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Research article

THE EFFECT OF DIFFERENT BOUTS OF EXERCISE ON WEIGHT LOSS IN OVERWEIGHT INDIAN FEMALE UNDERGRADUATES

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ABSTRACT

Background: The prevalence of obesity is increasing globally and in India with lack of sufficient time for continuous exercise being one of the causes. Performing multiple short bouts of exercise has been introduced as an alternative method to reduce weight gain. **Aim:** To determine the effects of different bouts of supervised exercise accumulated in 30 minutes on weight loss, in overweight Indian female undergraduate students, without dietary restriction. **Methods and Material:** Sixty otherwise healthy overweight female undergraduate medical students aged 18 to 25 years, with a body mass index (BMI) of 25 to 29.9 kg/m² were randomly selected and divided into four groups of 15 students each as follows: Group I: Non-exercising group (controls); Group II: Participants performed one 30 minute bout of exercise (1×30 =30min/day); Group III: Participants performed two 15 minute bouts of exercise (2×15 =30min/day); Group IV: Participants performed three 10 minute bouts of exercise (3×10=30min/day). Participants performed moderate intensity exercise using a bicycle ergometer for 16 weeks and their weight and Body Mass Index were measured before and after the exercise programs and statistically analyzed. **Results:** There was a significant weight reduction (p<0.05) in Group II, Group III and Group IV. **Conclusion:** Our study revealed that there was significant weight reduction in participants who performed single or multiple bouts of exercise. The use of accumulated short-bouts of moderate intensity exercise can therefore be recommended to young overweight females who have difficulty doing a single long-bout of exercise.

Key words: Exercise; overweight; short-bouts; weight loss.

INTRODUCTION

The prevalence of obesity is increasing globally. In their review highlighting the Asian Indian

body composition with regards to obesity, Chopra et al concluded from different studies

that women have higher prevalence of overweight and obesity (15-61%) when compared to men (12-54%) in India.¹ They also found that obesity was increasing in the youth.¹ The Centers for Disease Control and Prevention (CDC) and the American College of Sports Medicine (ACSM) has provided new physical activity recommendations for the public, that adults should accumulate 30 minutes of moderate-intensity physical activity with at least four hours interval between the bouts for 5 days in a week.^{2,3}

Jakicic et al showed that short-bouts of exercise enhance exercise adherence and may be preferred when prescribing exercise to obese adults.⁴ Schmidt et al proved that that exercise accumulated in several short-bouts had similar effects as one continuous bout with regard to aerobic fitness and weight loss during caloric restriction in overweight, young women.⁵ Woolf-May K et al⁶ found like Ebisu⁷ that there was little difference in the effect of continuous and accumulated exercise, although their findings on the effect on lipid profile varied. Woolf-May K et al⁸ further investigated the effects of single and accumulated short-bouts of walking on aerobic fitness and lipid profile. They found that there were similar changes in aerobic fitness among long, intermediate and short walkers and recommended the incorporation of accumulated bouts of moderate intensity exercise for health promotion since it might be easier for the individuals than single prolonged bouts.⁸ Murphy et al compared the effects of short and long-bouts of brisk walking in sedentary females and found that changes in anthropometric parameters did not differ between short- and long-bout walkers.⁹ De Busk compared the effect of 30 minutes of moderate exercise per day in 18 men with the effect of three 10 minute bouts of exercise per day and found that multiple short bouts of exercise significantly increased peak oxygen uptake.¹⁰

Quinn et al found that an intermittent exercise program, which is incremental in nature,

provided comparable, and in some cases greater, health and fitness benefits than those expected following traditional continuous exercise training.¹¹ Jakicic et al, in addition, investigated the effect of combining intermittent exercise with the use of home exercise equipment.¹² They found that access to home exercise equipment facilitated the maintenance of multiple short-bout exercise, although subjects in the short-bout group did not experience improved long-term weight loss when compared with the long-bout group.¹² In a randomized controlled trial involving 21 sedentary male and 19 female subjects, Osei-Tutu proved that while both long bout walking and short bout walking produced similar and significant improvements in VO₂ max, long bout walking was more effective at reducing percent body fat.¹³ Darling et al proved that intermittent bouts of moderate exercise in young, healthy college-aged males result in the same energy expenditure as continuous exercise of the same intensity.¹⁴ Schmidt et al concluded that current data appear to generally agree that though the magnitude of benefit is unclear, multiple short bouts of exercise per day appeared to increase aerobic capacity and were effective in decreasing weight.⁵

In view of the higher prevalence of obesity and overweight in Indian women and the increased prevalence among the youth; and in view of the above studies, we decided to study the effect of different bouts of exercise on weight loss in overweight Indian female undergraduate students. However, as Schmidt et al⁵ advised, we decided to verify both the actual time spent and the intensity of exercise done (as it was felt that this would be more informative than relying on unsupervised or self monitored exercise by the participants), and to include a non-exercising group also. The aim of the present study was therefore to determine the effect of different bouts of supervised exercise accumulated in 30 minutes on weight loss, in overweight Indian female undergraduate students, without dietary restriction.

