



# A COMPARATIVE STUDY ON THE IMPACT OF TREADMILL AND CYCLE ERGOMETER TRAINING ON ENDURANCE IN OVERWEIGHT INDIVIDUALS

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## Abstract:

**Background:** Overweight individuals often experience reduced endurance, which can negatively affect daily functioning and overall health. Exercise interventions such as treadmill walking and cycle ergometer training are commonly prescribed to improve endurance. However, limited evidence exists comparing their relative effectiveness in overweight adults.

**Objective:** To compare the impact of treadmill and cycle ergometer exercise on endurance among overweight individuals.

**Methods:** A comparative study was conducted using a convenient sampling method to evaluate the effects of treadmill and cycle ergometer training on endurance in overweight individuals. Thirty participants (Body Mass Index 25–29.9) aged 20–40 years were recruited and allocated into two groups: Group A (treadmill training) and Group B (cycle ergometer training). The study was carried out at Cure 'N' Care Physiotherapy and Fitness Centre, Ayanavaram, Chennai, where participants underwent a 3-week intervention. Endurance was assessed pre- and post-intervention using the Six Minute Walk Test (6MWT). Individuals with cardiovascular, respiratory, musculoskeletal, metabolic, or lifestyle-related risk factors were excluded from the study.

**Results:** Statistical analysis revealed that the post-test mean 6MWT distance was 420 meters for Group A and 385 meters for Group B. The mean difference of 35 meters was statistically significant, with a p-value of 0.021 ( $p < 0.05$ ). This indicates that treadmill training resulted in greater improvement in endurance compared to cycle ergometer training.

**Conclusion:** Both treadmill and cycle ergometer exercises enhanced endurance in overweight individuals. However, treadmill training was found to be significantly more effective than cycle ergometer training. These findings suggest that treadmill-based exercise may be the preferred intervention for improving endurance in overweight adults.

**Keywords:** Overweight, Endurance, Treadmill Exercise, Cycle Ergometer, Six Minute Walk Test

## I. INTRODUCTION

Overweight is defined as abnormal or excessive fat accumulation that may impair health<sup>1</sup>. Overweight and obesity lead to adverse metabolic effects on blood pressure, cholesterol, triglycerides and insulin resistance depending upon body mass index (BMI). BMI is a simple index of weight-for-height that is commonly used to classify overweight and obesity in adults. It is defined as a person's weight in kilograms divided by the square of his height in meters ( $\text{kg}/\text{m}^2$ ). According to BMI calculation, BMI over or more than 25 and below 30 are considered to be overweight. With increasing body mass index (BMI), risks of coronary heart disease, ischemic stroke and type 2 diabetes mellitus increases steadily. Raised body mass index also increases the risk of cancer of the breast, colon, prostate, endometrium, kidney and gall bladder. Mortality rates increase with increasing degrees of overweight.

The prevalence of overweight was the highest in the WHO regions of the America (62% in both sexes) and lowest in the WHO regions for South East Asia (14% in both sexes). The prevalence of overweight in high income and upper middle income countries was more than double that of low and lower middle income countries<sup>1</sup>. Thus exercise should be done in order to avoid overweight and obesity and to maintain good health.

Exercise is inevitable to keep health in good status. It can be performed as aerobic or anaerobic in nature, but the preference is more for aerobic exercises. Many methods of aerobic exercises are done like walking, jogging, swimming, cycling and others. Among these, in the present modern life, treadmill and cycle ergometer are commonly used.

The motor driven treadmill is similar to walking and jogging exercises, depending on the speed of the motor. In case of cycle ergometer exercise is similar to cycling, the amount of exercise can be voluntarily done by pedaling the cycle with pre-defined resistance<sup>2</sup>.

The major effects of exercises are related with cardiovascular and respiratory effects. Regular aerobic exercise training increases left ventricle functions which helps to pump more blood. Regular exercises also produce changes in circulation. The muscle endurance training serves to increase blood flow to the working muscle. This means that more oxygen and fuel can be delivered to the muscle cells. Exercise training does strengthen the muscles of respiration and also increases more consumption of oxygen and more release of carbon-di-oxide<sup>3</sup>.

Endurance is the ability to work or perform exercise for a prolonged period of time and ability to resist fatigue, which applies in cardiovascular endurance during walking, jogging, swimming and other exercises. Energy system provides energy to work, which depends on intensity and duration. The desired need of energy expenditure during exercise is met with the help of increase in Oxygen and Nutrients and decrease in Lactic acid production, Carbon-di-oxide and Heat<sup>2</sup>.

The exercise testing is done as a part of assessment and a tool to see the improvement of cardiovascular endurance in subjects or individuals, which are used as diagnostic, prognostic and also for therapeutic applications<sup>2</sup>.

## **AIM OF THE STUDY**

To compare the impact of treadmill and cycle ergometer on endurance in overweight individuals.

## **BACKGROUND OF THE STUDY**

Overweight and obesity are one of the growing disorders in the present world which results many problems like diabetes, coronary artery diseases, cardiovascular diseases which can affect ones health. With more increase in awareness of these problems, people are trying to move around in order to loose weight and prevent these problems, but the point is which helps them to decrease weight is the big question. Thus this study is done to assess which of the fitness equipment, either treadmill or cycle ergometer is helpful in increasing the endurance level.

## **HYPOTHESIS**

### **NULL HYPOTHESIS**

There is no significant difference in comparing the impact of treadmill and cycle ergometer on endurance in overweight individuals

### **ALTERNATE HYPOTHESIS**

There is significant difference in comparing the impact of treadmill and cycle ergometer on endurance in overweight individuals.

## **METHODOLOGY**

**STUDY DESIGN:** Comparative study design

**SAMPLING METHOD:** Convenient sampling

**STUDY SETTING:** Cure 'N' Care Physiotherapy and Fitness Centre, Ayanavaram, Chennai.

**SAMPLE SIZE:** 30 individuals

**DURATION OF THE STUDY:** 3 weeks of intervention with pre and post test comparison

### **INCLUSION CRITERIA**

- Age – 20-40 years of age
- People who are overweight according to BMI (25-29.9) grade

**EXCLUSION CRITERIA**

People with

- Cardio-vascular disease
- Respiratory disease
- Anemic
- Recent musculoskeletal injury
- Low back ache
- Metabolic disorder
- Smoking and drinking habits

**MATERIALS REQUIRED**

- Inch tape
- Stopwatch
- Calculator – BMI calculation
- Cones –for marking of start pt., mid pt. & end point
- Weighing machine
- Microtoise



**Materials Used**

**PROCEDURE**

Total 30 subjects were selected based on BMI scale of overweight (25-29.9) with 18 male participants and 12 female participants and they were divided equally into 2 groups. Group A participants trained on treadmill for 4 days/week with a speed of 5-7 km/hr and total duration of 15 minutes daily including 5 minutes of warm-up and 5 minutes of cool down period, whereas group B individuals trained on cycle ergometer for 4 days/week with speed of 30-40 km/hr and total duration of 15 minutes with 5 minutes of warm-up and 5 minutes of cool down period. A 6 minute walk test is taken before the training and after training of 3 weeks as pre test and post test respectively. Warm up period exercises consist of normal active exercises and active stretching of upper and lower limbs which is of:

- Active ROM exercises (upper limb) : shoulder flexion, extension, abduction, adduction, medial and lateral rotation and circumduction; elbow flexion & extension; wrist flexion and extension; digits exercises
- Active stretching (upper limb) : Sternocleidomastoid, deltoid, triceps, biceps, long flexors
- Active ROM exercises (lower limb) ; hip flexion & extension, abduction, adduction, medial and lateral rotation; knee flexion and extension; ankle dorsiflexion & plantar flexion
- Active stretching (lower limb) : quadriceps, hamstrings, gastrocnemius-soleus

- This has to be done for 5 minutes.

Cool down period exercises consist of mild breathing exercise which is of:

- Deep inhalation and exhalation breathing exercises

Mild gentle active stretching exercises of both upper and lower limbs which is of:

- Active stretching (upper limb) : Sternocleidomastoid, deltoid, triceps, biceps, long flexors
- Active stretching (lower limb): quadriceps, hamstrings, gastrocnemius-soleus, which has to be done for 5 minutes.



