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ORIGINAL ARTICLE

Combination of Aerobic and Resistance Exercise's Impact on the Cardiovascular Fitness of Office Workers Leading Sedentary Lifestyle

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ABSTRACT

Background: Less than 25 minutes of regular exercise each day is considered a sedentary lifestyle. It is linked to metabolic syndrome and obesity, both of which raise the risk of cardiovascular illnesses and impaired cardiopulmonary function. This study assessed the impact of combination of resistance and aerobic exercise on cardiopulmonary fitness in office workers who maintain sedentary lifestyles.

Methodology: Subjects between the ages of 25 and 50 were evaluated, chosen at random, and given their informed consent based on the inclusion and exclusion criteria. The participants were divided into two groups. They were assessed and assigned at random to one of two groups: group A received an intervention consisting of a combination of resistance and aerobic exercises under supervision, while group B received aerobic exercises under supervision.

The aerobic exercise programme was given for 12 weeks (3 times a week) respectively. A pre test and post test data for the two groups were evaluated for cardiopulmonary fitness using body mass index, waist hip ratio, harward step test by using International Physical Activity Questionnaire – Category score 1-inactive. The data was collected, compiled and analysed.

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Conclusion: Both the groups showed significant differences on comparison and they have found to be effective in addressing cardio pulmonary fitness. Therefore, study concludes, that 6 weeks of combined aerobic and resistance exercises demonstrated more expected outcomes in improving cardiopulmonary fitness in office workers leading sedentary lifestyle and decrease body mass, Waist hip ratio in office workers.

KEYWORDS

• Resistance exercise • Lung function • Cardiopulmonary fitness • Sedentary life style • Aerobic exercise

INTRODUCTION

Sedentary behaviour is emerging as an important risk factor for poor health and for mortality.[1] According to WHO, approximately 2 million deaths per year are attributed to physical inactivity, prompting WHO to issue a warning that a sedentary life style could very well be among the 10 leading causes of death and disability in the world.

This high amount of sedentary time increases all causes of mortality, double the risk of cardiovascular diseases, diabetes and obesity and increase the risk of colon cancer, high blood pressure, osteoporosis, lipid disorders, depression and anxiety. According to WHO, 60 to 85% of people in the world-from both developed and developing countries lead sedentary lifestyles, making it one of the more serious yet insufficiently addressed public health problems of our time.[2]

According to **Mark S Tremblay** *et al.* Sedentary behaviour is defined as any waking behaviour characterised by an energy expenditure < or = to 1.5 metabolic equivalents (MET's) while sitting, reclining or lying posture.[3]

With the evolution of the "technology age", sedentary time is reported to be increasing. Occupations that require employees to remain seated for extended periods of time are continually becoming more pervasive in today's workforce. Those who perform office/desk work are sitting on average 8-12 hours/day during workdays and 7-9.5 hours/day on day off. These trends are particularly worrisome considering higher prevalence for conditions such as metabolic syndrome; type 2 diabetes, deep vein thrombosis, and cardiovascular disease have been linked with habitual sedentary behaviour.[4]

Cardio-respiratory fitness is heart and lung's collective ability to transport and deliver adequate oxygen and body's ability to utilize maximum oxygen during the work so that work performance could last longer with sustained vigour.[5] Adequate supplement and maximum utilization of supplied oxygen would enable person to work efficiently for long. For better physical work performance, there are numbers of cardio-respiratory adjustments being made by the body such as increase respiratory rate, oxygen uptake, heart rate, cardiac output and importantly marked increase in utilization of available oxygen by the cells.

