EFFECT OF TREADMILL TRAINING PROGRAM VERSUS CYCLE ERGOMETRY PROGRAM ON CARDIOPULMONARY PARAMETERS AND QUALITY OF LIFE IN SEDENTARY INDIVIDUALS

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ABSTRACT

BACKGROUND: Physical activity of low intensity that depends basically on the aerobic energy generating process is known as aerobic exercise. The term aerobic means ‘with oxygen’ which means using the oxygen to manage energy demands during exercise through aerobic metabolism.

Objective: To find out the effect of treadmill exercises and cycle ergometry on Cardiopulmonary parameters and Quality of Life in sedentary individuals.

METHODOLOGY: 46 candidates were selected as per the inclusion and exclusion criteria and divided into two groups 23 each, Group T: Treadmill and Group C: Cycle Ergometry. Simple Randomization was done and participants were allotted in either of the group. Both groups were assessed for Blood Pressure by Sphygmomanometer, Forced Vital Capacity (FVC) and Maximal Voluntary Ventilation (MVV) by Spirometry, Peak Expiratory Flow Rate (PEFR) by Mini Wright Peak Flow meter and Quality of Life by SF – 36 questionnaire before the intervention and after 6 weeks. Treadmill and Cycle ergometry was performed at 60 – 70% HR_{max} for 4 times a week for 6 weeks. Results: t test was used to compare within group analysis and paired t test for between group analysis. The p value of <0.005 was considered to be statistically significant.

CONCLUSION: This study concludes that systolic Blood Pressure, Forced Vital Capacity (FVC) and Peak Expiratory Flow Rate (PEFR) are increased after treadmill training whereas Diastolic Blood Pressure, Maximal Voluntary Ventilation (MVV) and Quality of life (QOL) are increased after training on the cycle ergometry.

KEY WORDS: BP, Cycle ergometry, FVC, MVV, PEFR, SF – 36, Sedentary individuals, Treadmill training.

INTRODUCTION:

Human is of dynamic presence and should move to endure. In light of present day life of less physical activities in each period of individuals the issues, for example, hypertension, obesity, postural disorders, muscle atrophy and deficient cardiovascular and pulmonary systems are brought about by absence of activity and stationary way of life or hurtful addictions, for example, smoking[^1^]. “Any activity which uses larger group of muscles that can be continued repeatedly and is balanced in quality” is known as aerobic exercise according to the American College of Sports Medicine (ACSM)[^2^,^3^] whereas shortage of daily physical activity of less than 25 minutes per day can be described as sedentary lifestyle. Physical activity of low intensity that depends basically on the aerobic energy generating process is known as aerobic exercise. Regular physical activity is an important factor to maintain a healthy lifestyle which in turn keeps the body fit, maintains the well-being and away from diseases[^4^]. The term aerobic means ‘with oxygen’ which means using the oxygen to manage energy demands during exercise through aerobic metabolism. The heart and lungs work more strongly as they are overloaded more due to aerobic exercise as compared to rest. Examples of aerobic exercise are dancing, swimming, running, jogging, bicycling, swimming etc. Oxygen utilization by the body is enhanced by performing aerobic exercises[^5^]. Physical inactivity contributes to be one of the main hazards for cardiovascular and other numerous chronic conditions and diseases.
Due to the discovery of technological and scientific advances in past few generations there is an eradication of the activities of physical exercise in day to day living. Aerobic exercises if performed frequently have a valuable and favorable outcome on the different systems of the body [6,7]. Apparently, due to high intellectual requirement of the medical college the medical students get up to live an inactive physical life. It may produce fatigue to the students and they may not have any time or motivation to exercise. It has been cited that inactive physical life is a leading health complication.

Physical fitness is required not only by athletes for better performance but also by non-athletes in order to maintain good physical and mental health [8].

