Original Article

ISSN: 2349 - 4891

International
Journal of Recent Research and Applied Studies
(Multidisciplinary Open Access Refereed e-Journal)

# Effect of Different Intensities of Aerobic Training on Cardiac Output of Middle Aged Obese Men

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Received 1st September 2015, Accepted 16th November 2015

**Abstract**

*To achieve this purpose forty five (N = 45) obese men (BMI 30 ± 1 kg/m2) from Annamalainagar, Chidambaram, Tamil Nadu, India) from the total population of (obese volunteers) 173 were selected at random subjects for this study. Their age mean height and weight were 43 ± 2.7 years, 168 ± 6 cm and 81 ± 3.7 kg respectively. They were randomly divided into three equal groups, and each group consisted of fifteen (n = 15) subjects, in which, Group I underwent low intensity aerobic training, Group II underwent high intensity aerobic training and Group III acted as control. Low Intensity was Pedal at cadence of 40 revolutions per minute of bicycle ergo meter training for 5 days per week for sixteen weeks. High intensity Pedal at cadence of 60 revolutions per Minute of bicycle ergo meter training for 5 days per week for sixteen weeks. The selected criterion variable Cardiac Output to assess M-mode Doppler echocardiography and transducer was used to assess cardiac output. Pre-test data were collected two days before the training program and post-test data were collected two days after the training program. The collected data treated with ANCOVA. Level of confidence was fixed at 0.05. If obtained 'F' ratio significant scheffe's post hoc test were used. The result shows that High intensity aerobic training positively influences the cardiopulmonary (Cardiac output)*, *variable of middle-aged obese men. Low intensity aerobic training also positively influences the cardiopulmonary (Cardiac output) variable of middle-aged obese men.*

**Keywords:** Low Intensity Aerobic Training, High Intensity Aerobic Training, Cardiac Output, Bicycle Ergo Meter.


## Introduction

Today's world is a world of computers and spaceships. The civilization advances man's desire to compete with counterpart also increases. He wants to excel in his chosen field. The result of such desire is scientific discoveries and their application for excellent. Health, which is considered as the most precious asset of human being, is highly determined by the physical fitness status of the individual. For leading happy and prosperous life, being healthful is highly essential. An individual needs to be sufficiently physically fit to lead the normal life in comfortable manner, free from different ailments and can enjoy the life to the fullest. Physical exercises are essential to improve and to maintain the physical fitness of individual. Since, different physical exercise target different organs of the body, the selection of exercise should be selectively objective. Fitness can be conceived as the matching of the individual to his or her physical and social environment. The WHO defined fitness as "the ability to perform muscular work satisfactorily". In keeping with this definition, fitness implies that the individual has attained those characteristics that permit a good performance of a given physical task in a specified physical, social and psychological environment. The components of fitness are numerous and are determined by several variables including the individual's pattern of living habits, diet and heredity. Lifestyles affect people's health, with eating habits and regular physical activity being the two influential factors (Panagiotakos, 2004) irrespective of sex, age or country of residence (Yusuf, 2004). An appropriate way to assess health in apparently healthy people is to measure their health-related fitness, defined as the dynamic state of energy and vitality that allows people to perform daily tasks, enjoy active leisure and cope with unexpected emergencies without undue fatigue. At the same time, health-related fitness helps in the prevention of hypokinetic diseases, in maximum development of intellectual capacity, and in full enjoyment of life (Bouchard, 1993). Regular physical exercise is an important component in the prevention of some of the diseases of affluence such as heart disease, cardiovascular disease, Type 2 diabetes, obesity and hypercholesteremia (Swain *et al.*, 2006). Obesity and overweight seems to be caused by complex interchange of factors, including lifestyle, quality (i.e. nutrition content) and spacing (length of time between) of meals, exercise, genetics hormones, metabolism, dieting, history and perhaps even chemical pollutants. Which (if any) of those factors is most important and how they vary between individuals, is still under considerable debate.

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**Obesity**

The terms overweight and obesity is often used interchangeably, but technically they have different meaning. Overweight is defined as body weight that exceeds the normal or standard weight for a particular person based on height and frame size. Aerobic exercise has the aim of improving the body's consumption of oxygen. The word aerobic means with oxygen. Aerobic refers to our body's use of oxygen in its metabolic process (energy-generating process). Most aerobic exercises are done at moderate levels of intensity for longer periods, compared to other categories of exercise. An aerobic exercise session involves warming up, exercising for at least 20 minutes and then cooling down. Aerobic exercise involves mainly the large muscle groups.

**Cardiac Output During Exercise**

Saltin and Associates (1998), have told that due to exercise $\dot{Q}$ increases, but the rate of increase is vary between trained and untrained individuals.

According to Eklob (1988), maximal $\dot{Q}$ in trained male subjects can reach value in excess of 30 L/min. This represents a five to six fold increase over resting value, in fact it is not unusual to find out that highly trained athletes, who excel in endurance events and who have exceptionally high aerobic capacities, have maximal $\dot{Q}$ near 40 L/min.