Generally, there is linear relation between exercise and VO2 max therefore; it increases as exercise intensity increases. However, at the physiological limit in spite of further increase in exercise intensity, oxygen consumption remains same and attains plateau. This highest rate of oxygen utilization is maximum oxygen consumption (VO2 Max) or maximum aerobic capacity.[6]

Aerobic exercise, practiced for more than 30 minutes in a day helps to maintain physical fitness. The American College of Sports Medicine (ACSM) defines aerobic exercise as any activity that uses large muscle groups, can be maintained continuously and is rhythmic in nature. Examples of aerobic exercise include cycling, dancing, hiking, jogging/long distance running, swimming and walking. These activities can best be accessed via the aerobic capacity, which is defined by the ACSM as the product of the capacity of the cardio respiratory system to supply oxygen and the capacity of the skeletal muscles to utilize oxygen.[7]

Resistance exercise also referred to as resistance training is an essential element

in exertion programs for those who wish to promote or maintain health and physical well being, potentially enhance performance of motor skills and help or reduce the risk of injury and complaint according to Mark Lidegaard, MSc, *et al.* (1 March 2015).[8] Cardio respiratory fitness is the most important measure of health, multitudinous other primary health related parameters live and include musculoskeletal fitness, body composition and inflexibility, not only does resistance training ameliorate on these parameters, but it has also shown to enhance several other important aspects of physical and mental health.[9]

According to P Chinna Reddemma *et al.* most of the employees or office workers working as computer personnel's for more than five hours in a day is leading to altered physical activity and fitness so the aim of this study is to find the combined effect of both aerobic exercise and resistance exercise on cardiopulmonary fitness in office workers leading a sedentary lifestyle.[10]

AIM

Several studies suggested aerobic exercises and resistance exercises on cardio pulmonary fitness for sedentary life style workers. On the other hand, there are inadequate trials that offered the effect of combination of aerobic exercise and resistance exercise on cardiopulmonary fitness in office workers leading a sedentary life style. In order to give the knowledge needed of cardio pulmonary fitness, this study evaluated the benefits of resistive training, aerobic exercises and salutary goods of heart rate, systolic blood pressure and respiratory rate.

OBJECTIVES OF THE STUDY

The primary objective of this study is to observe and analysis the combined effect of aerobic and resistance exercise on the cardio pulmonary fitness in office workers leading a sedentary lifestyle.

Need of the Study:

As office workers leading a sedentary life style result in commonest cardio respiratory health issue faced by the public.

Methiya Thayon, PT *et al* (2016) investigate the goods of aerobic exercise on cardio pulmonary fitness and combined effect of aerobic exercise and resistance exercise in cardio pulmonary fitness in office workers leading a life for 8 weeks. He suggested that need to study of long term goods of resistance exercise on cardio vascular issues. Hence to analyse and estimate Combined resistance training and aerobic exercises has taken this study of 12 weeks for exploration research.

HYPOTHESIS

***Null Hypothesis*:** It is hypothesized that no significant improvement in cardiopulmonary fitness in office workers leading sedentary lifestyle trained using a combination of aerobic and resistance exercise.

***Alternative Hypothesis*:** It is hypothesized that there may be improvement in cardiopulmonary fitness in office workers leading sedentary life style but more significant improvement and better outcome was shown in experimental group who practised combined aerobic and resistance exercise than the control group who practiced only aerobic exercise.

METHODOLOGY

Materials and Methodology

Office workers working in NIEPMD were enrolled in this study. A total of 8 patients were assessed for eligibility. Two patients did not satisfy the inclusion criteria, and 2 refused to participate. Hence, a total of 4 office workers completed the trial. Subjects were then randomly divided into two groups (experimental and control groups) and all the participants were provided with informed consent.

Study Design and Setting:

A randomized experimental trial design was used. This study was conducted by using pre-test and post-test experimental study design, at National Institute for Empowerment of Person with Multiple Disabilities in Chennai, The period of Intervention and the quantitative data collection was 12 weeks for both the groups

Randomization:

The participants were screened according to the eligibility criteria and included according to the intention to treat principle. Patients were randomly assigned into two groups.

Inclusion Criteria:

- Age: 25 to 50
- Gender: women and men
- Waist hip ratio more than 0.7 in females and 0.8 in males
- International Physical Activity Questionnaire – Category score 1-inactive

Exclusion Criteria:

Personnel who are working less than 4 hours in a day, pregnant women, cardiac diseases, respiratory problems, musculoskeletal problems, neurological problems.

