Original Article

# Study of Exercise Time Models on Weight Loss and Coronary Risk Panel in Inactive Middle-aged Men by Overweight or Obesity

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**Received** 06 Apr 2018, **Accepted** for publication 05 June 2018


## Abstract

***Background & Aims:*** There are different methods concerning the exercise time duration, but information about its various models in middle-aged men is yet inadequate. The present study was meant to decide the interval training effects on losing weight and lipid profile and compare its efficiency with continuous training.

***Materials & Methods:*** The statistical population of this randomized trial (the CONSORT statement) research consisted of 82 middle-aged men (age 45 to 65 years old) via overweight or obesity who had come to the Hermas Sports Club of Zahedan during the summer of 2017. In the beginning, participants fulfilled anthropometric measurements for body height and weight after getting a medical certificate. Body mass index was computed as body weight (kg) /height ($m^2$). Following these steps, they were classified according to BMI into overweight or obese. Of all 82 participants, 70 persons ended the study. They were randomly partitioned into two groups, including continuous training, and interval training. The weight assessment parameters, including the change in weight and body composition, blood sample tests were performed before and 12 weeks after the study.

***Results:*** Compared to baseline, all parameters changed significantly in the groups. The increase in High-density lipoprotein cholesterol (HDL-C) within the groups showed a significant difference ($P < 0.001$). Drop in the proportion of total cholesterol to the HDL-cholesterol in interval training was higher than the continuous training group. The confidence level of the results was 95%.

***Conclusion*:** Both experimental groups confirmed a similar weight cut. Interval training impact on lipid profile had some advantage as compared to the continuous training. These findings will improve our knowledge about exercise time models for middle-aged men and while preventing cardiovascular accidents can contribute to choosing more effective exercise training program for losing weight.


***Keywords:*** Exercise Test; Middle Aged; Obesity; Overweight; Problems and Exercises; Weight Reduction Programs

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## Introduction

Physical dysfunctions, higher health care costs as well as elevated morbidity and mortality, are unavoidable consequences for older adults obesity (1,2). About 70% of the middle-aged and older groups (age≥45 years) are positioned in overweight. These people are under a raised obesity hazard (3). According to the World Health Organization, the prevalence of

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obesity and overweight in Iranian adults men and women in 2010 was 46% and 56% respectively(4). This prediction for men and women was 54% and 74% respectively by 2015(5). Although, age-related changes have a substantial genetic component; it is also impacted by food regime and physical exercise training. Losing fat is best achieved through a combination of diet and aerobic exercise (6). Epidemiological data demonstrate that most of the adult populace fails to meet recommended levels of physical activity. This conduces to a global epidemic of overweight/obesity and associated cardiovascular diseases (CVD) (7). CVD is the principal cause of death across the world (8). Exercise-based cardiac rehabilitation is a foundation for the prevention of CVD (9). Studies show that there is a reverse relationship between physical activity and cardiovascular disease (10). A principal reason for the frequent mention of the failure to take part in regular exercises is a noticed shortage of time.

Time models of exercise can be an imperative factor in therapeutic guidance about weight loss parameters, but there is not yet sufficient information about the efficacy of different courses of exercise time models on body weight and coronary risk profile of middle-aged people. Interval and/or continuous exercises are efficient systems for physical activity. *Continuous training*, also known as continuous exercise, is a kind of exercise time models that involves performing a session of exercise for a long time, often longer than 20 minutes without intervals of rest. Continuous training can be done in low, moderate, or high exercise intensities (11). Another kind of time models of exercise is *interval training*. Interval training is a kind of intermittent activity, which comprises a series of low- to high-intensity exercises alternating with periods of rest or relief (12). In this case, bouts of exercise that last for at least 10 minutes are added together to give a total time or duration for a given day (13). There are a challenge and disagreement about the impact of two exercise time models on obesity and coronary risk panel. Some researchers suggest interval training and continuous training equally improve coronary artery disease (14), but some other researchers do not think this way, and they believe that the effect of these two exercises method on weight loss and CVD is not the same (10, 15). The study examined the interval training influences on weight loss and its efficacy compared to continuous training in sedentary overweight/obese middle-aged men. Changes in the lipid profile of the participants, body weight, body mass index (BMI), HDL-cholesterol level and total cholesterol to HDL-cholesterol proportion were evaluated before and after the study to survey weight cut patterns.