METHODS

This study was conducted in the Department of Physiology of Meenakshi Medical College Hospital and Research Institute in Kanchipuram in South India, with the approval of the Institutional Ethics Committee. Informed consent was obtained from the all participants.

Sample Size: Sixty otherwise healthy overweight female undergraduate medical students aged 18 to 25 years, with a body mass index (BMI) of 25 to 29.9 kg/m² who satisfied the following inclusion and exclusion criteria were selected and divided into four groups of 15 students each by using random sampling method.

Inclusion criteria: Female under graduate medical students in the age group 18 to 25 years who were overweight with a BMI of 25 to 29.9 kg/m² who were staying in the hostel and eating food provided from the same hostel mess.

Exclusion criteria: Students suffering from diseases like diabetes mellitus, systemic hypertension, heart disease, bronchial asthma or medical problems that could influence heart rate and/or exercise capacity were excluded from the study. Students with history of smoking or alcohol or nicotine intake; or current intake of any medication; and students following regular physical exercise or weight reduction programs were also excluded from the study.

Screening of the participants (consisting of detailed history including dietary history and clinical examination) was done. The participants' height was measured by using a calibrated, wall-mounted stadiometer while standing straight and looking forward; weight was measured using a weighing scale and body mass index was calculated. Participants were randomly assigned to the following four groups:

Group I: Non-exercising group (controls)

Group II: Participants performed one 30 minute bout of exercise per day (1×30=30 min/day).

Group III: Participants performed two 15 minute bouts of exercise per day (2×15 =30 min/day).

Group IV: Participants performed three 10 minute bouts of exercise per day (3×10=30 min/day).

All participants were advised to eat food provided from the same hostel mess and not to eat food from elsewhere. The participants' weight and body mass index were measured before and after the 16 week period of exercise (Group II, III and IV) and after 16 weeks in the non-exercising group (Group I) also. Subjects who belonged to Group II, III and IV were asked to do moderate intensity of exercise on a bicycle ergometer for 5 days a week for 16 weeks. The intensity of the exercise was monitored by taking the participant's heart rate 10 seconds post-exercise, at the halfway point, and at the end of each session and comparing with the resting heart rate. The exercise was considered as moderate exercise if the participant's heart rate at the end of the session increased to 50-75% of the resting heart rate. Means and standard deviations of age, height, weight and BMI were calculated.

Statistical analysis: Data was analyzed by using SPSS 17. ANOVA was used to examine differences between the four groups and the paired Student's t test was used to compare the participants' weight and BMI before (pre-training) and after the 16 week period (post-training). Statistical significance was accepted at the 5% level.

RESULTS

There was no significant difference ($p > 0.05$) in age, height, weight and Body Mass Index (BMI) of participants measured at the start of the study, in all four groups, which indicated homogeneity between the groups in all parameters (Table 1). Significant differences ($p < 0.05$) were found on comparison of the pre-training and post training body weight and BMI (Table 2) of participants in Group II, III and IV.

Table 1 - Baseline characteristics of participants in all four groups of the study

| Parameter | Group I | Group II | Group III | Group IV |
|-------------------------|-------------|-------------|-------------|-------------|
| Age (years) | 18 ± 0.98 | 18 ± 0.75 | 18 ± 0.12 | 18 ± 1.22 |
| Height (cm) | 158.93±3.45 | 158.92±2.62 | 158.42±5.24 | 157.68±5.22 |
| Weight(kg) | 71.46±3.09 | 70.36±4.6 | 70.36±4.6 | 71.32±5.00 |
| BMI(kg/m ²) | 28.40±1.08 | 27.34±1.22 | 28.76±1.02 | 28.91±1.03 |

Data presented as mean ± standard deviation

Table 2 - Comparison of the pre-training and post-training body weight of participants

| Groups | Weight (kg) | | BMI (kg/m ²) | |
|-----------|--------------|---------------|--------------------------|---------------|
| | Pre-training | Post-training | Pre-training | Post-training |
| Group I | 71.46±3.09 | 73.63±4.82 | 28.4±1.68 | 29.02±2.33 |
| Group II | 70.36±4.60 | 66.42±3.4* | 27.34±1.22 | 25.95±1.00* |
| Group III | 70.36±4.60 | 67.42±4.54* | 28.76±1.02 | 27.05±1.26* |
| Group IV | 71.32±5.00 | 67.69±4.6* | 28.91±1.09 | 27.75±0.98* |

Data presented as mean ± standard deviation. *Significant (p < 0.05).