According to Fox and Mathews (1981), the large increases in $\dot{Q}$ during exercise are brought about through increase in SV, HR. Mathematically the relationship of $\dot{Q}$ to SV and HR are given below.

$$\dot{Q} \text{ L/min} = \text{SV L/beat} \times \text{HR b/min.}$$

The purpose of the study was find out effect of different intensities of aerobic training on cardiac output of middle aged obese men

**Methodology**

To achieve this purpose forty five (N = 45) obese men (BMI 30 ± 1 kg/m2) from Annamalainagar, Chidambaram, Tamil Nadu, India) from the total population of (obese volunteers) 173 were selected at random subjects for this study. Their age mean height and weight were 43 ± 2.7 years, 168 ± 6 cm and 81 ± 3.7 kg respectively. They were randomly divided into three equal groups, and each group consisted of fifteen (n = 15) subjects, in which, Group I underwent low intensity aerobic training, Group II underwent high intensity aerobic training and Group III acted as control. Low Intensity was Pedal at cadence of 40 revolutions per minute of bicycle ergo meter training for 5 days per week for sixteen weeks. High intensity Pedal at cadence of 60 revolutions per Minute of bicycle ergo meter training for 5 days per week for sixteen weeks. The selected criterion variable were cardiac output variable, M-mode Doppler echocardiography and transducer was used to assess cardiac out put. Pre-test data were collected two days before the training program and post-test data were collected two days after the training program. The collected data treated with ANCOVA. Level of confidence was fixed at 0.05. If obtained 'F' ratio significant scheffe's post hoc test were used.

**Training Program**

The percentage of intensity (Watts) variations in sixteen weeks training for 40 revolutions and 60 revolutions groups are given below:

**Table I**

| **Week** | 1 & 2 | 3 & 4 | 5 & 6 | 7 & 8 | 9 & 10 | 11 & 12 | 13 & 14 | 15 & 16 |
|---|---|---|---|---|---|---|---|---|
| **% of Intensity (Watts)** | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 |

**Results**

**Table II.** Analysis of covariance on cardiac output of low and high intensity aerobic training groups and control group

| | | **Low Intensity Group** | **High Intensity Group** | **Control Group** | **Source of Variance** | **Sum of Squares** | **df** | **Mean Squares** | **'F' Ratio** |
|---|---|---|---|---|---|---|---|---|---|
| Pre-test | $\bar{X}$ | 4.005 | 4.113 | 3.942 | B | 0.222 | 2 | 0.111 | 1.108 |
| | □□ | 0.309 | 0.384 | 0.238 | W | 4.208 | 42 | 0.100 | |
| Post-test | $\bar{X}$ | 4.644 | 4.812 | 4.046 | B | 4.872 | 2 | 2.436 | 34.14* |
| | □□ | 0.342 | 0.240 | 0.197 | W | 2.997 | 42 | 0.071 | |
| Adjusted Post-test | $\bar{X}$ | 4.65 | 4.76 | 4.09 | B | 3.724 | 2 | 1.862 | 48.50* |
| | | | | | W | 1.574 | 41 | 0.038 | |

* Significant at 0.05 level of confidence.

The table value for significance at 0.05 level of confidence with df 2 and 42 and 2 and 41 are 3.22 and 3.21, respectively.