Physical activity reduces blood pressure in hypertensive and normotensive persons, independent of weight loss. Clinical trials have demonstrated that lowering blood pressure reduces incidence of and death from cardiovascular disease. These investigations likewise show that a diminishing of as meager as 2 mm Hg in mean diastolic pressure in everyone could considerably lessen the hazard for ailment related with raised BP [9]. Nonetheless, proof with respect to the size of activity related decreases blood pressure is conflicting, both all in all and among subgroups of the people. Pooling results from individual clinical preliminaries gives increasingly exact and precise data on the impact of vigorous exercise on BP and permits investigation of variety in intercession impact among subgroups of concern.

The BRFSS definition of inactive is engaging in no leisure activity at all, and active is meeting the CDC/ACSM guidelines of either ≥30 min of moderate-intensity physical activity on ≥5 days/week (described in BRFSS as “causes small increases in breathing or heart rate”), or ≥20 min of vigorous-intensity physical activity on ≥3 days/week [10,11]. Oxygen consuming activities are prompted for wellbeing advancement and prophylaxis for some cardiovascular diseases. An ongoing logical articulation from the American Heart Association introduced a solid case for evaluating cardiorespiratory wellness (CRF) as a clinical fundamental sign.

Normal physical activities in healthy individuals is a compelling method for essential avoidance of cardiovascular diseases, since it straightforwardly alters the inactive way of life as an autonomous hazard factor for such pathology and in a roundabout way the lipid, glycemic and body composition factors. In the patient with a built up CAD, the optional counteraction is significantly progressively incredible, with the most extreme changes conceivable of the reversible hazard factors for the advancement of the diseases.

The adverse wellbeing outcomes related with being genuinely dormant are various and incorporate the expanded danger of different illnesses, for example, diabetes, breast and colon cancers, stroke, hypertension, and coronary illness [12]. Recent estimates indicate that the number of deaths per year is attributed to health issues associated with physical inactivity, making it the fourth leading risk factor for worldwide mortality. Performing regular physical activity cannot only protect against the development of chronic diseases, but also improve one’s quality of life (QOL). QOL hints to how people emotionally see the constructive and adverse parts of their lives and includes both mental and physical variables that all in all impact a person's view of the general fulfilment with his/her life.

Past investigations have announced positive connections between physical activity and different quality of life markers [14]. However, participants in many of these studies have been older adults or individuals with chronic diseases. Not many distributed examinations have explored the connection between physical movement and fulfilment with life among solid, young grown-ups and students going to college; of these couple of, have inspected the psychological results following a sole episode of work out. Subsequently, little is thought about the quality of life and psychological results related with the presentation of changing physical activity levels among the college students and young adults. Given that we, alongside different
specialists, conceptualize QOL as a worldwide psychological construct that mirrors a conscious, cognitive judgment of one's present fulfilment with his/her own life and view the psychological develops of exercise self-adequacy, physical confidence, and influence as potential effects on QOL among young grown-ups.

Pulmonary capacity is identified with age, gender, height, weight, race, dietary status, geological area and furthermore identified with cardiovascular capacity and sufficient haemoglobin in the blood circulation for carriage and transportation of oxygen [15,16].

As pulmonary function is a long-term indicator of overall survival rates in both the sexes, it forms a vital tool in general health assessment. Exercise gives rise to remarkable changes in bodily conditions owing to its stressful nature. On the contrary, inactive lifestyles could result in lesser effective pulmonary functions. Many studies have shown that effect of exercise exerts noteworthy enhancements in pulmonary functions.

Having different advantages in exercise the treadmill training is used in various kinds of experiments. The rotating speed and gradients can be adjusted according to the exercises so that one can accurately figure out the parameters. Ratio of cardiovascular disease can be reduced with regular treadmill exercise. Physical activities are increased and large muscle groups are used in the treadmill exercise.

The cycle ergometer is lightweight apparatus, of minimal effort and low-upkeep. Its utilization delivers a positive reaction in developing cardiovascular and pulmonary conditioning and increasing strength. As cycle ergometry has reduced compressive forces on the thoracic cage and upper extremities, it creates a local and central acclimation to endurance training.

