

# ORIGINAL RESEARCH

## Effectiveness of Exercise Intensity on Body Composition and Measurements in Overweight Individuals

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### ABSTRACT

**Introduction:** Obesity is a major health problem of the developing world and an associated modifiable risk factor for various metabolic disorders. The reason for the increasing trend of obesity in adults is a sedentary life style. Body composition is an important aspect of health for individuals from all age, gender, and ethnic groups. Recently, High intensity exercise done for less duration is emerging and gaining importance. **Aim:** To investigate a protocol of moderate and high intensity exercise on a simple stationary bicycle ergometer, required to produce significant change in body composition in overweight and obese individuals. **Materials and Methods:** A total of 50 volunteers were included and were assigned to 2 groups of moderate or high intensity exercise randomly. All the individuals completed the 15 weeks exercise protocol. Anthropometric measurements and body composition for each participant were recorded before and after the exercise regime. **Results:** There was a significant change in almost all the parameters studied i.e weight, waist hip ratio, skin fold thickness, circumference measures, fat mass, fat percentage, and lean body mass among moderate and high intensity group. Overall high intensity group showed greater significant decrease in measurements as compared to moderate intensity group. **Conclusion:** It can be concluded that High intensity exercise is more effective in comparison to moderate intensity exercise protocol, though significant change in terms of the body composition and circumference measurements are observed in both.

**Key words:** Obesity, overweight, exercise.

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### INTRODUCTION:

Obesity is a major health problem of the developing world and an associated modifiable risk factor for various metabolic disorders.<sup>1</sup> The reason for the increasing trend of obesity in adults is a sedentary life style. Body composition is an important aspect of health for individuals from all age, gender, and ethnic groups.<sup>2</sup> For example, obesity is a significant public health problem in the United States and other developed countries. According to the American College of Sport Medicine obesity has been shown to be associated with chronic diseases and health conditions such as cardiovascular disease, hypertension, diabetes, specific types of cancer and other chronic diseases.<sup>3</sup> It is important to prevent obesity, and exercise is established as an important component of behavioral weight loss program. The National program for prevention and control of diabetes and cardiovascular disease suggests moderate to vigorous activity for 5-7 days/week. Recognizing exercise protocols that are effective in reducing body fat and feasible to be followed by overweight, sedentary individuals are important.<sup>4</sup>

It is well established that aerobic exercise can be an important component of weight loss intervention, and

therefore is commonly included as part of a comprehensive weight management program. However, there is a controversy over whether exercise duration or exercise intensity is more important for stimulating decreases in the body fat content.<sup>5</sup> The optimal amount of exercise necessary to produce a change in body composition is still controversial. Apart from this, even requirement of an exercise program to be operational, must be economical and easy to implement without the necessity of complicated exercise equipment still exists. Studies have examined moderate and high intensity exercise for a change in body composition and have reported conflicting results

Therefore, in the present study we aimed to investigate a protocol of moderate and high intensity exercise on a simple stationary bicycle ergometer that was required to produce significant change in body composition in overweight and obese individuals

### MATERIALS AND METHODS

In the present study, a total of 50 volunteers were included in the study. Prehand Institute ethical committee approval was obtained. Inclusion criteria included sedentary overweight and obese individuals (BMI $\geq$ 25) in

the age group of 20-40 years of age. Informed written consent was taken from all the volunteers. They were assigned to moderate or high intensity exercise group randomly based on lot method. Exclusion criteria comprised individuals with history of previous surgery, cardiopulmonary and musculo- skeletal disorders, diabetics, hypertensives, and asthmatics. Complete clinical examination, ECG and echocardiogram were taken and fitness obtained from physician before volunteers were involved for the exercise program. All the individuals completed the 15 weeks exercise protocol with no injury due to the exercise.

For each individual included in the study record of weight, height, Waist circumference, Hip circumference was measured. Waist hip ratio was calculated to be waist circumference in cms divided by hip circumference in cms. Mean of three readings of each measurement was taken for the calculation of WHR. Mid arm, mid-thigh and mid-calf circumference were also measured. Skin fold measurements were taken from various sites including biceps, triceps, scapular, abdominal, supra iliac, thigh and medial calf sites according to standard procedures using skin fold caliper. All skin folds were measured to the nearest 1 mm. Mean of 3 readings was recorded at all the sites. All measurements were taken by the same investigator before and after completion of exercise protocol. Durnin's age specific equations (1974) was adopted to calculate body density that was further used in Siri's equation (1961) to determine the total body fat. Fat percentage, fat mass, lean body mass were derived using standardized equations.

**Exercise protocol:** In the laboratory, as subjects were already well acquainted with the exercise protocol, Exercise was performed on the bicycle ergometer at the fixed weight to reach the calculated target heart rate. Exercise protocol for moderate intensity exercise group included performance of Steady state cycling at the heart rate of 50%-74% of heart rate maximum reserve for a duration of 40 min, 5 days/week (n=37) and High intensity exercise group (n=35) performed 8 sec sprint cycling on bicycle ergometer at the heart rate of 75%-84% of heart rate maximum reserve followed by 12 sec of low intensity cycling for a duration of 20 min, 3 times/week with 5 min of warm up and 5 min of cool down in both the groups.

## RESULTS:

A Total of 50 participants were included in the study. They were further grouped into major groups i.e Group I (n=25) which included participants who did moderate intensity exercise and Group II (n=25) who did high intensity exercise. Mean age and BMI of group I came to be 26.45 yrs and 28.45 for group II came to be 23.16 yrs and 30.23 respectively.

