



EFFECT OF AEROBIC TRAINING ON CARDIORESPIRATORY FITNESS IN PHYSIOTHERAPY STUDENTS

Physiotherapy

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ABSTRACT

Background: The aim of the study was to study the effect of aerobic training on cardiorespiratory fitness in physiotherapy students. This was an analytical type of study using Chester's treadmill walk test as an outcome measure. This test consists of 6 levels and had been carried out before and after the intervention which consists of treadmill training for 8 weeks after which the pre and post fitness levels of physiotherapists was assessed.

Objective: To study the effect of endurance training on cardiorespiratory fitness in physiotherapy students. To assess the cardiorespiratory fitness using Chester's Treadmill Walk Test. To check the changes in VO_{2max} , heartrate, and blood pressure post the intervention strategy.

Methodology: 25 Participants were selected by Convenient Sampling who were college students from Dr. A.P.J. Abdul Kalam College of physiotherapy, PIMS, Loni. The participants included were between age group of 18-25 years who were not able to complete the Chester Treadmill Walk test for 12 minutes. After which those who were included were given a 8 weeks treadmill training intervention and then post testing was carried out again using the same test and then conclusion was carried out accordingly.

Results: The outcome measures considered were VO_{2max} , heartrate and blood pressure. According to the ACSM's Guidelines, aerobic training was given to 25 samples for 8 weeks. After which the participants were again tested using the same test. The student paired "t" test value of heartrate prior to intervention was 33.81 and post intervention was 8.34 and the student paired "t" test value for systolic blood pressure was 2.16 and diastolic blood pressure was 2.22. The student paired "t" test value of VO_{2max} was 4.03. Based on the readings of the "t" test values mentioned above, proves that there is significant increase in VO_{2max} post the aerobic training intervention

Discussion and conclusion: The results of the study supports that endurance training is effective and helps increasing cardiorespiratory fitness level in Physiotherapy students. It shows that there is a significant increase in VO_{2max} which was calculated using the formula for Chester Treadmill Walk Test after the aerobic training intervention was given for 8 weeks based on the ACSM's Guidelines.

KEYWORDS

Chester Treadmill Walk Test, Cardiorespiratory fitness, Treadmill training, Physiotherapy students

INTRODUCTION

Physical fitness as a whole is the basis of all activities of our society. And on the other side cardiorespiratory fitness reflects the overall capacity of the cardiovascular and respiratory systems and its ability to carry out exercise for a prolonged period of time. Therefore the cardiorespiratory fitness is considered as a direct and accurate measure of the physiologic status of an individual.¹

A sedentary lifestyle and low physical fitness, these two are the most prevalent modifiable risk factor and predictor of both cardiovascular disease and all causes of morbidity and mortality. It has been tested and found that high levels of cardio respiratory fitness provides strong and independent prognostic information about the overall risk of illness and death, related to cardiovascular causes.¹

Now a days, demands of Physiotherapy profession is increasing day by day. For this, the Physiotherapists are required to be engaged in various activities. They work in hospitals and in rehabilitation centers with varieties of patients. Their work involves giving various exercises to patient, transferring of patients and various other activities, for which they need good amount of strength, endurance and flexibility. Therefore the therapists need to maintain a good physical fitness level to meet their demands of increasing strength and endurance.¹

But due to poor attention given to the physical fitness by the physiotherapists, it has been reported that there is an increased prevalence of musculoskeletal disorder among the Physiotherapists as well as the students who are trainers. As trainers of fitness, they themselves are expected to have good fitness levels.¹

Exercise, in general, is one of the best preventive actions to fight illness and maintain health. There is an increasing evidence of cardiovascular problems in present era, due to which importance of exercise for development of fitness is on rise.²

There is a slow decline in cardiovascular function with advancing age that is significantly accentuated by a sedentary lifestyle. ACSM has released a physical activity guideline to improve physical fitness. Hence it was recommended that there should be accumulation of at least 30 minutes of moderate activity on most preferably all days of week.²

Low fitness levels are responsible for the highest proportion of deaths, followed by smoking had amongst the four cardiovascular lifestyle factors. Hence interventions are being made to decrease the prevalence of low physical fitness and smoking can promote reduced mortality rates.²

Participation in aerobic exercise develops increased cardiorespiratory fitness, which protects from cardiovascular morbidity and mortality. Maximal oxygen consumption (VO_{2max}) provides a measure of the maximal volume of oxygen that the body consumes via the respiratory system and is transported through the bloodstream to be used to release energy in the cell.³

VO_{2max} is currently the best indicator to assess cardiorespiratory fitness and it is directly related to cardiovascular health, and its improvement has been linked to decreases in risk of death from cardiovascular disease.³

Cardiorespiratory fitness (CRF) as a whole is a health-related component of physical fitness which is defined as the ability of the circulatory, respiratory, and muscular systems to supply oxygen at the time of sustained physical activity. Cardiorespiratory fitness or endurance is an indication of a person's overall physical health. The primary measure of cardiorespiratory fitness is VO_{2max} . It is a measure of how well your muscles are able to absorb and use the oxygen. Essentially, your cardiorespiratory fitness level is a measure of strength of your aerobic system.⁴

