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Endurance and high-intensity interval training improve the levels of anxiety and quality of life in overweight men

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SUMMARY

OBJECTIVE: Body mass index (BMI) values of 25 kg/m² or more have been associated with poor cognitive outcomes, reduced health-related quality of life (HRQoL), and mental health disorders. Participating in regular exercise may improve these negative outcomes. However, the optimal exercise prescription remains to be clarified. The purpose of the present study is to compare the effects of moderate-intensity continuous training (MICT) and high-intensity interval training (HIIT) on HRQoL, depression, and anxiety levels in middle-aged overweight men.

METHODS: Twenty-five sedentary, overweight men participated in the 8-week training intervention. Subjects were randomized into MICT or HIIT and performed exercise sessions three times per week for 8 weeks. Participants answered the Physical Activity Readiness Questionnaire, the Short Form-36 survey, the Beck Depression Inventory-II, and the Beck Anxiety Inventory. Statistical analysis was carried out using the GraphPad Prism 7.0, and the level of significance was set at 5% to quantitative variables.

RESULTS: HRQoL scores were enhanced to all domains of both the groups. MICT and HIIT did not significantly change the depression levels in middle-aged overweight men ($p>0.05$). Nevertheless, MICT was capable to reduce the anxiety levels in middle-aged overweight men ($p<0.05$). However, there was not a significant change in the anxiety levels at the HIIT group.

CONCLUSIONS: HIIT may be a useful treatment to improve the HRQoL, but MICT alone can positively impact the anxiety levels in middle-aged overweight men.

KEYWORDS: Physical exercise. Physical activity. Quality of life. Mood disorders. Brain.

INTRODUCTION

The prevalence of overweight and obesity is increasing worldwide[1]. Body mass index (BMI) is one of the main personal factors that can influence mood and behavior[2]. Previous studies indicated that being overweight, for example, is related to changes in lifestyle variables, such as the quality of life

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(QoL)[3] and mental health[4]. It has been suggested a reciprocal relationship between depression and obesity, indicating that obesity increases the risk of depression and depression is predictive of developing obesity[5]. Thus, weight status may impact health-related QoL (HRQoL)[6]. A growing body of evidence suggests that engaging in regular physical activity may be an effective strategy to improve anxiety, depression, and HRQoL[7,8].

Depression is a common cause of morbidity and mortality worldwide[3]. It was reported an inverse association between fitness and depression symptoms[9]. Moderate-intensity continuous training (MICT) is a type of physical exercise performed at moderate intensity for 30–60 min, 3–5 times per week. Another type of physical exercise is the high-intensity interval training (HIIT) that consists in short bouts of vigorous and intense exercise interspersed by periods of passive or active recovery. However, the comparison effects of MICT versus HIIT on the HRQoL and mood in overweight adult men are not found in scientific literature. The aim of this study was to evaluate the effects of MICT and HIIT on the HRQoL, anxious profile, and depressive behavior in middle-aged overweight men.

METHODS

Participants were included in the study if they met the following inclusion criteria: nonsmoker, aged 30–50 years, overweight or obese (BMI ≥25 kg/m^2), and no regular participation in a physical exercise program in the past year. Exclusion criteria included prescription drug use, limited physical exercise capability, or any contraindication to physical exercise as determined by the Physical Activity Readiness Questionnaire[10].

Study design

At the first preintervention visit, participants performed a shuttle run test to estimate oxygen maximum consumption (VO_{2max}). At the second preintervention visit, anthropometric data were collected, and subjects completed health and affective questionnaires. During the training intervention, subjects performed either MICT or HIIT three times per week for 8 weeks. Prior to the physical exercise intervention, subjects completed a 20-m multistage shuttle run test to estimate maximal velocity and VO_{2max}, as previously described[11].

Training protocols

Subjects randomized to HIIT performed repeated 200-m sprints (10×20 m) interspersed with 1-min bouts of passive recovery. The beep sounds were individualized for each subject and listened to through headphones, allowing them to run at 85% (weeks 1–2), 90% (weeks 3–6), 95% (week 7), or 100% (week 8) maximum velocity. Subjects randomized to the MICT group were instructed to run continuously on a 300-m track at a prescribed speed for a prescribed distance.

Health-related quality of life

To assess HRQoL, the Short Form-36 survey was administered[12].

Depression and anxiety

The Beck Depression Inventory-II was administered to determine individual severity of depressive symptoms[13]. To assess anxiety symptoms, the Beck Anxiety Inventory was administered[14].

Statistical analysis

The normality of the data was verified by the Shapiro-Wilk test. Student's nonpaired *t*-test was used to evaluate the participants' characteristics. The possible effects of the proposed interventions on the dependent variables between the groups were tested through two-way analysis of variance for repeated measures, with Tukey post hoc test. Data are presented as mean and standard deviation. The level of significance was fixed at $p<0.05$.

RESULTS

MICT and HIIT subjects had an average VO_{2max} of 44.02 and 45.48 mL/kg/min and an average BMI of 29.37 and 27.76 kg/m^2, respectively. This body mass mean classifies both groups as overweight. No significant difference was observed in baseline age, BMI, or VO_{2max} between the groups ($p>0.05$). Then, HRQoL scores were evaluated (Table 1).