## Materials and Methods

*1. Study population*

The study was a randomized trial (CONSORT Statement). Study participants (n = 82) were randomly selected from overweight or obese individuals aged 45-65 (over the three months before the study) who came to the Hermas Sports Club of Zahedan during the summer of 2017 to attend weight loss counseling programs. The research team had three members who had a sincere cooperation, Author (physician) and two volunteers (nutrition expert and nurse) from among colleagues working in the clinic. Enrollment, classification, and assignment of participants in the experiments were accomplished under the supervision of the physician. Participants were non-smokers and weight-stable (± 2kg, for over one year) with no history of regular exercise in no less than three months previously in the study. They had no history of CVD and various issues such that diabetes mellitus, depression, eating disorders, chronic use of the drug, kidney sickness, cancer, food hypersensitivity reactions or intolerance to items

utilized in food. Participants with irregularity in thyroid or electrocardiograph, any history of anti-obesity prescription or weight cut drugs, or weight control supplements were banned from the investigation. Throughout the investigation, participants ought not to utilize any sort of liquor, sugar, honey, sugar substitutes, or any household dressings (high in fat and sugar content).

*2. Intervention*

After the initial appraisals, Participants were classified into two exercise groups according to a simple randomized study design. Group I, had the continuous training plan (42 members) and group II, had the interval training plan (40 members). There were not any restrictions such as blocking and block size, though there was a balance between the study groups in size and baseline characteristics (16). Every group received specific instructions [low-calorie regime (details: 15% protein, 55% carbs, 30% lipid)] generated by The UK Food Standards Agency (FSA) and the Food Guide Pyramid and Dietary Guidelines (United States Department of Agriculture) (17, 18). The two groups had 5% restriction of caloric content from their daily energy needs and 10% raises in energy cost through structured regular exercise. Daily caloric needs were calculated by multiplying the basic metabolic rate (BMR) and the physical activity level (PAL) of the participants. For a more accurate estimate of BMR in men, Eq. (1) and Eq. (2) was used only for the 31-60 years and more than 60-year participants, respectively (17, 19).

Eq. (1) (Weight in kg × 11.6) + 879

Eq. (2) (Weight in kg × 13.5) + 487

*3. Measurement*

Participants vital signs were appraised, and their blood pressure was measured over the 10-min rest period on a seat from the right arm (twice, five-minute interval) with a manual mercury sphygmomanometer. Mean three measurement time was utilized for further investigation. Individual with blood pressure, lower than 140/85mm Hg have joined the research. The weight cut assessment included body weight, BMI, and coronary risk panel, which was measured pre- and post-intervention. BMI, as body weight (kg) / height ($m^2$), equal to or higher than 25.0 $kg/m^2$ was defined as overweight and obesity condition. Height was measured to the closest 0.1 cm by a wall-mounted stadiometer. Body weight was measured to the closest 0.1 kg on a digital scale (Scale-Tronix model 5002, Wheaton, IL, USA). All physical measurements were carried out using Light Street clothing and without shoes. Blood tests were taken from the antecubital vein. Total cholesterol (total-C), Triglycerides (TG) and High-density lipoprotein -cholesterol (HDL-C) were measured by spectrophotometry at 500 nm using an enzymatic kit (Elitech Diagnostics, Sees, France). Low-density lipoprotein cholesterol (LDL-C) was ascertained utilizing the Friedewald equation (20). Participants 9 to 12 hours before blood sampling with the exception of water, did not use food or drink. Normal values for blood tests were evaluated according to the following: the concentration in plasma of total-C below 200 mg/dl, LDL-C below 130 mg/dl, TG below 150 mg/dl, and last the HDL-C in plasma below 40-60 mg/dl.

PAL is the ratio of total daily energy cost to BMR. In the first stage to select participants with the sedentary lifestyle, the PAL values were determined using a customized self-report questionnaire. The questionnaire made from a seven-point Likert-type scale extending from "Not at all" (1 point) to "every day" (7 points) (21). The exercise rate of 1-2 sessions a month or less were analyzed as inactive. During the study, the participants had an active lifestyle (exercise session more than three times a week), and PAL was considered 1.5. To evaluate

weight cut in the healthy and effective rate, we looked at 15% cut (ten percent of energy costs and five percent of caloric restriction) in the maintenance calorie needs (17, 19, 22). Participants utilized a suitable method to distinguish their habit to the food and tendency to drink. They listed diet and drink intake (including water) during four days (three weekdays + 1 weekend day). They did it at starting on the research (basic level) and every month during the research. They used a diary, which previously, was approved by the basis of household measures. The diaries were tested for completeness and energy, and micronutrients compositions were calculated utilizing the Diets In Details software (19, 22, 23). Peak oxygen consumption was 65% to 85% (starting the training course at 40% of peak oxygen consumption). We used heart-rate monitors (Bowflex, Nautilus, Inc, Canada), for measurement of exercise-induced heart rates [220-age × (65 to 85%)]. So, aberrant calorimetry (Fitmate, Cosmed, Italy) was utilized to gauge energy cost equivalent to 10% of everyday calorie needs in every session for every person. Energy cost raised equally in both groups by undergoing supervised exercise, five days a week (two weight-training sessions a week and three sessions of aerobic activity) (19, 22).

