The Effect of a Four Week High Intensity Interval Training Programme on Physiological Health Measures – A Pilot Study

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ABSTRACT

Introduction: High intensity interval training (HIIT) has repeatedly been shown to represent a time-efficient exercise strategy that induces many physiological, performance and health-related adaptations. A number of these positive adaptations have been demonstrated to occur within a 6-12 week period. However, it is unclear if a shorter intervention elicits similar effects. **Aim:** To determine the effects of a short term (4 week) HIIT intervention on health measures in recreationally active individuals. **Methods:** Sixteen healthy participants (12 females, 4 males, 47 ± 10 years; BMI 26.6 ± 3.6; <4 hours physical activity p/w) were randomly assigned to a control or HIIT group. All subjects underwent physiological health tests: blood pressure, fasting glucose, glucose tolerance, total cholesterol, HDL-C, and body fat before and after the intervention. The HIIT group performed x2 HIIT sessions p/w for four weeks (10 x 60s intervals performed at 95% maximal aerobic capacity, interspersed with 120s of active recovery). The control group performed no physical training. **Results:** There was a significant decrease in systolic and diastolic blood pressure post intervention in the HIIT group (130.8 to 126.4 mmHg for systolic, p<0.05, d=0.92 and 81.1 to 76.4 mmHg for diastolic, p<0.05, d=0.58). There was no significant change in the other health measures in either group. **Conclusion:** A four week HIIT programme has a positive effect on blood pressure, but does not influence other physiological health markers in recreationally active individuals.

INTRODUCTION

High intensity interval training (HIIT) is recognised as a time efficient training method that produces similar and sometimes superior health benefits than the continuous exercise method (1). A large body of evidence demonstrates that HIIT programmes are highly effective at improving cardiorespiratory fitness, body composition, blood pressure, HDL-C, and insulin sensitivity (2).

A number of previous studies have implemented sprint cycling (Wingate) HIIT protocols (3) or a modified 10 x 60s protocol (1), which have proved to be effective following a 6-12 week training intervention (2). However, few studies have explored the effects of a low frequency of HIIT over a short-term period. Indeed, it is thought that 12 weeks of HIIT are required to achieve improvements in fasting glucose, blood pressure and body composition (2).

AIM

To determine the effects of a short term (4 week) HIIT intervention on health measures in recreationally active individuals.

METHODS

Sixteen healthy participants (12 females, 4 males, 47 ± 10 years; BMI 26.6 ± 3.6; engaging in <4 hours physical activity p/w) volunteered to take part in the study and were randomly assigned to a HIIT or control group. The study was approved by the St Mary's University Ethics Committee.

Maximal Aerobic Power (MAP) Assessment

MAP was determined using an incremental step test on a cycle ergometer (Monark 824E Ergomedic, Vaberg, Sweden). A 5 min warm-up was performed during which an appropriate cadence of 60 or 70 W was determined. The test commenced at an initial power output of 60 or 70 W and was increased by 18-21 W every minute until the participant could not maintain the required cadence. MAP was calculated as the PO achieved during the completion of the final 60s stage.

Measures

Blood pressure (HEM-907XL; OMRON, Japan), fasting blood glucose, glucose tolerance (2 hours following a 75g glucose ingestion: Oral Glucose Tolerance Test), HDL cholesterol, total cholesterol and body fat (Bod Pod, Life Measurement Inc. California, USA) were determined immediately before and after the four week intervention.

Training

The HIIT group performed two cycling sessions per week, performing 10 x 60s intervals at 95% of their MAP, interspersed with 120s of low intensity cycling (50-70 W). The total session duration was 28 minutes. The control group continued with their usual lifestyle. Both groups were asked to maintain their normal nutritional habits.

Data Analysis

A 2 × 2 (group × time) repeated measures analysis of variance (ANOVA) was performed. The alpha level for statistical significance was set at p< 0.05. Effect size was calculated using Cohen's d (d).

RESULTS

Changes in the physiological health measures before and after the intervention are presented in Table 1.

There was a significant decrease in systolic and diastolic blood pressure post intervention in the HIIT group (130.8 ± 6.3 to 126.4 ± 11 mmHg for systolic, p<0.05, d=0.92 and 81.1 ± 4.1 to 76.4 ± 6.8 mmHg for diastolic, p<0.05, d=0.58). There was no significant change in the other health measures in either group.

Table 1. Health measures before and after the four week intervention

	Control Group		HIIT Group	
Age (yr)	45.4		47.9	
	Before	After	Before	After
Body Mass (kg)	70.2 ± 16.1	70.0 ± 15.8	78.8 ± 14.6	78.9 ± 14.9
BMI (kg/m^2)	25.1 ± 3.7	25.0 ± 3.8	28.1 ± 3.7	29.6 ± 3.8
Systolic BP (mmHg)	119.4 ± 12.4	121.8 ± 9.1	130.8 ± 6.3	126.4* ± 11.0
Diastolic BP (mmHg)	75.4 ± 9.9	78.1 ± 8.6	81.1 ± 4.1	76.4* ± 6.8
TC mmol/L)	4.2 ± 0.9	4.8 ± 0.7	4.7 ± 1.2	5.2 ± 0.8
HDL-C (mmol/L)	1.5 ± 0.4	1.5 ± 0.4	1.7 ± 0.4	1.6 ± 0.4
Fasting glucose (mmol/L)	4.8 ± 0.7	4.6 ± 0.5	4.7 ± 0.3	4.6 ± 0.4
Glucose - OGTT (mmol/L)	6.1 ± 0.7	6.4 ± 1.0	6.2 ± 1.0	5.7 ± 1.0
Body fat (%)	31.8 ± 6.4	31.9 ± 8.3	38.4 ± 5.6	38.4 ± 6.3

Values are presented as mean ± SD
*Significantly lower than pre-training value (p<0.05)
TC: Total cholesterol; **HDL-C**: High-density lipoprotein cholesterol; **OGTT:** Oral glucose tolerance test

CONCLUSIONS

A four week HIIT programme, consisting of 8 HIIT sessions, performed at 95% MAP reduces systolic and diastolic blood pressure in healthy, recreationally active individuals. This finding warrants further investigation as previous research indicates that a 12 week training intervention is required to significantly reduce blood pressure (2). It appears that a longer HIIT programme is required to significantly influence other health markers.

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