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Original Research

Effect of Inclination Changes in High-Intensity Interval Training on Quality of Life of Male with Overweight and Obesity

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ABSTRACT

Background: Overweight and obesity are major public health concerns globally and cause poor quality of life. Physical exercise plays a major role in reducing body weight, however, lack of time for exercise leads to a lack of regular exercise. High-intensity interval training (HIIT) is proposed as an alternative exercise in dealing with overweight and obesity and ultimately increases the quality of life.

Aim: To proposed as an alternative exercise in dealing with overweight and obesity and ultimately increases the quality of life.

Material and Methods: A randomized-controlled trial was conducted in a rehabilitation outpatient clinic. Twenty-two subjects with overweight or obesity were randomly allocated into the intervention and control group. The intervention group received HIIT using a treadmill (HR rest + 80-90% HR reserve) with inclination changes for 30 minutes (preceded by warming up and ending with cooling, 5 minutes each), 3 times a week, for 2 weeks. The Control group received no intervention. Change of quality of life was assessed by using SF-36 before and after the intervention.

Results: Subjects' baseline body height, body weight, BMI, VO2Max, and SF-36 on both groups showed no significant differences ($p<0.05$). Subjects in the control group are older than the intervention group (34.82±3.09 vs 30.36±2.58, $p=0.002$). Significant improvement of SF-36 was found only in domains of physical function in the intervention group ($p=0.02$). However, the between-group comparison analysis showed no difference of SF-36 Δ Value between groups.

Conclusion: High-intensity interval training can be proposed as an exercise therapy option to improve the quality of life of males with overweight and obesity. It is necessary to do further research on HIIT with a larger number of samples, longer time, group training, and combined with other exercises.

Keywords: *High-intensity interval training, Healthy lifestyle, Exercise, Overweight, Obesity, Quality of life*

Introduction

Overweight and obesity are major public health concerns as the prevalence is increasing globally, especially in adults in developing countries, where the incidence of obesity in women is greatly increased when compared to men. In 2014, globally, 39% of adults were overweight and 13% were obese and became one of the causes of death in various countries. Obesity data in Indonesia in 2017 was 14.8% and in 2018 it was 21.8%, which means that there is a rapid increase.[1]

Overweight and obesity and are characterized by excess adipocyte tissue caused by an imbalance of energy metabolism as a result of excess energy intake and insufficient energy expenditure [2]. Excessive energy intake is caused by high food consumption, while insufficient energy output is caused by low body metabolism, low physical activity, and the thermogenetic effect of food determined by the food composition.[2] The risk factors of overweight and obesity are considered to be multifactorial and related to genetic and environmental factors, one of the most common is a reduction of physical activity due to a sedentary lifestyle.[2,3]

Overweight and obesity are related to the development of diabetes mellitus along with insulin resistance, cardiovascular disease, non-alcoholic fatty liver disease, endocrine diseases, and various cancers.[2] Furthermore, overweight and obesity also cause a decrease in muscle mass, joint pain disorders, metabolic disorders, and psychological disorders.[4,5] These disorders are associated with decreased fitness, emotional state, daily physical activity, and social interactions which lead to a lower quality of life among patients with overweight or obesity.[4,5]

Physical exercise plays a central role in dealing with overweight and obesity. However, lack of time for exercise is a common reason that hinders a person from doing regular physical exercise.[6] High-intensity interval training (HIIT) is proposed as an alternative to standard moderate-intensity exercise in reducing overweight and obesity. High-intensity interval training is an exercise with periods of intense training and rest that alternate with variations in intensity and duration in each exercise segment.[7] Previous studies showed that HIIT improved cardiovascular health, metabolic capacity, aerobic performance, fitness, and quality of life.[8] Furthermore, aerobic exercise with changes in inclination has also been proven in improving balance which is crucial in daily activities.[9]

One of the instruments that are commonly used to assess the quality of life is SF-36 (Short Form-36). The SF-36 broadly assesses the quality of life from two aspects, namely physical health and mental health, defined through physical function, the role of physical functioning, bodily pain, general health, vitality, social function, the role of emotional functioning, and mental health.[10,11] Based on the problem stated above, the researcher aims to compare the quality of life before and after HIIT in overweight and obese men by using the SF-36.