*4. Method management*

The method has not changed amid the investigation. Weight loss assessment parameters and laboratory tests were performed before and after intervention for all subjects and compared to each other. At the start of the experiments, the participants had a weekly meeting. We explained all procedures and requirements for subjects. Shifts in exercise levels or food regimes are correlated to potential confounding effects over the study. Therefore, we recommend them to preserve their current PALs and diets throughout the intervention. They were instructed to report any problems that could affect their involvement in the study. The research was according to declare Helsinki and was approved by the sports science department of University of Sistan and Baluchestan. Participants completed a questionnaire about the medical history and physical activity before entering the research and presented permission of their personal physician stating that the intended research was not contraindicated for them. All of them were informed about this study and each one signed a written informed consent prior to data collection.

*5. Data analysis*

Analyses were conducted on all participants who completed the research (all variables). The normal distribution of collecting data was done using the Kolmogorov-Smirnov test. The data were normally distributed. All research statistics were expressed as the mean ± standard deviation (SD). The pre- and post-study outcomes for the groups were analyzed by the paired t-test, and the changes between the groups were examined by the independent t-test. *P* values less than 0.05 were analyzed statistically significant. Statistical analysis was accomplished with SPSS software (version 19.0 for Windows).

## Results

*1. Study population*

The study sample included volunteers from the surrounding community. Of all 82 participants, 70 persons finished the experiment. Table 1 indicates daily calorie needs.

**Table 1.** Time models of exercise and daily energy intake (mean ± SD).

| Group | Time models of exercise | Daily calorie needs* (kcal) | Daily energy intake** (kcal) |
|---|---|---|---|
| I | Continuous training | 2867 ± 224 | 2723 ± 194 |
| II | Interval training | 2835 ± 202 | 2693 ± 178 |

* BMR × PAL

** Daily calorie needs – 5%

The morphological characteristics of the final sample size are summarized in Table 2. Twelve participants did not follow the study conditions. Thus, they were excluded from further assessments. Most participants were white (about 92%), and the remaining were African (n = 4), and "other" (n = 1).

**Table 2.** Subjects' morphological characteristics in each group, before the intervention (mean ± SD).

| Parameters | Continuous training (n=35) | Interval training (n=35) |
|---|---|---|
| Race, white/non-white, n | 32 / 3 | 33 / 2 |
| Age, years | 59.6 ± 9.9 | 59.1 ± 10 |
| Height, cm | 172.4 ± 6 | 174.7 ± 7.4 |

*2. Baseline characteristics*

No significant changes were observed between groups in terms of percentage of energy consumed as dietary fat, at least moderate intensity, and minutes of physical activity of leisure. In both groups before the experiment did not have any significant differences in the values of the body weight, total-C, HDL-C, and LDL-C.

*3. Outcomes of study*

In comparison with baseline, The results of the assessments significantly raised after research as shown in Table 3.

**Table 3.** Subjects' demographic quality in groups at pretest and post-test assessments plus the P-values of comparable means within groups (mean ± SD).

| Parameters | Group I | | Group II | |
|---|---|---|---|---|
| | Before studying, mean ± SD | After studying, mean ± SD | Before studying, mean ± SD | After studying, mean ± SD |
| Weight, kg | 91.5 ± 9.7 | 83.46 ± 9.7* | 91.7 ± 8.9 | 83.1 ± 8.53* |
| BMI, kg/m2 | 30.27 ± 3.3 | 27.74 ± 3.2 | 30.51 ± 2.67 | 27.66 ± 2.7 |
| Total-C, mg/dl | 192.4 ± 6.5 | 160.2 ± 6.39* | 191.8 ± 4.3 | 163.7 ± 5.87* |
| HDL-C, mg/dl | 51.73 ± 2.68 | 55 ± 3.47* a a a | 51.6 ± 3.52 | 60.8 ± 4.16* |
| LDL-C, mg/dl | 124.86 ± 3.4 | 101 ± 4.67* | 124.46 ± 4.6 | 103.2 ± 4.73* |
| TC:HDL-C ratio | 3.7 ± 0.3 | 2.9 ± 0.28* a a a | 3.67 ± 0.31 | 2.68 ± 0.23* |

* $P < 0.05$ compared to pre-intervention measurement.

a a a $P < 0.001$ compared to interval training (Group II).