DISCUSSION

Our study done to determine the effects of different bouts of supervised exercise accumulated in 30 minutes on weight loss, in overweight Indian female undergraduate students, without dietary restriction, revealed that significant weight reduction occurred in participants in Group II (who performed one 30 minute bout of exercise per day), Group III (who performed two 15 minute bouts of exercise per day ie. 2 × 15 = 30 min/day) and Group IV (who performed three 10 minute bouts of exercise per day ie. 3 × 10 = 30 min/day) over a period of 16 weeks.

Schmidt et al also found that that exercise accumulated in several short bouts in overweight, young women had similar effects on weight loss as one continuous bout.⁵ However, their study differed from ours in that they subjected their participants to caloric restriction, while our participants did not have any dietary restriction, although uniformity in diet was maintained. Woolf-May K et al⁶ and Ebisu⁷ also found that there was little difference in the effect of

continuous and accumulated exercise. Murphy et al compared the effects of short- and long-bouts of brisk walking in sedentary females and found that changes in anthropometric parameters did not differ between short- and long-bout walkers.⁹ The findings of our study differ however from those of Osei-Tutu who found that long bout walking was more effective at reducing percent body fat¹³ and Jakicic et al who found that subjects in the short-bout exercise group did not experience improved long-term weight loss when compared with the long-bout group.¹²

Excess post-exercise oxygen consumption (EPOC) and exercise induced anorexia could be the reasons for the weight reduction in Group II, III and IV of our study. There is a possibility of equal energy expenditure in both single and multiple bouts of exercise. Following each bout of exercise, the slight elevation in body temperature directly stimulates metabolism to increase recovery oxygen consumption. Moreover, restoration of pulmonary ventilation and circulation and redistribution of calcium,

potassium and sodium ions within muscle and other compartments also require additional energy.

The main effect of exercise is negative energy balance due to both increased energy expenditure and also decreased energy intake.^{14, 15, 16} Acute moderate intensity exercise has been known to increase the secretion of polypeptide YY (PYY), glucagon-like peptide (GLP-1), and pancreatic polypeptide (PP) and suppresses the hunger score in the post exercise period.^{14, 18} Although it is generally accepted that the role of exercise is mainly to prevent weight gain,¹⁹ exercise also causes moderate weight reduction even without dietary restriction due to exercise induced anorexia.¹⁸ In our study also, the weight reduction that was achieved in the groups performing different bouts of exercise, without dietary restriction could be due to the exercise induced anorexia.

In our study, as Schmidt et al.⁵ advised, we had verified both the actual time spent in exercising and the intensity of exercise done by the participants. We had included a non-exercising group also in whom it was found that there was an increase in weight, which however was not statistically significant. The results of our study therefore assume more significance. In view of the increased prevalence of obesity in females and the youth in India,¹ it is recommended that short-bouts of exercise accumulated in 30 minutes can be adopted by young overweight Indian females in order to reduce their weight. Using accumulated bouts of moderate intensity exercise has been recommended by others too, since it is easier (than single prolonged bouts) and since similar changes in aerobic fitness have been found among long, intermediate and short walkers,⁸ and since short-bouts of exercise also increase the adherence to the exercise programme.⁴ Limitations of this study include the small sample size and duration of exercise; failure to measure exact calorie intake, VO₂ max and lipid profile; and the fact that the results of this study may not necessarily be applicable to

other age groups or even to males in the same age group.

CONCLUSION

Our study done to determine the effects of different bouts of supervised exercise accumulated in 30 minutes on weight loss, in overweight Indian female undergraduate students, without dietary restriction, revealed that significant weight reduction occurred in participants who performed a single bout of 30 minutes of exercise and those who performed two 15 minute bouts of exercise or three 10 minute bouts of exercise per day over a period of 16 weeks. The use of accumulated bouts of moderate intensity exercise can therefore be recommended to young overweight females who have difficulty doing a single long bout of exercise.

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