

Durational Effects of HIIT Training on Physiological Variables

Berger, Sydney; McMillan, Neil; Ouk, Lidia; Skog, Levi; Wirth, Taylor
 Faculty Mentor(s): Jeffrey Janot, PhD and Saori Braun, PhD
 University of Wisconsin-Eau Claire, Eau Claire, WI



University of Wisconsin-Eau Claire
Kinesiology

ABSTRACT

PURPOSE: To compare the effects of high intensity interval training (HIIT) and steady-state aerobic exercise on VO_{2max} and body composition, and to quantify the lasting effects of these physiological variables following a two week detraining period.

METHODS: 27 college-aged recreationally active participants (17 males, 10 females) from a university were randomly assigned to either an experimental high-intensity interval training (HIIT) group (EXP), or steady-state aerobic endurance control group (CON). Each group underwent 30 minutes of training (warm up, training, cool-down), twice a week for three weeks. The HIIT group completed 10 bouts of 1-minute maximal effort, 1-minute recovery at 90-95% HR_{max} and 60-65% HR_{max} , respectively. The CON group maintained a pace at 60% HR_{max} for 20 minutes. Descriptive statistics of the baseline characteristics were gathered for the dependent variables (DV): age, height, weight, VO_{2max} , body fat, and visceral fat.

RESULTS: There was a significant correlation between levels of visceral fat and time amongst both the CON and EXP group ($F(2,50) = 3.92, p = .026$). There was no significant improvement in VO_{2max} between groups or over time ($F(2,50) = 0.32, p = .729$)

CONCLUSION: A three-week, six session HIIT and Aerobic Training program elicit significant reductions in visceral fat mass over time as well as similar improvements in VO_{2max} . HIIT is a viable, time efficient method to improve measures of fitness among healthy college-aged individuals

INTRODUCTION

- HIIT is characterized by alternating periods of intense exercise followed by short periods of recovery. Compared to traditional aerobic exercise, HIIT offers a time-efficient way for individuals to dedicate to exercise during the week
- Coronary artery disease (CAD) patients reported HIIT training to be more enjoyable as measured by Profile of Mood States Questionnaire (Oliveria, Slama, Deslandes, Furado, Santos, 2013).
- HIIT is safe and tolerated by several populations including CAD, diabetics, older adults, as well as the overweight and obese (Gillen and Gibala, 2013).
- HIIT can induce changes in body composition, VO_{2max} , and ventilatory threshold after interventional training (Talanian et al., 2007).

PURPOSE

The purpose of this study was twofold; first, to compare the effects between high intensity interval training (HIIT) and steady-state aerobic exercise on VO_{2max} and body composition, and second, to quantify the lasting effects of these physiological variables following a two week detraining period.

Table 1. Descriptive Statistics

	N	Minimum	Maximum	Mean	Standard Deviation
AGE	27	19	24	20.59	1.047
WEIGHT (kg)	27	44.2	98.8	73.15	13.6735
HEIGHT (cm)	27	157.5	195.6	175.02	9.5750
Valid N (listwise)	27				

METHODS

Participants

- 27 college-aged recreationally active participants (17 males, 10 females) that meet the ACSM Guidelines for physical activity
- Inclusion criteria included being without any injuries that would be aggravated by high impact exercise (orthopedic, cardiovascular, or musculoskeletal)
- Participants were randomly assigned to one of the two groups: steady-state aerobic exercise (CON), or HIIT (EXP)

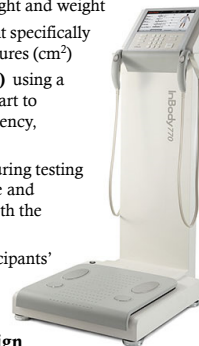


Measures

- Anthropometric Measures** including height and weight
- InBody 770** body composition assessment specifically for percent body fat and visceral fat measures (cm^2)
- VO_{2max} (maximal oxygen consumption)** using a Parvo Medics TrueOne 2400 metabolic cart to determine each participants aerobic efficiency, measured in $mL \cdot kg^{-1} \cdot min^{-1}$
- Polar Heart Rate Monitors** were used during testing and training periods to monitor heart rate and maintain an ideal heart rate ranges for both the CON and EXP groups
- Borg Scale** was used to standardize participants' rating of perceived exertion during both maximal testing, and training periods for both groups

Study Design

- A two-way ANOVA repeated measures test was conducted to compare measures between HIIT and steady-state training groups over time
- A 3-week training period was designed to elicit physiological responses in both HIIT and steady-state aerobic exercise groups. The CON group maintained a steady pace, while the HIIT group alternated between high intensity intervals and moderate-intensity recovery



RESULTS

Table 2. Tests of Within-Subject Effects on Visceral Fat

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent Parameter	Observed Power ^a
Time	144.764	2.000	72.382	3.924	.026	.136	7.848	.681
Time * Group	2.182	2.000	1.091	.059	.943	.002	118	.058

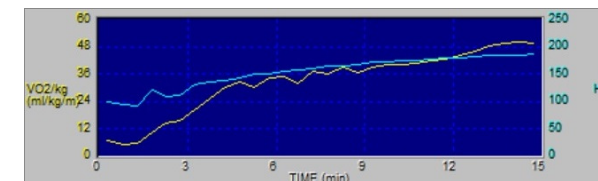
- No association existed between groups and levels of visceral fat ($p = .943$)
- A significant association ($p = .026$) existed between time and visceral fat, illustrating that the intervention was successful in reducing amounts of visceral fat
- Using an alpha of .05, the two-way repeated measures ANOVA indicated Group (EXP and CON) was not a significant predictor of Visceral Fat, $F(2,25) = .003, p = .956$ respectively. In addition, no significant interaction effect was examined, $F(2,50) = .059, p = .943$. However, there was a significant interaction between Time (PreT, PT, PDT) and Visceral Fat, $F(2,50) = 3.92, p = .026$.

Table 3. Tests of Within-Subject Effects on VO_{2max}

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent Parameter	Observed Power ^a
Time	8.211	2.000	4.105	1.507	.231	.057	3.014	.306
Time * Group	1.731	2.000	.865	.318	.729	.013	.635	.098

- Using an alpha of .05, the two-way repeated measures ANOVA indicated Time (PreT, PT, PDT) and Group (EXP and CON) were not significant predictors of VO_{2max} , $F(2,50) = 1.51, p = .231$ and $F(1,25) = 0.77, p = .390$, respectively. In addition, no significant interaction effect was examined, $F(2,50) = 0.32, p = .729$.

Figure 1. VO_{2max} Plateau with Increasing Workload



Validation of VO_{2max} : Increases in VO_2 less than $2.5 (mL \cdot kg^{-1} \cdot min^{-1})$ with increasing workload, observed HR with 11 beats $\cdot min^{-1}$ within age-predicted max or failure to increase with increasing workload, RER above or equal to 1.10, RPE of 8 or above

CONCLUSIONS

- A three-week, six session HIIT and Aerobic Training program elicit significant reductions in visceral fat mass over time as well as similar improvements in VO_{2max}
- HIIT is a viable, time efficient method to improve measures of fitness among healthy college-aged individuals
- Data Analysis is yet to be conducted regarding Ventilatory Threshold 1 and Ventilatory Threshold 2
- Certain individuals improved in the respective outcome measures more than others, suggesting potential responders and non-responders to the allotted exercise dose