The mean weight loss was 8.1kg for the continuous training group; and 8.6kg for interval training group (P<0.001). Weight loss was significant at 12 weeks, however, there was no significant variance in body weight changes between groups after study (P > 0.05). Similar changes were seen in BMI. The changes in body weight and BMI are given in table 3. The differences in HDL-C levels were significant between the two groups within 12 weeks (P <0.001). Differences between groups in total C and LDL-C after the study were not significant (P> 0.05). Analysis of energy consumption showed no significant differences between groups. Energy demand fell for all groups at 12 weeks (Table 1).

## Discussion

With increasing levels of obesity in the world, we need tools to help change the weight gain process. While physical training is an important part of a behavioral program of weight loss, time model of exercise that needed for the improvement of weight loss is still unclear. In this research, the influence of prescribing of time models of exercise (continuous and interval) on weight loss in sedentary overweight middle-aged men has been investigated. Concerning to previous studies, weight loss and lipid profile changes with exercise and diet need to be at least 12-weeks, and many investigators have used it (24, 25). So, the study was halted after three-month. We did not face trial limitations such as potential bias, a multiplicity of analyses, and so on. During the study, except for the lack of commitment of some participants to their individual diets or/and PALs; these participants were not included in the study. Reasons for exclusion of subjects included changes in PAL, diet, drinking alcohol, or consuming sugar, honey, sugar substitutes, or any commercial dressings (high fat and sugar contents) throughout the intervention. Blood triglyceride levels are linked to eating, and the low-calorie diets cut these levels. Accordingly, TG variable was ousted from the study (19, 22, 23).

All parameters, including Wight, Total-C, HDL-C, and LDL-C, changed after study compared to before the study in both groups which confirm the effectiveness of treatments. Elevated blood lipids are risk factors for CVD and get worse with age. Coronary disease is much lower in young and middle-aged women than in men, although gender differences in the mortality of atherosclerosis after menopause are less pronounced (26). Many CVD risk factors in older adult men are linked to increased serum concentrations of C reactive protein. Circulating concentrations of lipids are also associated with serum C reactive protein concentrations (27, 28). Effectiveness of exercise time models was similar concerning weight loss, total-C, and LDL-C. The absence of a significant difference in 12-week weight loss between study groups may be a reflection that all groups have reduced energy consumption. Diet in both groups (low-calorie diet) was high in carbohydrates and low in fat (29). So, it seems the cholesterol level in the diet had an important impact on the outcomes. Study findings were consistent with the findings of the Franz et al.'s study evaluating weight loss efficacy of dietary interventions and exercise, and meal replacements (30).

HDL-C is the most important determining factor of CVD. Its change is of utmost critical in healthcare because one benchmark to estimate the risk of CVD is the ratio of total-C to HDL-C (31). There is a significant relationship between the incidence of CVD and high-density lipoprotein cholesterol. HDL-C is a predictor of the risk of CVD (32). The chance of acquiring CVD reduces with raising HDL-C values. Changes in the ratio of TC to HDL-C are better predictors for CVD risk than the change in LDL-C levels alone (33). Our data showed that increment HDL-C levels in the group II were significantly higher than group I. This finding may be the product of differences in time models of exercise, not resulting in the difference in energy cost. As shown in Table 3, total-C/HDL-C ratio changed in both experimental groups; there was raised significantly in

total-C/HDL-C ratio between pre- and post-study as well as between the groups after study. The decline in total-C/HDL- C ratio was greater in interval training than in continuous training. This finding showed that interval training may provide more health, regardless of body weight and may have clinical applications. The adverse effects that were recorded during this study (caused by consumption of low-calorie diet) were a headache and constipation. These clinical Adverse effects previously have been reported by other investigators (34).

## Conclusion

There were no restrictions such as blocking and block size (There was a balance between study groups in size or primary details). Each of exercise time models can have significant health benefits. Impact of interval training on total-C and LDL-C had no advantage over continuous training. Experimental groups showed similar patterns of weight loss. Interval training impact on HDL-C levels and preventing the occurrence or development of cardiovascular dysfunctions was its remarkable advantage over a continuous training program. In future studies, this research is recommended for women in the middle-aged subgroup.

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