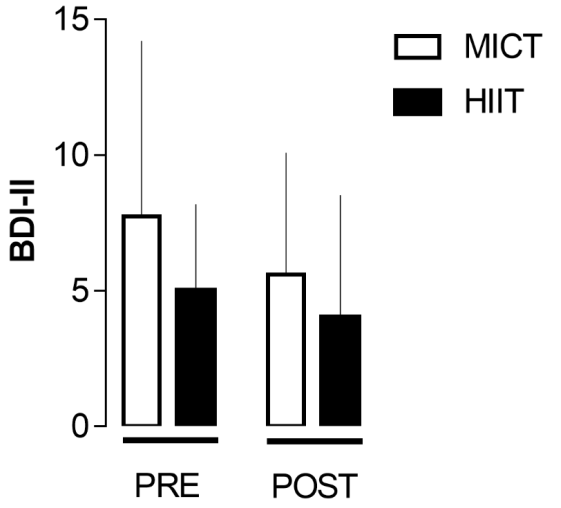
The scores of QoL were enhanced to all domains of both groups, MICT and HIIT. The evaluation of the QoL has a qualitative compound and not quantitative. It was also identified a significant effect of the treatment (exercise) on the mental component score, while an effect of the time can be seen in the physical component score. These results together indicate that MICT and HIIT are capable to improve the QoL of middle-aged overweight men, and the endurance exercise has an important effect over mental health.

Next, we evaluated the anxiety (Figure 1) and depression levels (Figure 2). MICT and HIIT did not significantly change the depression levels in middle-aged overweight men. Nevertheless, MICT was capable to reduce the anxiety levels in middle-aged overweight men. However, there was not a significant change in the anxiety levels at the HIIT group. We also performed a linear regression (results not showed) between all variables, but no significant results were seen.

Table 1. Health-related quality of life.

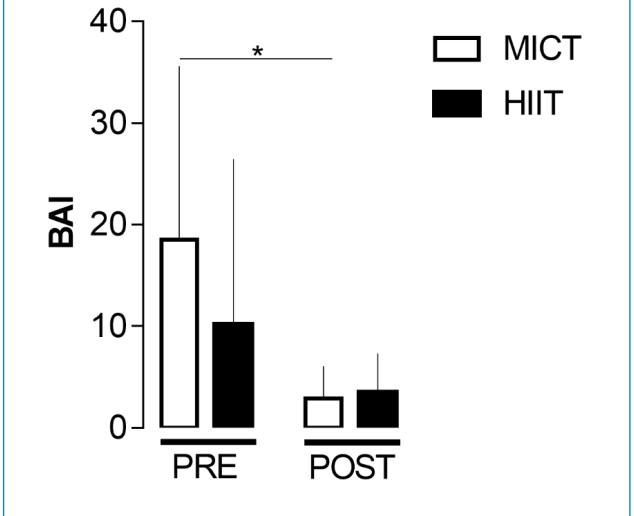
SF-36 domains	MICT (n=12)			HIIT (n=13)			Treatment	Time	Interaction
	Pre	Post	p-value	Pre	Post	p-value	p-value	p-value	p-value
Physical function	92.9±12.5	96.8±3.61	0.8800	88.6±13.3	95±8.4	0.3931	0.0287*	0.5723	0.1084
Physical role	79.1±29.8	87.9±22.4	0.8033	83±23.6	92.3±18.8	0.7540	0.5421	0.1871	0.9706
Pain	79.8±23.1	82.8±19	0.9747	70.1±13.9	77.2±12.6	0.7298	0.1291	0.3129	0.6807
General health perception	75.8±14.8	84.8±13.1	0.7382	72.4±16.5	82.3±16.6	0.4442	0.6836	0.0821	0.7618
Vitality	67.9±18.5	78.5±7.9	0.3642	61.8±12.8	71.5±20.5	0.4073	0.1495	0.0278*	0.9202
Social function	81.3±21	93.5±11.5	0.5282	73.1±23.3	81.7±27.8	0.7499	0.1138	0.1004	0.7730
Emotional role	88.8±21.8	98.8±4	0.4962	89.4±22	92.3±14.6	0.9735	0.5499	0.1944	0.4722
Mental health	80.6±16.6	83.4±4.9	0.9642	67.5±14.4	76±17.8	0.4451	0.0157*	0.1734	0.4890
Physical component score	53.8±14.3	61.42±6.4	0.2488	50.2±7.42	57.6±9.8	0.2403	0.1923	0.0102*	0.9689
Mental component score	52.08±7	55.9±3.13	0.6037	47.65±8.1	51.1±9.9	0.6500	0.0357*	0.0950	0.9312

SF-36: Short Form-36 survey; MICT: moderate-intensity continuous training; HIIT: high-intensity interval training. Data are presented as mean±standard deviation and compared scores between baseline (PRE) and follow-up (POST) training protocol of MICT and HIIT with their respective p-values, and also the p values relative to the treatment (physical exercise), time, and interaction by a two-way analysis of variance with Tukey post hoc test. *p<0.05.



