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ARTICLE

Added Effects Of Circuit Resistance Training With Treadmill Training On Cardio-Pulmonary Endurance In Young Obese Individuals

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ABSTRACT:

AIM: To study the effect of treadmill training combined with circuit resistance training (CRT) and treadmill training alone on cardio-pulmonary endurance in young obese individuals. OBJECTIVES: 1) To study the effect of treadmill training on cardio-pulmonary endurance in young obese individuals.2) To determine the additional effects of CRT on cardio-pulmonary endurance in young obese individuals and compare it with aerobic training alone. **METHODOLOGY:** 30 young individuals, both male and female, with BMI> 25 kg/m2, were included in the study. They were randomly divided into two groups A and B. Group A performed treadmill training thrice a week, for 20 minutes for four weeks duration at an intensity decided by heart rate reserve calculated by Karvonen's formula. Group B performed ten minutes of treadmill training followed by 30 minutes of circuit resistance training consisting of exercises like leg curls, leg extension, leg press, abdominal curls, lateral pull-down, triceps push away, biceps curls. The intensity of these exercises was 50% of 1 RM and 30 seconds at each station. The VO2 max was determined pre and post four weeks using Queen's College step test, and body weight was also recorded pre and post four weeks. **RESULT:** Wilcoxon Signed Rank test was used to analyze the two outcome measures result within the group pre-post values. The P-value for Vo2 max for both group A and B was <0.05. The same was the p-value for body weight. Mann-Whitney Rank Sum Test was used for the between-group analysis of VO2 max and body weight, and the p-value was <0.05. All these p values were statistically significant. **CONCLUSION:** From this study, we concluded that a training program consisting of treadmill training and circuit resistance training has a positive effect on cardio-pulmonary endurance.

Introduction:

Obesity is now recognized as the most prevalent metabolic disease worldwide, reaching epidemic proportions in both developed and developing countries and affecting adults and children and adolescents.[1] It has been found to be prevalent in all age groups. 18-25-year-olds are identified by WHO as a group with a high risk of weight gain due to some social and environmental changes.[2] The prevalence of cardiovascular disease has increased substantially over the past two decades in the younger population.[3] WHO defines weight status according to body mass index (BMI), the ratio of weight (in kilograms) divided by height (in meters squared).[4] The negative effects of obesity on health are beyond dispute. Obesity and cardio-respiratory fitness (CRF) are modifiable and independent risk factors for cardiovascular mortality.[3]

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Unfavorable cardiovascular risk profiles are found in youth with low levels of CRF and high percentage of body fat.[3] Risk factors for CVD including hypertension, diabetes and hypercholesterolemia are suspected to be influenced by fitness and these factors may mediate the association between low cardio respiratory fitness and mortality. Also there is strong and consistent evidence from observational studies that physical inactivity and poor cardio respiratory fitness are associated with higher morbidity and mortality from all causes, including cardiovascular disease (CVD) and cancer. In the absence of weight loss, exercise has many beneficial effects on body composition, metabolism and cardiovascular fitness.[5] Maximum oxygen consumption is an internationally accepted parameter and is the first to measure In obese individuals, there is an increase in type II muscle fibres and decreased type I muscle fibres, which may affect reduced oxygen uptake. Aerobic and resistance training are two major forms of exercises recommended for obesity and related health risks. Traditionally, the predominant aerobic exercise training has been recommended as priority by the international scientific community when it comes to exercise and weight loss.

Aerobic exercise training or conditioning is augmentation of the muscle's energy utilization through an exercise program.[7]Aerobic training produces cardio vascular and/or muscular adaptations and is reflected in an individual's endurance. Circuit Resistance Training (CRT) is yet another system of mechanical resistance. It, instead of providing brief intervals of heavy, local-muscle overload as in standard resistance training provides more general conditioning that improves body composition, muscular strength and endurance and cardiovascular fitness[8]. Aerobic training affects the reduction of weight and body fat, whereas resistance training affects the maintenance or increase in lean body mass but doesn't affect body fat. So, there are diverse effects of aerobics and resistance training in individuals with obesity. Keeping in mind this fact, we hypothesized that an optimal training programme including combination of aerobic and resistance training will be more effective in improvement of cardiopulmonary fitness of young obese individuals and risk reduction.