International physical activity questionnaire – Category score 2 and 3-minimally active and HEPA active

Selection of Subjects:

Experimental group: Combination of aerobic exercise and resistance exercise with supervision.

Control group: Aerobic exercise with supervision.

The aerobic exercise programme was given for 6 weeks (3 times a week)

MEASUREMENT TOOLS

1. Body Mass Index

Body mass index is commonly used because it is very easy to measure and also correlates strongly with the percentage of body fat.

2. Waist-Hip Ratio

According to the WHO, Waist-hip ratio was suggested as an additional measure of body fat distribution.

MEASUREMENT

Waist circumference

Hip circumference

3. Harvard Step Test

Harvard step up test is a sub maximal exercise test for estimating VO2 max. I t is a practical field test for assessing individual's aerobic fitness.

Procedure

4 subjects were selected as per the addition criteria. The written conscent was taken from each subject sharing in the study. Subjects were also divided randomly into 2 groups containing 2 subjects each. Prior to giving intervention, each subject reported for the familiarization of exercises.

Group A is the experimental group- Supervised combination of aerobic exercise and resistance exercise is enforced to the subjects starting with medium phase exercises for the first 4 weeks, medium fast exercise for the coming 2 weeks and briskly exercise for the final 2 weeks. The intervention was given for 12 weeks (3 times a week) for 30 minutes

Exercise Program

There are three components of the exercise program: (1) a warm up period, (2) the exercise period (3) a cool down period.

1. A warm up period - A warm up consists of a minimum of 5 to 10 minutes low to moderate activity brisk walking or warm up on a treadmill was given.
2. The exercise period – The detailed description of exercises is given below:

Medium Phase (First 2 weeks)
Aerobic Exercise
3. Spot walking with hands on hip
4. Spot walking with arm swing
5. Two step side move
6. Walk forward and backward with forward kick
7. March forward and backward with elbow up and down
Resistance Exercise
8. Open chain resisted knee flexion
9. Squats
10. Heel rise
11. Sitting press-ups
12. Wall push-offs

Medium Fast Phase (For 3rd and 4th Week)
Aerobic Exercise
13. March forward and backward with elbow up and down
14. Two steps side move with arm rotation
15. Walk forward and backward with forward kick
16. Double side steps and kick
17. Double steps side move and jumping with arms up and down.
Resistance Exercise
1. Lunges
2. Sitting press-ups
3. Wall push-up
4. Squats
5. Heel rise

Faster Phase (Last 2 weeks)
Aerobic Exercise
1. Walk forward and backward with arm rotation
2. Juming with alternate elbow and knee touch
3. Walk forward and backward with forward kick
4. Bent leg jump
5. Juming jacks
Resistance Exercise
1. Wall push-offs
2. Open knee resisted knee flexion
3. Heel rise
4. Lunches
5. Squats

3. A cool down period: The cool down should consist of a minimum of 5 to 10 minutes of low to moderate level activity, stretching is given during this period.

Group B is the control group - Supervised aerobic exercise without resistance exercise is implemented to the participants starting with medium phase exercises for the first 4 weeks, medium fast exercise for the next 2 weeks and faster exercise for the final 2 weeks. The intervention was given for 12 weeks (3 times a week) for 30 minutes.

Cardiopulmonary fitness was assessed pre and post the intervention using Harvard step up test along with BMI and Waist-hip ratio.

Figure 1: Harvard Step Test

Figure 2: Open chain resisted knee flexion Resistance exercise

Figure 3: Aerobic exercise - jumping

DATA ANALYSIS AND INTERPRETATION

Data Analysis

Statistical analysis has been carried out to analyse the significant impact of the treatment issued to the subjects of both control and experimental groups.

Of the 4 subjects 2 were randomized with experimental group and 2 were randomised into control group. All the 4 subjects completed entire protocol as defined by 12 weeks of treatment. The outcomes of the study were BMI, Waist-Hip Ratio and Harvard step test.

Independent t-test was used to compare the differences between the 2 groups. Descriptive measures like mean, standard deviation have been reported along with p-value.