BDI-II: Beck Depression Inventory-II; MICT: moderate-intensity continuous training, HIIT: high-intensity interval training.

Figure 1. Moderate-intensity continuous training and high-intensity interval training do not significantly change depression levels in middle-aged overweight men. Assessment of the Beck Depression Inventory-II scores in middle-aged overweight men with main effect of treatment (exercise) F (1,46)=2.569 and p=0.1158; time F (1,46)=1.372 and p=0.2475; and interaction F (1,46)=0.1862 and p=0.6681. Scores were compared between baseline (PRE) and follow-up (POST) training protocol of moderate-intensity continuous training (p=0.6845) and HIIT (p=0.9504) through a two-way analysis of variance followed by Tukey post-hoc test. Data are expressed as mean±standard error mean.



BAI: Beck Anxiety Inventory; MICT: moderate-intensity continuous training, HIIT: high-intensity interval training.

Figure 2. Moderate-intensity continuous training reduces the anxiety levels in middle-aged overweight men, while high-intensity interval training does not cause significant change. Assessment of the Beck Anxiety Inventory scores in middle-aged overweight men with main effect of treatment (exercise) F (1,46)=1.306 and p=0.2590; time F (1,46)=10.45 and p=0.0021; and interaction F (1,46)=1.697 and p=0.1992. Scores were compared between baseline (PRE) and follow-up (POST) training protocol of moderate-intensity continuous training (*p=0.0141) and HIIT (p=0.4966) through a two-way ANOVA followed by Tukey post-hoc test. Data are expressed as mean±S.E.M, *p<0.05.

DISCUSSION

To our knowledge, no studies have examined the relationship between MICT and HIIT in overweight or obese individuals simultaneously. The main findings of our study indicate that both MICT and HIIT can improve HRQoL, while MICT alone reduces the anxiety levels. No effect of either exercise intervention, MICT or HIIT, was observed on the depression levels.

A recent prospective study suggested that low fitness is much more strongly related to the onset of elevated depressive symptoms than fatness[15]. Depressed individuals often suffer from physical fatigue, which can lead to physical inactivity[16], while overweight individuals present a higher risk factor for developing depression[15]. Many explanations for establishing a relationship between obesity and depression have been suggested, such as psychological, sociological, and biological factors[8,17].

Physical exercise programs can be used as a nondrug method of maintaining brain health and treating psychiatric conditions[18]. It has been reported that the antidepressant effect of physical exercise is significantly higher in participants diagnosed with major depressive disorder when compared to participants with subclinical levels of depression[19]. Thus, the failure to see a significant change in depression scores in the present study may be due to the relatively low baseline levels of depression identified.

It has been shown that physical exercise interventions can improve symptoms of anxiety[20]. In our study, middle-aged overweight men who engaged in the MICT group for 8 weeks presented a significant reduction in the anxiety levels. However, this change was not seen in the HIIT group. Although the causal relationship between anxiety and obesity is not well understood, researchers speculate a bidirectional relationship between these factors. For example, the overweight status may increase the risk of developing an anxiety disorder, but, on the other hand, anxiety may also lead to increased appetite and subsequent weight gain through hypothalamic-pituitary-adrenal axis dysregulation[21].

CONCLUSIONS

Eight weeks of MICT or HIIT improved HRQoL. No exercise effect of MICT or HIIT was observed on depression scores. MICT was capable to reduce the anxiety levels, but HIIT did not induce this change. Future research should aim to elucidate the mechanisms responsible for mental health improvements after MICT and HIIT in middle-aged overweight men. Findings from the present study implicate that both MICT and HIIT may be a useful treatment to improve the HRQoL, but MICT alone can positively impact the anxiety levels in middle-aged overweight men.

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ETHICAL STATEMENT

This study was approved by the Research Ethics Committee of the Federal University of the Valleys Jequitinhonha and Mucuri (protocol number 667.788). This study was performed in accordance with the Declaration of Helsinki and CONSORT guidelines.

AUTHORS' CONTRIBUTIONS

RALS: Conceptualization, Formal analysis, Investigation, Methodology, Writing – review & editing. **FTA:** Conceptualization, Formal analysis, Investigation, Methodology, Writing – review & editing. **NSL:** Conceptualization, Formal analysis, Investigation, Methodology, Writing – original draft. **FG:** Conceptualization, Formal analysis, Investigation, Methodology, Writing – original draft. **CODM:** Conceptualization, Formal analysis, Investigation, Methodology, Writing – original draft. **SHP:** Conceptualization, Formal analysis, Investigation, Methodology, Writing – original draft. **MFDP:** Conceptualization, Formal analysis, Investigation, Methodology, Writing – original draft. **RSMJ:** Conceptualization, Formal analysis, Investigation, Methodology. **KB:** Conceptualization, Formal analysis, Investigation, Methodology. **RCC:** Conceptualization, Formal analysis, Investigation, Methodology, Resources, Supervision, Writing review & editing.

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