

The effect of high intensity interval vs moderate continuous endurance exercise training on program adherence

Introduction & Background

For optimal health, current Canadian physical activity guidelines recommend 150 minutes of moderate intensity or 75 minutes of vigorous-intensity endurance exercise training per week. Yet many Canadians fail to meet these recommendations apparently due to lack of time. Recently, several studies observed that very brief, repeated exercise bouts at high intensity promote similar health and exercise performance benefits as those found with moderate endurance training of much longer duration. For example, MacPherson and colleagues (2011) has compared brief, sprint vs much longer continuous endurance exercise training and found similar improvements for endurance capacity and exercise performance. Similarly, Gillen et al. (2014) found three 20 second bouts of high interval training at an all-out effort intensity elicited similar physiological benefits as to 50 minutes of moderate endurance training. Further, another recent study found short, repeated bursts of high-intensity training over 12 weeks had similar health benefits as 50 minutes of moderate endurance training (Gillen et al., 2016). The current study will follow a similar exercise training protocol as Gillen et al. (2016) however, importantly, will control exercise time (20 minutes in both groups) because it is assumed that the shorter duration in the high intensity groups of previous studies may contribute to greater program adherence rates.

Research Objectives

1. To determine whether high-intensity interval training (HIIT) group experience a greater program adherence than moderate continuous endurance exercise training (MCEET) group when matched for time commitment of 20 minutes
2. To assess whether HIIT group results in greater improvements in fat loss and endurance capacity than MCEET group

Research Hypothesis

The study hypothesizes that HIIT group will result in greater program adherence than MCEET. Also, HIIT group will result in greater improvements in fat loss and endurance capacity vs. MCEET group.

Methods

40 healthy adults aged 19 to 35 years (20 men, 20 women) will participate in the study. Participants will be recruited from Western University and its surrounding community via university poster. Interested participants will be asked to come to the Exercise Nutrition Research Laboratory (Room 2235 3M Centre) for a face-to-face interview with the investigator and to complete Get Active Questionnaire (GAQ) that includes medical history for pre-screening eligibility. Inclusion criteria include healthy participants between the ages of 19 to 35 years who engage in physical activity less than three times per week. They must be able to run a mile, have an access to the gym as well as smart phones (such as Android, Cat phone, Google Nexus, Samsung Galaxy, iPhone, Microsoft Lumia, myTouch or Phablets) and can access to Apps (such as MyFitnessPal, Rise Up, Calorific, My Diet Coach, Yazio, On The Regimen, See How You Eat, Lost It, MyNetDiary or MyPlate). Exclusion criteria include diabetic, pregnant, individuals with a history of fainting, low and high blood pressure, heart disease, respiratory disease, migraines, heartburn, smokers, engage in physical activity

more than two times per week and answering YES to any questions from page 1 of GAQ. Eligible participants will be provided with the written informed consent.

Once completed, all participants will complete body composition testing via air displacement plethysmography (Bod Pod) pre and post intervention (week 0 and 6). Following Bod Pod measurements, participants will run a practice mile run for familiarity and will run again for measurement purposes before and after the exercise intervention to assess their endurance capacity. Time will be measured by a stopwatch. Participants will be match-paired based on their endurance capacity to either HIIT or MCEET group for five weeks. They will fill out two validated questionnaires, physical activity enjoyment scale (PACES) and exercise adherence rating scale (EARS) after the 6th, 9th and 15th session to assess their program adherence. They will be instructed not to engage in any either exercise program during the study period.

The first week of the exercise intervention will consist of one-on-one supervised treadmill training, three times per week in the lab. From week two to five, participants will follow the same exercise program on their own at their preferred gym three times per week in order to examine free-living individuals adhere to two exercise programs. Each participant will be matched to either HIIT or MCEET group based on their timed one-mile run. The HIIT group will perform six, 20-second bouts of high intensity interval exercise separated by 2 minutes of active recovery (walking) while the MCEET group will perform 14 minutes of continuous endurance exercise at 70% Maximum Heart Rate (MHR). Both exercise protocols will include 3 minutes of warm up and cool down at a 30% MHR, for a total of 20 minutes for each treatment.

Ratings of perceived exertion (RPE; Borg CR-10 scale) will be recorded at the end of each interval for HIIT group and at 10 and 20 minutes of exercise for MCEET group on the 6th, 9th and 15th session. All participants will log their heart rate before, during, and immediately after each training session using Fitbit or a free heart rate monitor mobile App (e.g. Argos) to ensure safety and achievement of their targeted heart rate. Participants will also complete physical activity enjoyment scale (PACES) and exercise adherence rating scale (EARS) on the 6th, 9th and 15th session to assess their program adherence. To accommodate progression, training intensity will be adjusted to maintain the desired relative exercise intensity based on above measurements. Finally, no attempt will be made to modify the participants daily diet, but a 3-day food log will be collected via free mobile app (e.g. MyFitnessPal) to assess food intake for any change. Completed questionnaires and the recorded heart rate data saved on Fitbit or a mobile app will be used to confirm program adherence.

All the collected data will be statistically analyzed by Sigma Plot 12.0 (Systat Software, San Jose, CA, USA) using a two-way analysis of variance (ANOVA), Tukey's post hoc test, and a paired t-test. Significance set at $p < 0.05$. Sample size estimates are generated with a two-way analysis of variance (ANOVA). The primary outcome variable is the program adherence, with a minimum important difference of 19.6 between HIIT (103.8 ± 9.4) and MCEET (84.2 ± 19.1 ; Thum, Parsons, Whittle & Astorino, 2017). Based on the data from Kadam & Bhalerao (2010), we calculate the pooled variance (19.1), effect size f (0.8), and Cohen's d (1.96) for the sample size estimation.

Using ANOVA, match-paired study design, a minimum of 15 participants is required for an alpha of 0.05 and 95% power. 34% of drop out rate (Linke, Gallo & Norman, 2011) will be included in addition to the minimal sample size resulting in 20 participants for each group.

References

- Gillen, J. B., Martin, B. J., MacInnis, M. J., Skelly, L. E., Tarnopolsky, M. A., & Gibala, M. J. (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.
- Gillen, J. B., Percival, M. E., Skelly, L. E., Martin, B. J., Tan, R. B., Tarnopolsky, M. A., & Gibala, M. J. (2014). Three minutes of all-out intermittent exercise per week increases skeletal muscle oxidative capacity and improves cardiometabolic health. *PLoS One*, *9*(11), e111489.
- Kadam, P., & Bhalerao, S. (2010). Sample size calculation. *International Journal of Ayurveda Research*, *1*(1), 55–57. <http://doi.org/10.4103/0974-7788.59946>
- Linke, S. E., Gallo, L. C., & Norman, G. J. (2011). Attrition and adherence rates of sustained vs. intermittent exercise interventions. *Annals of Behavioral Medicine*, *42*(2), 197.
- Macpherson, R. E., Hazell, T. J., Olver, T. D., Paterson, D. H., & Lemon, P. W. (2011). Run sprint interval training improves aerobic performance but not maximal cardiac output. *Medicine & Science in Sports & Exercise*, *43*(1), 115-122.
- Thum, J. S., Parsons, G., Whittle, T., & Astorino, T. A. (2017). High-Intensity Interval Training Elicits Higher Enjoyment than Moderate Intensity Continuous Exercise. *PloS one*, *12*(1), e0166299.