Table 1: Comparison of mean, standard deviation, t-value and p-value of BMI in pre-intervention and post-intervention of the experimental group (Group A = Aerobic + Resistance) and control group (Group B = Aerobic)

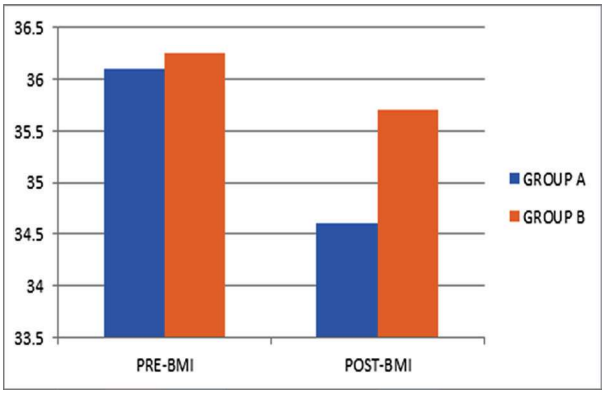
Groups		N	Mean	Standard Deviation	t-value	p-value
Group A	Pre-Intervention	2	36.1	2	0.493	0.670
	Post-intervention	2	34.6	2.15		
Group B	Pre-Intervention	2	36.2	0.65	0.533	0.646
	Post-Intervention	2	35.7	0.8		

Table 2: Comparison of mean, standard deviation, t-value and p-value of Waist-Hip Ratio in pre-intervention and post-intervention of the experimental (Group A = Aerobic + Resistance) and control group (Group B = Aerobic)

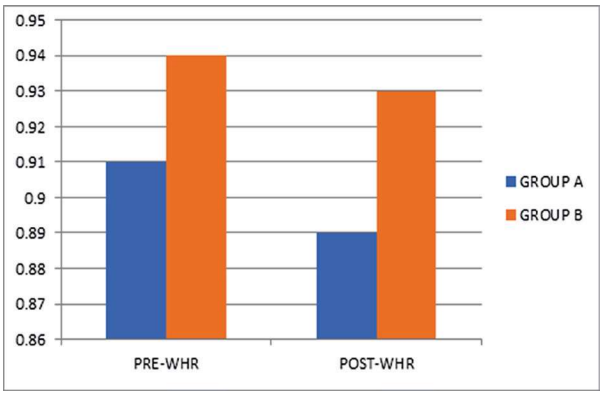
Groups		N	Mean	Standard Deviation	t-value	p-value
Group A	Pre-Intervention	2	0.91	0.02	0.353	0.757
	Post-intervention	2	0.90	0.02		
Group B	Pre-Intervention	2	0.94	0.01	1.152	0.368
	Post-Intervention	2	0.93	0.004		

Table 3: Comparison of mean, standard deviation, t-value and p-value of Harvard step test in pre-intervention and post-intervention of the experimental (Group A = Aerobic + Resistance) and control group (Group B = Aerobic)

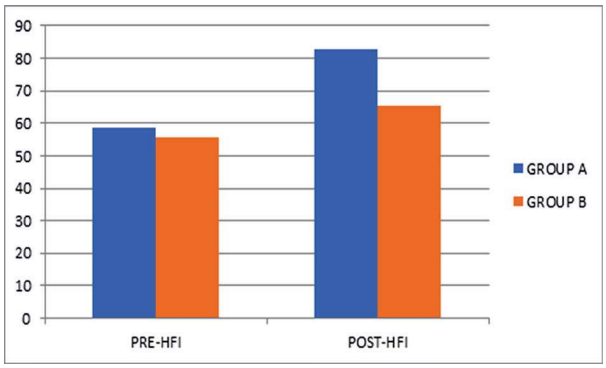
Groups		N	Mean	Standard Deviation	t-value	p-value
Group A	Pre-Intervention	2	58.48	7.20	-3.145	0.087
	Post-intervention	2	82.80	2.80		
Group B	Pre-Intervention	2	55.56	4.44	-2.985	0.096
	Post-Intervention	2	69.09	0.09		



Graph 1: The graph compares BMI between the two groups before intervention and after intervention



Graph 2: The graph compares Waist-Hip Ratio between the two groups before intervention and after intervention



Graph 3: The graph compares Harvard fitness index between the two groups before intervention and after intervention

RESULTS

The statistical analysis shows an insignificant difference between group A and group B in terms of the BMI, WHR and Harvard fitness index. P-value is >0.05 which is considered insignificant, which may be due to small sample size.