Intense transient physiological reactions to vigorous exercise incorporate increase in pulse rate, breathing rate, blood pressure and tidal volume. Long durations of vigorous exercise investment is demonstrated to build the measure of maximal oxygen utilization during exceptional high-impact work out in the form of aerobic exercises, lower pulse rate and resting blood pressure. New meta-analytical investigation from western world affirms that oxygen consuming activity would bring about clinically noteworthy decrease in blood pressure.

Physical activity has range of physiological impacts on the cardiovascular system, and the most eminently impacts are improving vascular endothelial capacity by means of upgrading blood flow intervened vasodilation, decreasing the resting heart rate by expanding parasympathetic tone. Physical activity has been related with diminished Blood Pressure in observational epidemiologic investigations and individual clinical experiments.

It is generally acknowledged that Forced Vital Capacity (FVC) is a strong indicator of lung function, which decrease because of weight and sedentary life style.. Review of research evidences shows that aging or obesity combined with sedentary lifestyles has a direct effect on the function of respiratory system by altering lung volume, airway calibre and respiratory muscle strength.

Peak Expiratory Flow Rate (PEFR) is the maximal expiratory stream rate accomplished and this happens right off the bat in the constrained expiratory move. The peak expiratory stream rate gauges how quick an individual can exhale out (breathe out) air. It is one of numerous tests that measure how well your aviation routes work. It is a straightforward technique for estimating aviation route hindrance and it will recognize moderate or extreme ailment. Physical movement is known to improve physical wellness and to lessen dismalness and mortality from various interminable infirmities. The peak flow meter assists with evaluating the wind stream through the aviation routes and in this way help to decide the level of obstacle
along them. The estimation of PEF was spearheaded by Dr Martin Wright who delivered the main meter explicitly intended to quantify this list of lung work.

The present study was undertaken to investigate effect of aerobic exercise in the form of treadmill training and cycle ergometry on Cardiopulmonary parameters and Quality of Life in sedentary individuals.

METHODOLOGY:

Ethical clearance was taken by the ethical committee of Dr. D. Y. Patil Vidyapeeth, Pune. Subjects were recruited for this study from Dr. D.Y. Patil College of Physiotherapy, Dr. D. Y. Patil Vidyapeeth, Pune. Sedentary individuals between the age group 20-30 included in the study. 2 groups were made by lottery method. 50 chits were made; 25 for Treadmill training and 25 for Cycle ergometry. Subjects were explained about the procedure and the outcome measures of the study. Depending on the lottery method, subjects were either a part of the Treadmill group or Cycle ergometry group. Two groups were named as "Treadmill Group (T)" being the Treadmill training group and "(C)" as the Cycle Ergometry group. There were 25 in each group. On the first day, demographic data, BP, FVC, MVV and PEFR values were taken and SF – 36 questionnaires were filled by them. Same parameters were also assessed on the last day of the session, that is, after 6 weeks.

INCLUSION CRITERIA:

1. Both genders.
2. Individuals of age between 20 to 30 years of age.

EXCLUSION CRITERIA:

1. Recently injured.
2. Regular physical exercises.

Outcome Measures:

2. Forced Vital Capacity (FVC) and Maximal Voluntary Ventilation (MVV) by Spirometry.
3. Peak Expiratory Flow Rate (PEFR) by Peak Flow Meter.
4. And quality of life by the Short Form (SF) – 36 Questionnaire.

PROCEDURE:
The approval to carry out the study was obtained from the ethical committee of the college and the University. Candidates were selected and were enrolled in the study. An informed consent by the candidates was taken. Information, nature and procedure of the study was conveyed to them. The candidates were divided into two groups on basis of Simple Random Sampling.

The candidates were assessed for FVC and MVV by using a Spirometer, PEFR by Peak Flow Meter, Blood Pressure by the Sphygmomanometer and Quality of Life by SF – 36 Questionnaire. For both the groups the intervention was given for 4 days for 6 weeks.