Material and Methods

This study is a randomized controlled trial involving 22 patients with overweight or obesity who were recruited from the rehabilitation outpatient clinic of Dr. Soetomo Academic General Hospital. Inclusion criteria used in this study were: 1.) male, 2.) age 18-55 years, 3.) normal cognitive function, 4.) Body Mass Index (BMI)> 22.9 kg / m2, 5.) systolic blood pressure <140 mmHg and diastole <90 mmHg, and 6.) willing to participate in this research voluntarily by signing informed consent. Subjects were excluded if they had the following condition: 1.) routine aerobic exercise program 2 times a week, 2.) erythema, sores, ulcers or gangrene in the leg, 3.) peripheral neuropathy, 4.) area of motion of the joints of the two ankles for plantar flexion <45 degrees and dorsiflexion <30 degrees, 5.) restrictive or obstructive airway disease, 6.) neuromusculoskeletal disease of the lower limbs that interfere with ambulation function, 7.) impaired balance, and 8.) impaired vision.

Subjects that meet the criteria were then divided randomly into intervention and control groups using Research Randomizer computer software.[12] The intervention

group received HIIT using a treadmill (HR rest + 80-90% HR reserve) with inclination changes for 30 minutes (preceded by warming up and ending with cooling, 5 minutes each), 3 times a week, for 2 weeks. The Control group received no intervention and was educated to continue physical activity as usual. Two weeks was chosen as a study period because previous studies showed improvement of physical and psychological function related to the quality of life after two of weeks exercise.[13–15]

The outcome measurement tools used in this study were SF-36 which were evaluated before and after the intervention. Statistical analysis was conducted using the Statistical Package for Social Sciences (SPSS). The characteristic baselines were compared using Independent T-Test and Mann-Whitney U Test. The change of SF-36 before and after the treatment was analyzed using Paired T-Test and Wilcoxon Signed Rank Test. Between-group differences of SF-36 Δ Value were analyzed using Independent T-Test and Mann Whitney U Test, p-value < 0.05 is considered significant. This study was approved by the ethical committee of Dr. Soetomo Academic General Hospital.

Results

Twenty-two subjects completed the sessions and study protocol. The homogeneity test of subjects' baseline characteristics including body height, body weight, BMI, VO2Max, and SF-36 on both groups showed no significant differences ($p<0.05$), except for age which showed that subjects in the control group are older than the intervention group (34.82±3.09 vs 30.36±2.58, $p = 0.002$). The result of the SF-36 assessment after intervention showed significant improvement only in domains of physical function in the treatment group ($p = 0.02$). However, the between-group comparison analysis showed no difference of SF-36 Δ Value after intervention between the two groups.

Discussion

In this study, the physical function domain of quality of life improved significantly in the group that receives HIIT. However, this improvement did not appear to be significantly different compared to the control group. This result may be due to several reasons. Firstly, prescription of HIIT as a sole exercise may not be effective to reduce weight in short term thus not beneficial enough in improving quality of life which is highly correlated with weight reduction. American College of Sports Medicine suggests a combination of moderate-intensity aerobic exercise for 30 minutes, 5 times per week for a total of 150 minutes per week, and resistance training for large muscles to improve physical function.[6,16] Besides regular aerobic and resistance exercises, other exercises that need to be incorporated to improve quality of life are coordination and balance exercises aimed at improving energy performance and mobility.[16,17] It is also important to understand that quality of life is formed by various variables that need to be addressed to reach significant improvement. Therefore, patients also need to receive education about weight reduction, avoiding sedentary behavior, and change of diet.[6,16–18] Psychological and behavioral intervention is also crucial since overweight and obesity are highly correlated with poor psychological conditions.[19]