The first component of the cardiorespiratory fitness is the ability of your body to transport oxygen to your muscles during prolonged exercise. The second component of cardiorespiratory fitness is the ability of the muscles to absorb and make use of the oxygen while you are exercising.⁴

Physical Therapy is a basic necessity to improve health of the individuals these days. It helps maintaining the working of the bodily systems which includes nervous system, cardiovascular system, respiratory system, musculoskeletal system, gastrointestinal system, etc. Physical Therapy consists of specially designed exercises to improve and maintain the physical abilities of an individual to perform specific tasks.⁵

Physiotherapy itself suggests physical activity. Being a physiotherapist, one needs to be physically fit as it requires a lot of manual strength to give various treatments to the patients. Hence regular physical activity might help maintaining fitness and muscular strength and also improve the cardiovascular health, which overall states that it helps in improving and increasing the physiological processes of the body.⁵

Cardiorespiratory endurance training indicates the subject's level of aerobic health and physical fitness. Physical fitness training includes jogging, walking, treadmill training, swimming, cycling, sprinting etc. Cardiorespiratory endurance training can be given at three levels that is mild, moderate and high intensity exercise.

AIM OF THE STUDY

1. To study the effect of endurance training on cardiorespiratory fitness in physiotherapy students.

OBJECTIVE OF THE STUDY

1. To assess the cardiorespiratory fitness using Chester's Treadmill Walk Test to check the changes in VO_{2max} , heartrate, and blood pressure post the intervention strategy.

METHODOLOGY AND RESEARCH DESIGN

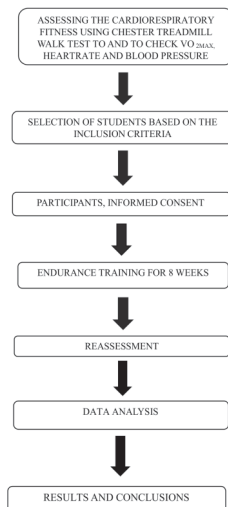
Ethical clearance was obtained from the Institutional Ethical Committee. The study was an Analytical Study which involved Convenient Sampling. The samples were the students of Dr. A.P.J. Abdul Kalam College of Physiotherapy, Pravara Institute of Medical Sciences, Loni. A sample size of 25 within the age group of 18 years to 25 years who were not able to complete Chester Treadmill Walk Test for 12 minutes were included. After which those who were included were given a 8 weeks treadmill training intervention according to the ACSM's Guidelines and then post testing was carried out again using the same test and then conclusion was carried out accordingly.

OUTCOME MEASURES

Cardiorespiratory Fitness will be assessed pre and post the intervention. The participants will be assessed using the Chester Treadmill Walk Test. This test is a 12 minute treadmill walk test consisting of 6 levels. After each level the gradient of the treadmill will be increased by 3% and each level will be of 2 minutes each. Before starting the test, participant will be asked to walk on treadmill at 0% gradient for 2 minutes as warm up session and also at the end of 6 levels the gradient will be at 0% and the participant will be asked to walk for 2 minutes as a part of cool down period. At the end of each level heartrate and rate of perceived exertion is to be noted. At the end of the test VO_2 max is to be predicted and the participants are to be included accordingly based on the inclusion criteria.

STAGE	TIME(MINS)	SPEED(KM/HR)	GRADIENT(%)
1	0	6.2	0
2	2	6.2	3
3	4	6.2	6
4	6	6.2	9
5	8	6.2	12
6	10	6.2	15

PROCEDURE



STATISTICAL ANALYSIS

Statistical analysis was done using the Microsoft Excel. Various statistical measures such as mean, standard deviation [S.D.] and test of significance such as Student Paired 't' test were utilized to analyze the data. The results were concluded to be statistically significant with $p = 0.002$. Paired 't' test was used to compare the difference in scores between the pre-intervention and post-intervention values in a group.

Heart Rate	Pre Intervention Mean + SD	Post Intervention Mean + SD	Paired "t" Test Value	"p" value and significance
Pre-test	80.6 + 5.197	79.28 + 4.504	33.81	$p = 0.002$ significant
Post-test	160.52 + 18.5	176.2 + 8.9	8.34	$p = 0.002$ significant

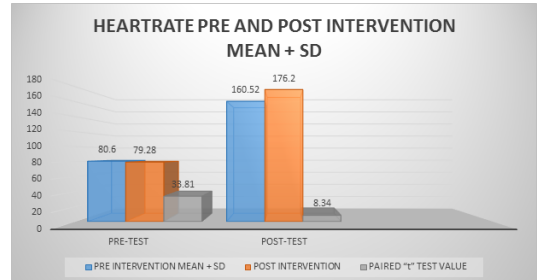
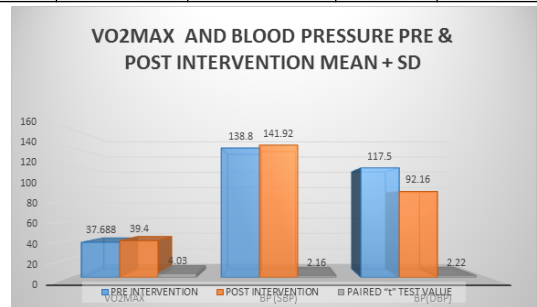