**Group T:**

Warm up: Stretching and low intensity exercises for 5 minutes.

Aerobic exercise in form of Treadmill exercise was given for 30 minutes to the candidates and a Polar monitor was used to maintain 60 to 70 % of $HR_{max}$.

Cool down: For 5 minutes.

**Group C:**

Warm up: Stretching and low intensity exercises for 5 minutes.

Aerobic exercise in the form of Cycle Ergometry was given for 30 minutes to the candidates and a Polar monitor was used to maintain 60 to 70 % of $HR_{max}$.

Cool down: for 5 minutes.

The candidates were reassessed for FVC, MVV, PEFR, BP and Quality of Life after 6 weeks.

**Summary of the procedure**
Ethical clearance

50 samples were recruited, Outcome measures assessed

Treadmill Group (25)  Cycle ergometer Group (25)

2 dropouts  2 dropouts

30 min sessions, 4 days, 6 weeks.

Outcome measures reassessed
Monitoring Peak Expiratory Flow Rate.

STATISTICAL ANALYSIS AND INTERPRETATION

Data was analysed using unpaired t test for comparing both the groups.
Data was analysed using the paired t test for pre and post readings.

RESULTS:

TABLE NUMBER 1: Mean age of Treadmill group and Cycle ergometry group

<table>
<thead>
<tr>
<th>Age</th>
<th>Treadmill group</th>
<th>Cycle ergometry group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean ± SD</td>
<td>23 ± 1.087</td>
<td>23.22 ± 1.413</td>
</tr>
</tbody>
</table>
Interpretation: Table 1 shows the means of ages of Treadmill group and Cycle ergometry group which has a p value of $p = 0.562$

TABLE NUMBER 2: Mean genders of Treadmill group and Cycle ergometry group.

<table>
<thead>
<tr>
<th>Gender</th>
<th>Treadmill group</th>
<th>Cycle ergometry group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Males</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Females</td>
<td>21</td>
<td>21</td>
</tr>
</tbody>
</table>

Interpretation: Both the groups have equal number of males and females.

TABLE NUMBER 3: Mean Systolic BP values of Treadmill group and Cycle ergometry group.

<table>
<thead>
<tr>
<th>BP SYSTOLIC</th>
<th>TREADMILL GROUP</th>
<th>CYCLE ERGOMETRY GROUP</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRE MEAN ±SD</td>
<td>116.3 ± 7.419</td>
<td>120.9 ± 5.877</td>
</tr>
<tr>
<td>POST MEAN ±SD</td>
<td>124.3 ± 5.667</td>
<td>127.3 ± 5.522</td>
</tr>
<tr>
<td>P VALUE</td>
<td>0.000</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Interpretation: Table number 3 shows that there is statistical significance in systolic BP before and after exercise.

TABLE NUMBER 4: Mean values of BP Diastolic of Treadmill group and Cycle ergometry group.

<table>
<thead>
<tr>
<th>BP DIASTOLIC</th>
<th>TREADMILL GROUP</th>
<th>CYCLE ERGOMETRY GROUP</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRE MEAN ± SD</td>
<td>73.52 ± 7.31</td>
<td>79.7 ± 5.389</td>
</tr>
<tr>
<td>POST MEAN ± SD</td>
<td>82.52 ± 3.86</td>
<td>83.3 ± 3.611</td>
</tr>
<tr>
<td>P VALUE</td>
<td>0.000</td>
<td>0.002</td>
</tr>
</tbody>
</table>

Interpretation: The table number 4 shows that there is statistical significance in pre and post diastolic BP after exercise.
TABLE NUMBER 5: Mean FVC values of Treadmill group and Cycle ergometry group

<table>
<thead>
<tr>
<th></th>
<th>TREADMILL GROUP</th>
<th>CYCLE ERGOMETRY GROUP</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRE MEAN ± SD</td>
<td>123.5 ± 19.54</td>
<td>113.1 ± 38.35</td>
</tr>
<tr>
<td>POST MEAN ± SD</td>
<td>152.4 ± 28.05</td>
<td>167.8 ± 29.2</td>
</tr>
<tr>
<td>P VALUE</td>
<td>0.000</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Interpretation: There is significant statistically in pre and post FVC in all the groups, according to table and graph number 5 whereas \( t = -7.345 \).

