criteria – inclusion of pre- and post-adolescent children. A six year-old child will demonstrate a very different physiological response to exercise compared to a 17 year-old youth, largely due to age-dependent metabolic and musculoskeletal differences.³ Further, the authors reported that the weighted mean difference for SBP was 3.67 mmHg, which is a greater relative change in a 6 year-old child with an expected resting SBP of ~96 mmHg, compared to a 17 year-old adolescent with an expected resting SBP of ~118 mmHg.⁴

Arguably more important than the methodological constraints is the lack of adequate consideration for clinical inference, implementation science, and importance to public health. With regards to clinical inference, the weighted mean difference was 1.92 ml·kg⁻¹·min⁻¹ for $\dot{V}O_{2\max}$ and 3.67 mmHg for SBP, both of which are within respective measurement error.^{5, 6} As such, it is difficult to discern the clinical importance of such small changes. In terms of implementation and public health, HIIT may overcome the time barrier to exercise adherence, but there are a number of additional considerations which need to be addressed. Queries such as, but not limited to: should HIIT be tailored to the age and gender of the child? Will this form of exercise prescription put obese children at increased risk for musculoskeletal injury? Should some form of priming period precede the implementation of HIIT, i.e., should HIIT be employed following a period of strength training, which has been shown to improve cardiorespiratory fitness and psychological wellness in obese children, and is well-tolerated?^{7, 8} Will this form of exercise be enjoyable and sustainable? With regards to the last point, the authors cite one of our previous studies⁹ as support for HIIT being more enjoyable compared to other forms of exercise. However, our previous study investigated a high intensity games intervention, not HIIT *per se*, and we did not compare the games intervention to other forms of exercise⁹. Lastly, what kinds of physical resources and

practitioner training are required to implement HIIT at the community level, and should school physical educators receive such training?

In conclusion, the authors are to be applauded for addressing an interesting and highly relevant topic. However, owing to the methodological limitations, health professionals and public health policy makers should be cautious when interpreting these findings. Prior to advocating HIIT in overweight and obese children, there are a number of questions that need to be addressed in order to determine the physiological and psychosocial benefits of such exercise, as well as the feasibility of implementing HIIT.

References

- 1 Garcia-Hermoso A, Cerrillo-Urbina AJ, Herrera-Valenzuela T, Cristi-Montero C, Saavedra JM, Martinez-Vizcaino V. Is high-intensity interval training more effective on improving cardiometabolic risk and aerobic capacity than other forms of exercise in overweight and obese youth? A meta-analysis. *Obes Rev* 2016; **17**: 531-540.
- 2 Moher D, Liberati A, Tetzlaff J, Altman DG, Group P. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA Statement. *Open Med* 2009; **3**: e123-130.
- 3 Boisseau N, Delamarche P. Metabolic and hormonal responses to exercise in children and adolescents. *Sports Med* 2000; **30**: 405-422.
- 4 NIH. Fourth Report on the Diagnosis, Evaluation, and Treatment of High Blood Pressure in Children and Adolescents. National Institutes of Health: Bethesda, MD 2004.
- 5 Young Y, Abdolhosseini P, Brown F, *et al.* Reliability of oscillometric central blood pressure and wave reflection readings: effects of posture and fasting. *J Hypertens* 2015; **33**: 1588-1593.
- 6 Vickers Jr RR. Measurement Error in Maximal Oxygen Uptake Tests. Human Performance Department, Naval Health Research Center: San Diego 2003.
- 7 LeMura LM, Maziakas MT. Factors that alter body fat, body mass, and fat-free mass in pediatric obesity. *Med Sci Sports Exerc* 2002; **34**: 487-496.
- 8 Shultz SP, Stoner L, Lambrick DM, Lane AM. A boxing-oriented exercise intervention for obese adolescent males: findings from a pilot study. *J Sports Sci Med* 2014; **13**: 751-757.
- 9 Lambrick D, Westrupp N, Kaufmann S, Stoner L, Faulkner J. The effectiveness of a high-intensity games intervention on improving indices of health in young children. *J Sports Sci* 2016; **34**: 190-198.