Table No. 2 VO_{2max} And Blood Pressure Pre & Post Intervention Mean & SD

	Pre Intervention Mean + SD	Post Intervention Mean + SD	Student paired "t" test value	"p" value and significance
VO_{2MAX}	37.688 + 2.3	39.4 + 2.0478	4.03	$P = 0.002$ Significant
BP (SBP)	138.8 + 5.7735	141.92 + 6.6452	2.16	$P = 0.002$ Significant
BP (DBP)	117.5 + 5.350	92.16 + 5.5051	2.22	$P = 0.002$ Significant



DISCUSSION AND RESULT

Table no .1 shows the mean and standard deviation readings of heartrate pre and post testing, pre and post intervention which are 79.28 ± 4.504 and 176.2 ± 8.9 respectively. And the student paired "t" test value pre intervention pre testing was 33.81 and post intervention post testing was 8.34 which shows that there is a significant decrease in heartrate post the intervention given which suggests that the vitals were much more stable post the intervention. When exercising, heart needs to work really hard to pump blood to your lungs and muscles. When you let it to this stress regularly over time, it slowly adjusts (by growing stronger) and ultimately is able to pump enough blood with fewer beats. The activity of exercising end up being less stressful, since your cardiovascular system gets prepared to handle them. This is why, when you do something like working out at higher intensity, over time you'll eventually be able to work at a higher intensity for longer than when you first started.¹⁷

The more you exercise, the better your body gets at activating the parasympathetic nervous system. Exercise stimulates your sympathetic nervous system, or the "flight or fight" response, i.e parasympathetic nervous system counters it. At this time, the recovery and regeneration system that calms down the body. It relaxes lungs, heart, blood vessels, digestion, and more. When training and put the body is put under stress it stimulates the sympathetic system, the body gets better at flipping on the parasympathetic system to restore balance post-exercise. A more activated parasympathetic system contributes to

a lower heart rate.¹⁷

Table no. 2 shows mean and standard deviation of VO_{2max} and blood pressure pre and post intervention in which VO_{2max} pre intervention mean and standard deviation was 37.688 ± 2.3 and post intervention was $39.4 + 2.0478$ and the student paired “t” test value was 4.03. Systolic blood pressure pre intervention mean and standard deviation was 138.8 ± 5.7735 and post intervention was 141.92 ± 6.6452 and diastolic blood pressure pre intervention mean and standard deviation was 117.5 ± 5.350 and post intervention was 92.16 ± 5.5051 . The student paired “t” test value of systolic blood pressure was 2.16 and diastolic blood pressure was 2.22. The “p” value for heartrate as well as VO_{2max} and blood pressure is 0.002 which is significant.

Training marks in an increase in the efficiency of oxygen transport within the body. By lowering the resting heart rate (HR), and the HR at sub maximal loads, the heart pumps extra blood with every heartbeat. In addition to other physiological changes, there is an increase in the oxygen extraction capability. When the subject is tested before and after training while performing exercise at the same load, a lower heartrate is shown after training because more blood and oxygen is delivered in each time the heart beats. Such heartrate differences during exercise can be used to calculate aerobic fitness. More the increase in heartrate, more increase in VO_{2max} .¹⁸

Systolic blood pressure increases with increases in exercise intensity. As a bigger quantity of blood gets pumped from the heart the pressure rises in the blood vessels that transport the blood with each heartbeat. Same goes for the diastolic blood pressure. The higher the intensity of exercise, the greater the rise in heart rate will be, and consequently the larger the increase in systolic blood pressure.¹⁹

The dramatic effects on raising blood pressure occurs because the skeletal muscles are under strain from the heavy load with an increase the intra-muscular pressure, as a result the heart has to work harder to push blood into the tightly contracted muscles thus causing an increase in blood pressure.¹⁹

After completing the statistical analysis, the results conclude that the level of VO_{2max} is increased and the aerobic training is effective to increase the level of cardiorespiratory fitness in physiotherapy students.

CONCLUSION

The results of the study supports that endurance training is effective and helps increasing cardiorespiratory fitness level in Physiotherapy students. It shows that there is a significant increase in VO_{2max} which was calculated using the formula for Chester Treadmill Walk Test after the aerobic training intervention was given for 8 weeks based on the ACSM's Guidelines.

LIMITATIONS OF THE STUDY

1. The study was conducted in a limited age group i.e 18 – 25 years.
2. The intervention was given only for 8 weeks i.e a short term study.
3. The sample size was limited.
4. The study was limited only for healthy individuals.

FUTURE SCOPE OF THE STUDY

1. The testing can be carried out for higher age groups to check the VO_{2max} of various age groups.
2. The study can be carried out on a larger population.

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