TABLE NUMBER 6: Mean MVV values of Treadmill group and Cycle ergometry group.

<table>
<thead>
<tr>
<th>MVV</th>
<th>TREADMILL GROUP</th>
<th>CYCLE ERGOMETRY GROUP</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRE MEAN ± SD</td>
<td>92.09 ± 32.91</td>
<td>118.8 ± 42.62</td>
</tr>
<tr>
<td>POST MEAN ± SD</td>
<td>119.3 ± 30.22</td>
<td>154.7 ± 45.18</td>
</tr>
<tr>
<td>P VALUE</td>
<td>0.000</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Interpretation: Table number 6 shows there is statistical significance in pre and post values of MVV in Treadmill group and Cycle ergometry group and \( t = -9.393 \).

TABLE NUMBER 7: Mean PEFR values of Treadmill group and Cycle ergometry group.

<table>
<thead>
<tr>
<th>PEFR</th>
<th>TREADMILL GROUP</th>
<th>CYCLE ERGOMETRY GROUP</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRE MEAN ± SD</td>
<td>283.5 ± 42.92</td>
<td>247.8 ± 44.31</td>
</tr>
<tr>
<td>POST MEAN ± SD</td>
<td>323.5 ± 46.67</td>
<td>282.2 ± 43.06</td>
</tr>
<tr>
<td>P VALUE</td>
<td>0.000</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Interpretation: According to table number 7 there is statistical significance in PEFR in both the groups.

TABLE NUMBER 8: Mean values of SF – 36 questionnaire of Treadmill group and Cycle ergometry group
SF 36 | TREADMILL GROUP | CYCLE ERGOMETRY GROUP
---|---|---
PRE MEAN ± SD | 66.74 ± 8.672 | 59.26 ± 12.13
POST MEAN ± SD | 93.57 ± 8.623 | 91.57 ± 9.322
P VALUE | 0.000 | 0.000

Interpretation: According to table number 8 the data is statistically significant in context to the scoring of SF – 36.

TABLE NUMBER 9: Difference of systolic BP between Treadmill group and Cycle ergometry group

<table>
<thead>
<tr>
<th>DIFFERENCE BP SYSTOLIC</th>
<th>Treadmill group ± SD</th>
<th>7.957 ± 5.772</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cycle ergometry group ± SD</td>
<td>6.391 ± 5.639</td>
<td></td>
</tr>
<tr>
<td>P VALUE</td>
<td>0.156</td>
<td></td>
</tr>
</tbody>
</table>

Interpretation: The difference in systolic BP between both the groups is statistically not significant.

TABLE NUMBER 10: Difference between Diastolic BP of Treadmill group and Cycle ergometry group

<table>
<thead>
<tr>
<th>DIFFERENCE BP DIASTOLIC</th>
<th>Treadmill group ± SD</th>
<th>9 ± 6.296</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cycle ergometry group ± SD</td>
<td>3.609 ± 4.943</td>
<td></td>
</tr>
<tr>
<td>P VALUE</td>
<td>0.156</td>
<td></td>
</tr>
</tbody>
</table>

Interpretation: The difference in diastolic BP between Treadmill group and Cycle ergometry group is also not statistically significant.