Even though statistical value is not significant, we can see that there is significant improvement in cardiopulmonary fitness in the combined aerobic and resistance exercise done by Group A when compared to aerobic exercise done by Group B.

DISCUSSION

The purpose of the study was conducted to know the combined effect of aerobic exercise and resistance exercise on cardiopulmonary fitness in office workers leading sedentary lifestyle. The collected data shows that the BMI, Waist-Hip ratio has reduced more in experimental group and Harvard fitness index has considerable increased in experimental group.

When analysing the BMI, in Group A, the pre-intervention mean BMI value is 36.1 which has reduced to 34.6 after the intervention was given. In Group B, the mean pre-intervention value is 36.2 and post-intervention value is 35.7, even though there is a decrease in the BMI but it is not much as compared to the Group A.

While analysing the WHR we can see that not much difference is present between both the groups, with group A having mean pre-WHR value as 0.91 and mean post-WHR value as 0.90 and group B having mean pre-WHR value as 0.94 and post-WHR value as 0.93, but in both the groups the WHR has reduced.

In the case of Harvard fitness index which is used to measure the cardiopulmonary fitness, significant improvement is seen in Group A when compared to Group B. The mean value of Harvard fitness index in pre-test of Group A is 58.48 which has increased to 82.80 in post-test which shows significant improvement. In the case of Group B the mean pre-intervention value of Harvard fitness index is 55.56 which has increased to 69.09. So, even though both groups showed improvement in cardiopulmonary fitness, Group A was found to be showed more improvement.

According to the data analysis, even though the p>0.05 and the study is not significant, the values show a considerable difference in favour of the combined effect of aerobic and resistance exercise. A significant difference was found between the mean pre and post test values of WHR, BMI and cardiopulmonary fitness measured using Harvard step test in both experimental and control groups, but comparatively more significant changes was found in the experimental rather than the control group.

A number of studies has done on the effect of aerobic exercise on cardio-pulmonary fitness, one such study is done by P Chinna Reddemma and Dr K Madhavi *et. al.* (2015) who concluded that aerobic exercise has a significant influence in computer using individuals.

Even though statistical value is not significant, the values show a considerable difference in favour of combined resistance and aerobic exercises. So, the null hypothesis can be rejected in favour of the following alternate hypothesis 'There was improvement in cardiopulmonary fitness in office workers leading sedentary life style but more improvement was shown in experimental group who practised combined aerobic and resistance exercise than the control group who practiced only aerobic exercise'.

CONCLUSION

The study concludes that subjects who admit combined use of aerobic and resistance exercise of cardiopulmonary fitness in office workers leading sedentary life style showed better outcomes and significant progression in the experimental group.

The statistical analysis suggested that there was a significant change in factors like BMI, Waist-hip ratio and heart rate and Harvard

fitness indicator. When statistically analysed the p-value of Harvard fitness indicator was 0.087 which was lesser than the t-value which was -3.145, thus the nullthesis is rejected and hence it's concluded that 12 weeks of combined aerobic and resistance exercise is effective in perfecting cardiopulmonary fitness in office workers leading sedentary life.

LIMITATION AND RECOMMENDATION

Limitation

- Study had a small sample size
- Psychological factors were not considered
- Unequal gender distribution was present
- Daily routine activities were not taken in to consideration.

Scope of The Study

- Study can also be carried out for different age groups.
- Long term follow up can be included.
- Studies can be implemented in different populations.

Source of funding: No funding was obtained for the study.

Conflict of Interest: No conflicts of interest are present.

Ethical clearance: The research was conducted in accordance to the ethical standards of National Institute for Empowerment of Person with Multiple Disabilities in Chennai. Written informed consent were provided by all participants prior to participation.

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