Anthropometric measurements and body composition before and after exercise in group I and group 2 were recorded and tabulated in Table 1 and table 2 respectively. The results showed a significant change both after moderate intensity and high intensity exercise protocol for a period of 15 weeks.

TABLE 1: Anthropometric measurements and body composition before and after exercise in group I

ANTHROPOMETRIC MEASUREMENTS	BEFORE EXERCISE	AFTER EXERCISE
WEIGHT	78.25	74.35
WEIGHT /HIP RATIO	0.74	0.70
ARM CIRCUMFERENCE	31.24	29.21
THIGH CIRCUMFERENCE	58.42	54.35
CALF CIRCUMFERENCE	35.25	32.23
SKIN FOLD MEASUREMENTS	91.11	79.26
FAT PERCENTAGE	31.23	30.45
FAT MASS	28.65	24.21
FAT FREE MASS/LEAN BODY MASS	52.25	50.15

TABLE 2: Anthropometric measurements and body composition before and after exercise in group II

ANTHROPOMETRIC MEASUREMENTS	BEFORE EXERCISE	AFTER EXERCISE
WEIGHT	80.85	77.24
WEIGHT /HIP RATIO	0.79	0.76
ARM CIRCUMFERENCE	33.45	30.28
THIGH CIRCUMFERENCE	58.34	54.13
CALF CIRCUMFERENCE	36.65	33.25
SKIN FOLD MEASUREMENTS	88.56	79.10
FAT PERCENTAGE	35.13	30.23
FAT MASS	28.15	24.43
FAT FREE MASS/LEAN BODY MASS	51.85	51.14

On comparison of body composition measures between group I and II it was observed that there was a significant improvement in the lean body mass and the body fat mass also decreased significantly ( $p < 0.005$ ). Even fat percentage was significantly decreased in both groups ( $p < 0.005$ ).

When circumference measurements were compared between both the groups, it was observed that a significant change occurred in the arm circumference and sum of skin fold measurements. Whereas Comparison of Waist hip ratio did not show any significant difference.

## DISCUSSION:

The purpose of this paper was to discuss the results of a prospective study in which two groups of moderate and high intensity exercise workout produced a significant change in body composition and circumferential measurements. Exercise training has long been thought to be a good addition to any weight loss program because individuals who train on regular basis are usually thin and of lower fat compared with their sedentary counterparts.

Body composition refers to the constituents of body lean mass, fat mass and water, and is not only important for athletes, since an athlete's performance is partially influenced by the proportion of his fat-free mass (FFM) and fat mass (FM), but also for individuals of all ages, gender and ethnic groups.<sup>6</sup>

Tremblay *et al.* conducted a cross-sectional study to compare the effects of physical activity intensity on body composition. The most important finding from their study was that people engaging in vigorous activities had less subcutaneous fat, thus indicating that both the effects of exercise on body fat and its distribution result from energy balance components, such as increased post-exercise resting metabolic rate, rather than from the energetic cost of activities.<sup>7</sup>

Determination of body composition using anthropometric measures proves to be a convenient and economical method. Our results showed that reduction of weight in moderate intensity group was greater as compared to high intensity group. It can be explained on the basis that the high intensity group showed a comparable increase in the fat free mass. If the gain in fat free mass is attributed to muscle hypertrophy rather than glycerol stores then resting metabolic rate increases which is favourable for long term weight control.

The results of our study are consistent with the results shown by Majann *et al.*<sup>8</sup> and John *et al.*<sup>9</sup> who also reported that participants exposed to vigorous exercise intensity did not have greater weight loss in comparison to moderate intensity workout participant.

Further when fat percentage and fat mass were compared within the 2 groups, a significant decrease in values was observed in the high intensity group as compared to the moderate intensity group. Our results were in consistence with the results shown by Knoepfli *et al.*<sup>10</sup>. Results obtained by Bryner *et al.*<sup>11</sup> were also similar to those in this study, in which the group engaging in the high intensity physical exercise had a significant percent fat reduction, while that performing the moderate-intensity physical exercise had no significant loss. It can thus be said that high intensity exercise favours more fat loss. But our results were in contrary to the results shown by Desprese and Leijssen *et al.* in their studies.<sup>12</sup>

When the waist hip ratio was compared within both the groups, significant reduction of size was observed in the high intensity group. Similar results were shown by Van Aggel *et al.* in their study.<sup>13</sup> They explained this on the basis that this could be because individuals with obesity oxidize more fat during intense physical activity.

In a 12-week investigation, Swenson & Conlee had subjects engaged in exercise 5 times/week to evaluate

body composition differences between a group performing low-intensity aerobic exercise and another one performing high-intensity aerobic exercise, using a cycle ergometer. There was no significant difference between both groups, though, despite the fact that workload for the high-intensity group was 33 % greater. Although the energy expenditure was larger in the high-intensity group, the energy intake may have been larger as well.<sup>14</sup>

The results of change in the circumference between both the groups, showed a significant decrease in the mid arm circumference and mid- calf circumference in the high intensity group. These findings show that there is an increase in the lean body mass in both types of exercise.

## CONCLUSION:

We can conclude that High intensity exercise is more effective in comparison to moderate intensity exercise protocol though significant change in terms of the body composition and circumference measurements are observed in both.

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