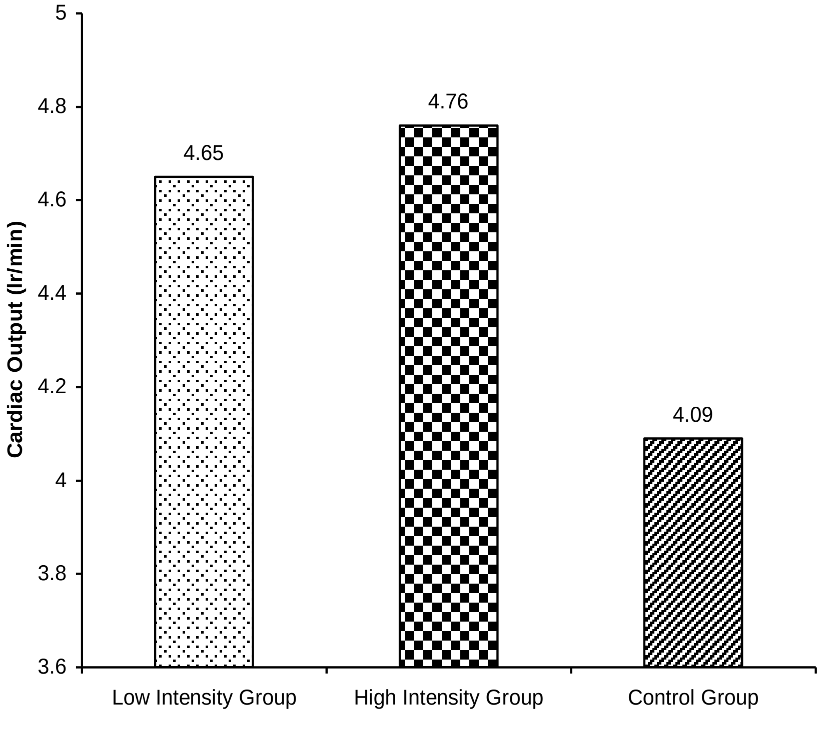
The table II shows that the pre-test means of low and high intensity groups and control group are 4.005, 4.113 and 3.942 respectively. The obtained 'F' ratio of 1.108 for pre-test means of cardiac output is lesser than the table value 3.22 for df 2 and 42 required for significance at 0.05 level. The post-test means of low and high intensity groups and control group are 4.644, 4.812 and 4.046 respectively. The obtained 'F' ratio of 34.14 for post-test means of cardiac output is higher than the table value 3.22 for df 2 and 42 required for significance at 0.05 level. The adjusted post-test means of low and high intensity groups and control group are 4.65, 4.76 and 4.09 respectively. The obtained 'F' ratio of 48.50 for adjusted post-test means of cardiac output is higher than the table value of 3.21 for df 2 and 41 required for significance at 0.05 level. The results of the study indicate that there is a significant difference among low intensity, high intensity and control groups on cardiac output. To determine which of the paired means had a significant difference, Scheffe's post-hoc test was applied and the results are presented in Table III.

**Table III.** Scheffe's test for the difference between the adjusted post-test paired means of cardiac output

| **Adjusted Post-test Means** | | | **Mean Differences** | **Confidence Interval** |
|---|---|---|---|---|
| **Low Intensity Group** | **High Intensity Group** | **Control Group** | | |
| 4.65 | 4.76 | - | 0.11 | 0.18 |
| 4.65 | - | 4.09 | 0.56* | 0.18 |
| - | 4.76 | 4.09 | 0.67* | 0.18 |

* Significant at 0.05 level of confidence.

The table III shows the adjusted post-test mean difference of cardiac output between low intensity and high intensity groups, low intensity and control groups and high intensity and control groups are 0.11, 0.56 and 0.67 respectively, which were greater than 0.18 at 0.05 level of confidence. The results of the study showed that, high intensity aerobic and low intensity aerobic training groups has significantly differed on cardiac output level when compared to control group, but between the training significant differences was not found. Hence it was concluded that both high and low intensity aerobic training was equally better method to increase the cardiac output level. The adjusted post-test mean values of low intensity, high intensity and control groups on cardiac output level were graphically represented to Figure I.



**Discussion on Findings**

High and low intensity aerobic training has significantly improved stroke volume, cardiac output and reduced resting heart rate when compared to control. However between the training significant differences was found infavour of high intensity aerobic training on stroke volume and resting heart rate. But insignificant difference was found between training on cardiac output. Hence it was concluded that high and low intensity aerobic exercises positively influence resting heart rate, stroke volume and cardiac output. Further it was concluded, high intensity aerobic training was the best method to improve stroke volume and cardiac output of obese people.

The results shows that High intensity, Low intensity aerobic training positively influences the cardiopulmonary (Cardiac output) variable of middle-aged obese men. Same results agreement with that found that in contrast, athletes achieved a substantially increased $\dot{Q}$ basically through a prominent increase SV, their exercise HR was similar to that of sedentary individuals. The greatly increased SV resulted from both increases in end-diastolic volume and marked decreases in end-systolic volume compared with those in sedentary persons. These volumetric changes were reflected in a striking increase in ejection fraction (Hermansen,1988),.

Concluded highly trained endurance athletes heart have adapted to training, by drastically increasing SV, lower HR can provide optimal cardiac output. 12 weeks of exercise training heightened $\dot{Q}$ was due to an increase in HR and SV (Turkvich *et al.* 1988),

Viewed that during dynamic exercise, the increase demand for $O_2$ in the active muscles is effectively met by increased vascular conductance in the exercising muscle and redistribution of an increased $\dot{Q}$ by sympathetically induced vasoconstriction in non-exercising muscle and in the visceral organs. As exercise progresses in intensity, increase in vascular conductance, which has the potential to increase flow demand in excess of the pumping capacity of the heart (Saltin 1998). Endurance training and sprint interval training increase $\dot{Q}$ (Macpherson *et al.*, 2011). Endurance training increases SV and $\dot{Q}$ (Rice *et al.*, 2000). The results of the study may in conformity with the above findings.

**Conclusions**

1. High intensity aerobic training positively influences the cardiopulmonary (cardiac output) variable of middle-aged obese men.
2. Low intensity aerobic training also positively influences the cardiopulmonary (cardiac output) variable of middle-aged obese men.

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