Another thing that can inhibit the significant effect of HIIT training in this study is the short intervention time of only 2 weeks. Previous research showed a combination program for weight loss that includes physical exercise sessions, dietary regulation, and behavioral therapy for 24 weeks has been shown to improve the quality of life for obese people as reflected by an increase in SF-36 scores in the domains of vitality, general health, role limitation. due to physical disorders, and physical functions.[20] Another study showed that a combination of aerobic and resistance training for 12 weeks with 60 minutes of training can improve general health and vitality.[21,22] Four weeks of aerobic exercise also has been shown to increase aerobic capacity.[23]

Table 1. Demographic Characteristic of Research Subjects

Characteristics	Groups		p
	Treatment (n=11)	Control (n=11)	
Age (years)	30.36±2.58	34.82±3.09	0.002*
Body height(cm)	167.91±5.92	167.36±6.27	0.836
Body weight (kg)	81.00±12.51	76.36±10.44	0.357
BMI (kg/m^2)	28.63±3.32	27.18±2.61	0.268
VO2Max	28.46±2.95	27.15±4.43	0.479

*p<0.05

Table 2. Baseline assessment of SF-36

Domains	Groups		p
	Treatment (n=11)	Control (n=11)	
SF-36 (%)			
a. physical function	68.64±4.52	67.27±6.07	0.561
b. role of physical functioning	75.00±15.91	72.73 ±7.54	0.687
c. bodily pain	75.82±4.05	77.64±5.05	0.350
d. general health	68.36±5.05	68.82±4.62	0.884
e. vitality	63.64±6.74	64.55±6.11	0.757
f. social function	90.91±12.61	90.91±12.61	1.000
g. role of emotional functioning	75.76±15.57	72.73 ±25.03	0.851
h. mental health	81.45±4.82	82.55±4.82	0.694

Table 3. Pre- and post- intervention assessment of SF-36 in intervention group

Domains	Intervention (n=11)		
	Pre	Post	p
SF-36 (%)			
a. physical function	68.64±4.52	71.82±6.03	0.02*
b. role of physical functioning	75.00±15.91	79.55±10.11	0.157
c. bodily pain	75.82±4.05	77.64±5.05	0.157
d. general health	68.36±5.05	69.27±5.64	0.157
e. vitality	63.64±6.74	66.82±3.37	0.102
f. social function	90.91±12.61	93.18±11.68	0.317
g. role of emotional functioning	75.76±15.57	81.82±17.41	0.157
h. mental health	81.45±4.82	84.00±4.00	0.102

*p<0.05

Table 4. Pre- and post- intervention assessment of SF-36 in control group

Domains	Control (n=11)		
	Pre	Post	p
SF-36 (%)			
a. physical function	67.27±6.07	68.64±7.10	0.083
b. role of physical functioning	72.73 ±7.54	70.45±15.08	0.317
c. bodily pain	77.64±5.05	78.55±5.22	0.317
d. general health	68.82±4.62	67.55±6.96	0.157
e. vitality	64.55±6.11	65.45±4.72	0.157
f. social function	90.91±12.61	92.05±11.56	0.317
g. role of emotional functioning	72.73±25.03	75.76±21.56	0.317
h. mental health	82.55±4.82	83.27±5.00	0.317

Table 5. Between group comparison of SF-36 Δ Value

Variables	Intervention (n=11)	Control (n=11)	*p*
Change of SF-36 (%) (Δ Value)			
a. physical function	3.18±3.37	1.36±2.34	0.081
b. role of physical functioning	4.55±10.11	-2.27±7.54	0.088
c. bodily pain	1.82±4.05	1.82±4.05	1.000
d. general health	0.91±2.02	-1.27±2.83	0.051
e. vitality	3.18±5.60	0.91±2.02	0.447
f. social function	2.27±7.54	1.14±3.77	0.948

g.	role of emotional functioning	6.06±13.48	3.03±10.05	0.544
h.	mental health	2.55±4.48	0.73±2.41	0.261

Conclusions

There is an improvement in the physical function domain of quality of life after giving HIIT for 2 weeks in men with overweight/obesity, however, the change was not significant compared to the control group who received no exercise. High-intensity interval training can be proposed as an exercise therapy option to improve the quality of life of males with overweight/obesity. It is necessary to do further research on HIIT with a larger number of samples, longer time, group training, and combined with other exercises such as resistance and flexibility exercises.

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