TABLE NUMBER 11: Difference between FVC of Treadmill group and Cycle ergometry group
### Difference FVC

<table>
<thead>
<tr>
<th></th>
<th>Treadmill group ± SD</th>
<th>Cycle ergometry group ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>P VALUE</strong></td>
<td>28.87 ± 18.85</td>
<td>54.65 ± 34.64</td>
</tr>
<tr>
<td><strong>P VALUE</strong></td>
<td></td>
<td>0.001</td>
</tr>
</tbody>
</table>

Interpretation: Table number 11 suggests the difference in FVC between both the groups is statistically significant and \( t = -3.943 \)

### Table Number 12: Difference between MVV of Treadmill group and Cycle ergometry group

<table>
<thead>
<tr>
<th></th>
<th>Treadmill group ± SD</th>
<th>Cycle ergometry group ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>P VALUE</strong></td>
<td>27.26 ± 13.92</td>
<td>35.87 ± 9.938</td>
</tr>
<tr>
<td><strong>P VALUE</strong></td>
<td></td>
<td>0.000</td>
</tr>
</tbody>
</table>

Interpretation: The difference between Treadmill group and Cycle ergometry group is statistically significant for MVV, \( t = -2.810 \)

### Table Number 13: Difference between PEFR of Treadmill group and Cycle ergometry group

<table>
<thead>
<tr>
<th></th>
<th>Treadmill group ± SD</th>
<th>Cycle ergometry group ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>P VALUE</strong></td>
<td>40 ± 11.28</td>
<td>34.35 ± 8.435</td>
</tr>
<tr>
<td><strong>P VALUE</strong></td>
<td></td>
<td>0.047</td>
</tr>
</tbody>
</table>

Interpretation: The difference in PEFR between both the groups is statistically significant.

### Table Number 14: Difference between SF – 36 of Treadmill group and Cycle ergometry group

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
</table>
Treadmill group ± SD  26.83 ± 8.932
Cycle ergometry group ± SD  32.65 ± 9.916
P VALUE  0.038

Interpretation: The difference of SF - 36 between Treadmill group and Cycle ergometry group is statistically significant and \( t = -2.206 \).

DISCUSSION:

Purpose of this study was to compare the effect between Treadmill training and Cycle ergometry on BP, FVC, MVV, PEFR and QOL in Sedentary individuals.

Vigorous activities as treadmill and cycle ergometry are seen as useful to keep up a solid way of life and mental prosperity. As the speed of treadmill increments continuously, the pulse and ventilation is likewise expanded in treadmill practice in typical individuals. Endurance preparing additionally builds number of vessels in skeletal muscle, in this manner permitting a more prominent limit of blood stream in the practiced muscle. Huge metabolic changes create in skeletal muscles consequently to vigorous exercise. The size and number of mitochondria help broadly alongside the development of oxidative proteins. Myoglobin content in the muscle is likewise augmented. Such changes gotten together with increase in vessels and muscle blood flow in the muscles which are trained, greatly overhaul the oxidative extent of muscles which are under aerobic exercise. Blood vessel circulatory strain very still, pulse during submaximal exercise, and top circulatory strain all show a slight decrease because of aerobic exercise. Cardiovascular changes again rely upon the kind of activity and seriousness of activities. Cardiovascular responses vary in bike ergometer exercise and treadmill practice as the technique for practice varies.

It is regularly recognized that people with increasingly noteworthy degrees of physical exercises will when all is said in done have progressively raised degrees of physical wellness and that physical exercises can subsequently advance cardiopulmonary wellness as well.

This examination compares with the investigation of Zahara K. Polen et. Al which proposes physical action improved aspiratory work in sound inactive individuals.

CONCLUSION:

From the information of this study this can be inferred–

1. Systolic Blood pressure, Forced Vital Capacity (FVC) and PEFR are increased after treadmill training.
2. Diastolic Blood Pressure, Maximal Voluntary Ventilation (MVV) and Quality of life (QOL) are increased after training on the cycle ergometry.

ACKNOWLEDGEMENT:

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Ethical clearance: The study was done in Dr. D.Y Patil College of Physiotherapy and Dr. D Y Patil Vidyapeeth, Pimpri, Pune. Informed written consent was taken from all the subjects.

Source of funding: Self

Conflict of interest: Nil

REFERENCES:


