The Effect of Amount of Physical Activity on Cardio Respiratory Fitness and Body Composition

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Abstract

The goal of this study was to assess the effects of amount of ergometer cycle training on Vo_2max and body composition in overweight women. Forty-one sedentary premenopausal women, age 25 to 45 years, were randomly assigned in three groups. Cycle ergometer training consisted of one day per week for group A, two days per week for group B and three days per week for group C. Participants trained for 60 min in any session with moderate intensity (50-60% Vo_2max) for 12 weeks. Participants were counseled not to change their diet during the study period. There were no significant differences among variables in three groups at baseline. Means (±SD) of weight, body fat, WHR, BMI and Vo_2max in groups were 67.43±9.54kg, 31.56±4.6 percent, 0.82±0.05, 25.54±4.16 kg/m^2 and 31.72±7.2 $ml.kg^{-1}min^{-1}$ respectively. After 12 weeks, ANOVA test indicated there were significant differences among mean body composition among the three groups. Use of Tukey post-hoc tests showed that difference in theses groups is because of group C. Paired 't' test showed that there was significant difference between mean body composition ($p<0.01$) in group C. Vo_2max in group B and C improved 12% and 21% ($p<0.01$) respectively with ergometer training. But in group A it was not changed significantly. These findings indicate that the three days in week with 60 min of moderate-intensity, cycle ergometer training is sufficient to improve body composition and Vo_2max in over weight women. With two days training i.e. 120 min in a week only, Vo_2max improved. The results indicate that two days regular training improves Vo_2max in overweight women without change in body composition. With less of amount of physical activity neither body composition nor Vo_2max improve significantly. These findings strongly suggest that, in the absence of changes in diet, a higher amount of activity is necessary for improving body composition and Vo_2max.

Key words: Overweight, Body composition, Ergometer training, Cardiorespiratory fitness

Introduction

Obesity and over weight present significant public health concerns because of the link with numerous chronic health conditions *(Jakicic, 2003).* Also aerobic exercise capacity measured as maximal oxygen uptake (VO_2max) is a major predictor of all-cause mortality both in normal and cardiovascular disease subjects *(Myers et al, 2002 & Gulati et al, 2003).* Body fat content and VO_2max are both inversely associated with the risk of cardiovascular diseases and with all-cause mortality. Exercise is an important component of behavioral weight control and cardio respiratory fitness interventions. Recent clinical and epidemiological studies suggest that beneficial effects of regular physical exercise may depend on intensity or amount of work performed during training *(Gregg et al, 2003, Lee et al, 2003 & Rognmo et al, 2004).*

Based on studies it is gathered that change in body composition is related more to frequency than to intensity of exercise *(Bassulk, 2003 and Chambliss, 2003).* Scientific literature indicate that at least 60 minutes of moderate-intensity of physical activity may be necessary to

maximize weight loss and prevent significant weight regain (*Jakicic, 2003; Kemper et al, 2003; Hill & Wyatt, 2005).* But many researches suggest that high-intensity training is more effective in improving cardio respiratory fitness (Vo_2max) than moderate-intensity training *(Caspersen et al,* 1985 *& Chambliss, 2003*). Many over weight women can not be trained at high intensity level and prefer moderate level of physical activity. On the other hand for individuals constrained by a busy lifestyle, an exercise prescription that delivers benefits with the minimum investment of days is attractive *(Jakicic, 2003),* therefore the goal of this study was to assess the effects of amount of ergometer cycle training on Vo_2max and body composition in over weight women.

Material and Methods

This study has been completed in Tehran University of Tehran. Inclusion criterion were gender female, age (25-45 years), BMI (25-30 Kg/m^2) and freedom from serious concurrent medical or psychological problems. Forty-one sedentary premenopausal women were randomly assigned in three groups. Cycle ergometer training consisted of one day per week for group A, two days per week for group B and three days per week for group C. Participants trained 60 min in any session with moderate intensity (50-60% VO_2max) for 12 weeks. There were no significant differences among variables in three groups at baseline. Subjects provided written informed consent to participate in this study.

Participants took 60 minutes of cycle ergometeric training at 50-60% VO_2max for 12 week. It means that first group took one day in a week of 60 minutes of cycle ergometer training; second group took two days in a week equal to 120 minutes and third group took three days in week of 180 minutes of cycle ergometer training per week. The training was completed on a cycle ergometer (Monark), and heart rate was monitored, so as to control the intensity of the exercise training. During intervention, skilled exercise experts controlled the participant's training on cycle ergometer and provided encouragement and support to the participants for continuing the exercise program. All the participants were asked not to change their eating habits during the intervention period, and food diaries were kept and monitored weekly.

Height and weight were measured (shoes off) using a balance beam scale. Body mass index was calculated by dividing weight (kilograms) by height squared (meters square). The waist measurement was taken at the narrowest part of the torso between the rib cage and the iliac crest, after a normal expiration. Hip circumference was measured at the greatest gluteal protuberance while the subject stood with the feet together.

Percent body fat was measured by the using skin fold calipers (baseline) at three sites (triceps, subscapular & abdomen). Vo_2max was predicted by sub maximal Astrand test on cycle ergometer.

All the tests were repeated after the completion of 12-weeks of ergometer training.

Data analyses for this study were done by using SPSS statistical software

(version 11.0). Significance was set at $P<0.05$ for all tests. Analyses of the dependent variables (i.e., weight, BMI, percent body fat, and waist and hip circumferences) were performed in 2 steps. First, ANOVA was utilized to determine whether body composition and Vo_2max variables varied across activity groups. Tukey post-hoc tests was applied to find the the groups that differed from each other in statistical terms. Paired't' test was applied to evaluate the effect of twelve weeks of cycle ergometer training in statistical terms on the body composition and VO_2max in the the three groups.

Results

Baseline characteristics of the subjects' belonging to the three groups before the the start of the training program are presented in table 1.

Table 1: Subject Characteristics at Baseline for all groups

	First Group		Second Group		Third Group	
	Mean	±SD	Mean	±SD	Mean	±SD
Body Weight (kg)	67.00	9.10	67.04	9.10	68.40	10.70
%t body fat	30.84	5.30	31.90	5.01	31.10	4.20
BMI (Kg/m2)	24.44	3.30	25.78	3.02	26.50	2.35
WHR	0.82	0.03	0.81	0.07	0.82	0.06
Vo2max	31.84	5.30	29.90	5.01	30.10	4.20

All participants completed the 12-week program of exercise. The analysis of variance showed neither significant interactions nor differences among groups with regard to weight, body fat, WHR, BMI at baseline.

Means (±SD) of post-test weight, body fat, WHR, BMI in all the groups are shown in Table 2. After 12 weeks, ANOVA test indicated there was significant difference among mean body composition among the three groups. Use of Tukey post-hoc tests showed that difference in theses groups is because of group C. Paired 't' test showed that there was significant difference in mean body composition ($p<0.01$) in group C. These tests were used for Vo_2max too. Paired 't' test showed that Vo_2max in group B and C improved 12% and 21% ($p<0.01$) respectively. But in group A it did not change significantly.

Table 2: Body Weight, Percent body fat, Body Mass Index, and waist and hip Circumferences following 12 Weeks of training for all groups

	First Group		Second Group		Third Group		P
	Mean	SD	Mean	SD	Mean	SD	
Body Weight (kg)	66.45	9.05	67.10	8.50	66.50	9.80	0.03
%t body fat	32.67	4.40	31.40	4.30	29.95	3.90	0.03
BMI (Kg/m2)	28.28	3.40	26.65	2.80	25.02	2.40	0.03
WHR	0.82	0.04	0.79	0.05	0.78	0.05	0.02
Vo2max	32.14	3.30	34.90	4.07	38.10	5.00	

Discussion

This study investigated the effect of number of ergometer cycling days in a week on body composition and Vo_2max. The findings indicate that three days in a week with 60 min of moderate-intensity cycle ergometer training is sufficient to improve body composition and Vo_2max in over weight women. With two days training (120 min) in a week, only Vo_2max improved, so two days regular training without change in body composition is a useful strategy for improving Vo_2max in overweight women. With less of this amount neither body composition nor Vo_2max improve significantly. The data showed importance of the amount of training in a week. Amount of physical activity time to change body composition is in accordance

with *IOM report (2002)* that recommended 60 minutes of daily moderate intensity physical activity. Current population - level recommendations for levels of physical activity from the Centers for Disease Control and Prevention are also the same i.e. exercise of moderate or greater intensity per week *(Pate et al, 1995).* In the present study the first and second groups who were engaged for 60 and 120 minutes of physical activity per week did not reveal changes in the body composition. According to our study the exercising subjects in the third group who underwent 60 minutes of cycle ergometer training for three days a week showed significant reduction in body weight, percent body fat, body mass index, WHR while the values for the rest of the groups' actually decreased slightly over the same time frame. The fact that first and second groups of the present study did not lose weight is supported by other research studies that generally reveal that weight loss needs at least 150 minutes of moderate intensity of exercise per week *(Saris et al, 2003)*. Dutch standard for healthy levels of exercise also stipulates a minimum of thirty minutes of moderate exertion for adults preferably every day but on no less than five days per week *(Kemper et al, 2003).*

Secondly, our results suggest that two and three 60-min days of moderate-intensity training in a week significantly improve Vo_2max but one day training in a week is not sufficient to change Vo_2max. This finding is consistent with those of previous researchers (*Macfarlane et al, 2006)* who demonstrated the efficacy of 150 min of exercise training. Based on the results of the present and earlier studies, the health benefits of physical activity on Vo_2max are believed to relate more to the exercise intensity than to the volume *(Kemia et al, 2005).* Several publications report that the cardiovascular effects vary with the intensity or amount of exercise *(Wisløff et al, 2005)* and some investigations indicate that this amount and intensity of exercise should be sufficient in order to improve Vo_2max *(Myers et al, 2002)*.

Thirdly results of some investigators disclose that physical exercise alone without dieting (caloric restriction) has a modest effect on total body mass and fat loss *(Bouchard et al, 1993; Després and Lamarche, 1993; Stefanick, 1993)* and helps to maintain weight loss and prevent weight regain *(NIH, 1996 & Wing & Hill, 2001).* However in the present study subjects were requested not to change their dietary habit, it is possible that by reducing calorie intake they would have improved their body composition more. Many studies have divulged that over weight or obese people lose weight and improve in body composition better with a combination of dietary and exercise regimen than with dietary or exercise regimen alone *(Després and Lamarche, 1993 & Chambliss, 2003).*

These findings strongly suggest that, in the absence of dietary restrictions, a higher amount of activity is necessary for improving the body composition and Vo_2max. It is suggested that to have greater improvements in health and fitness one needs to increase the duration or days of physical activity alongwith creation of daily calorie intake deficit.

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