OBJECTIVES

1) To study the effect of treadmill training on cardio-pulmonary endurance in young obese individuals

2) To find out the additional effects of CRT on cardio-pulmonary endurance in young obese individuals and compare it with aerobic training alone

MATERIALS AND METHODOLOGY

STUDY DESIGN: - experimental study.

STUDY SETTINGS:-As approved by guide and institute.

SAMPLE SIZE: - Thirty (30).

SAMPLING METHOD:- Simple random sampling by fish-bowl (chit method) was used.

SAMPLE POPULATION:-Young obese individuals with BMI>25 kg/m2 and age group 18- 25.

INCLUSION CRITERIA:-

1. BMI >25
2. Age group 18-25
3. Physically inactive for more than 3 months

EXCLUSION CRITERIA

1. Diagnosed cardiac or pulmonary disorders
2. Any major systemic illness
3. Musculoskeletal or neurological conditions
4. Recent surgery
5. Those who are participating in other physical conditioning activity.

PROCEDURE

Ethical clearance was taken from the institute's ethical committee. Numerous subjects from and around the study setting were selected and a written consent was obtained from them. Afterwards they were screened and included in the study on the basis of inclusion and exclusion criteria. They were randomly divided into two groups A (treadmill training) and B (treadmill + CRT) by fish-bowl method immediately after screening. BMI, and VO2 max were measured both before and after 4 weeks of exercise intervention. BMI was calculated as weight in kg divided by height in meters square. VO2 max was measured using queens college step test. According to this test, the subject stepped up and down on a 16.25 inches or 41.3 cm step for three minutes. The rate of stepping was 24 steps/min for males and 22 steps/min for females. A metronome was used to keep the pace. After the completion of the exercise he/she was asked to remain standing comfortably and the carotid pulse was measured from 5th to 20th seconds of the recovery period. This 15 second pulse rate was converted into beats/min and then VO2 max was calculated using the following formula [9]:

- Male: 111.33-(0.42 x PR)
- Female: 65.81-(0.1847 x PR

Vitals of the subjects were noted prior to every exercise session which included blood pressure, pulse rate and oxygen saturation. Every exercise session was started with a warm up period of 10 minutes consisting of general stretching exercise. Group A (only treadmill) exercised on a treadmill in the OPD thrice a week on alternate days for 20 minutes for four weeks with comfortable footwear. Intensity of exercise was determined by using Karvonen's formula and maximum heart rate.[10] It was then followed by cool-down period of 10 minutes. Group B (treadmill+ CRT) performed combined training consisting of circuit resistance training and treadmill training which was also of four weeks. Treadmill training was same as that of group A in all aspects except that it was of 10 minutes duration. It was followed by rest period of 5 minutes. Circuit resistance exercise consisted of various exercises at seven different stations: leg curls, leg extension, leg press, abdominal curls, lateral pull down, triceps push away, and biceps curls. Starting from the first station, subject lifted a weight of 50% of 1RM as many times possible for 30 sec. The participant then moved to the next resistance exercise station after a rest period of 15 sec and so on to complete the circuit. A single circuit was repeated several times so that the total exercise session lasted for about 30 minutes. At the end of four weeks, BMI, waist to hip ratio and VO2 max was again recorded.

RESULT

The data was analyzed for its statistical significance using appropriate software and Microsoft Excel. Wilcoxon Signed Rank Test was used for within group analysis of pre and post values of VO2 max, body weight and waist to hip ratio at the end of four weeks intervention for both the groups A and B. Mann-Whitney Rank Sum Test was used for between group descriptive analysis for the values of VO2 max, body weight and waist to hip ratio at the end of four weeks intervention for both the groups A and B. There was no significant difference between the two groups at base level with respect to VO2 max, body weight and waist to hip ratio.

1 The mean differences in VO2 max between group A and B were 5.48±2.27 and 7.03±1.77 respectively and the p-value of <0.05, which is statistically significant.

2 The mean differences in body weight between group A and B were 1.7±0.92 and 2.46±0.80 respectively and p-value of <0.05 which is statistically significant.

3 The mean differences in waist to hip ratio between group A and B were 0.02±0.02 and 0.01±0.01 respectively and p-value of >0.05 which is statistically insignificant.

DISCUSSION

The purpose of the study was to find whether there is any added effect of circuit resistance training with aerobic training on cardio pulmonary endurance in young obese individual of age group 18-25.

After four weeks of training to both the groups, it was observed that there was statistically significant improvement in both the outcome measures VO2 max, body weight and within the group. However, statistically significant improvement was seen in group B which performed circuit resistance training in addition to treadmill training when between group (A and B) analysis was done. With an aim to improve cardiopulmonary endurance, aerobic exercises are the first choice and the effect is well documented. Endurance training elicits numerous changes in the oxygen transport system components that enable it to function more effectively. Maximal oxygen consumption depends on the muscles capacity to utilize oxygen. In obese individuals, there is an increase in type II muscle fibres and decreased type I muscle fibres, which may affect reduced oxygen uptake[11]. Researches have demonstrated a positive relationship between VO2 max and the relative number of slow-twitch fibres. Therefore, it is evident that in obesity, cardio-pulmonary endurance is reduced because there is excess fat and reduced lean body mass/ fat free mass.(Fat free mass= bone mass + skeletal mass + water content) which is the metabolically active tissue.

A study done by Sang-Kab Park and colleagues showed that the aerobic training group significantly decreased in body weight, % body fat but not in lean body mass[12]. Substantial studies have documented that both aerobic exercise training and resistance exercise training have made significant changes in body weight and body composition in obese individuals. So in the present study, statistically significant ($p<0.05$) improvement in VO2 max was seen in both the groups because both the group performed treadmill training for varying duration.

There was an increased improvement in VO2 max seen in group B. This improvement can be attributed to the unique effects of resistance exercise performed by them as a part of CRT. Resistance exercises are usually meant for strength gains and rarely used for improving aerobic fitness. The mechanism associated with strength gains is very complex. These include structural as well as neural adaptations in the motor system. Enoka has made a convincing statement that strength gains are possible without structural changes but not without neural adaptations. Out of numerous neural adaptations, fibre type alterations are one of the factors. The earliest researches concluded that neither endurance nor resistance training could alter the basic fibre type, specifically from type I to type II. However, these earlier studies showed that fibres tend to take on certain characteristics of the opposite fibre type if training is of the opposite kind. (e.g type II fibers might become more oxidative).[13] This may contribute to maximum oxygen consumption. Satron and co-workers have reported evidence of fiber type transformation in women due to heavy resistance training.[13]

In-circuit training lower loads make it possible to do more repetitions. Thus, the exercise is supposed to have an effect both on strength and on cardio-respiratory fitness. The stimulus here is aerobic in nature as the rest interval in between is almost equal to zero. This may be a reason for better response in group B in our study.

After the completion of the study, we concluded that a training program consisting of treadmill training and circuit resistance training has a positive effect on cardio-pulmonary endurance in young obese individuals. It also helped to decrease body weight significantly.

CONCLUSION

This study concluded that a training program consisting of treadmill training and circuit resistance training has a positive effect on cardio-pulmonary endurance in young obese individuals. It also helped to decrease body weight significantly.

From the present study result, we can assume that treadmill and circuit resistance training together should be included in a training program to address the need to improve cardio-pulmonary endurance and weight loss altogether.

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