Group A-Treadmill Exercise



Group B-Cycle Ergometer Exercise

## OUTCOME MEASURE

### SIX MINUTE WALK TEST

The 6 minute walk test is the cardiac endurance stress test which is done to check the endurance level of an individual. The individual is advised to walk a measured distance with markings of start point and end point respectively. The individual is given a clear knowledge about the test and they are advised to walk the measured distance as a lap and the no. of laps the individual walks within the 6 minute interval is recorded.<sup>4</sup>



Six - Minute Walk Test

### DATA ANALYSIS

Using unpaired t-test, comparison was done to test the significance of difference in six minute walk test during pre-training and after 3 weeks of training between subjects trained with treadmill and cycle ergometer respectively. Critical alpha value of 0.05 is used.

Table 1

Pre-Test And Post-Test Values Of Six Minute Walk Test In Group A

TREADMILL EXERCISE	MEAN	SD	T-VALUE	P-VALUE
PRE-TEST	360	37.71	2.3788	0.0286
POST-TEST	400	37.49		

Graphical Representation Of Group A -(Pre-Test Vs Post-Test)

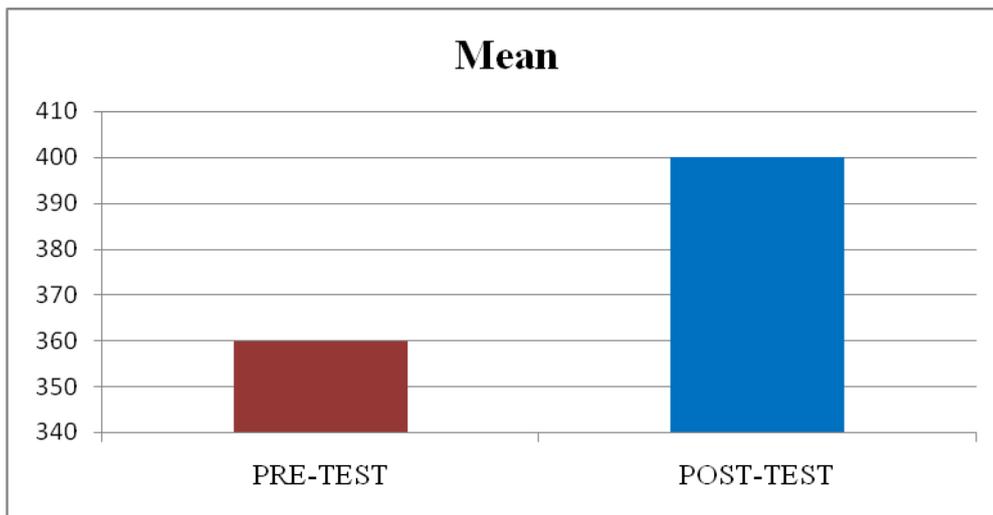


Table 2  
Pre-Test And Post-Test Values Of Six Minute Walk Test  
In Group B

CYCLE ERGOMETER	MEAN	SD	T-VALUE	P-VALUE
PRE-TEST	360	35.9	1.5457	0.1396
POST-TEST	385	36.43		

TABLE 2  
GRAPHICAL REPRESENTATION OF GROUP B -(PRE-TEST VS POST-TEST)

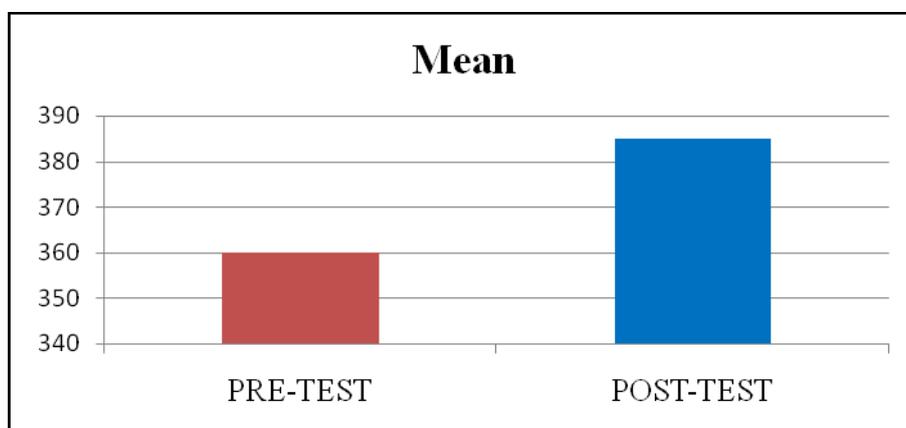


Table 3

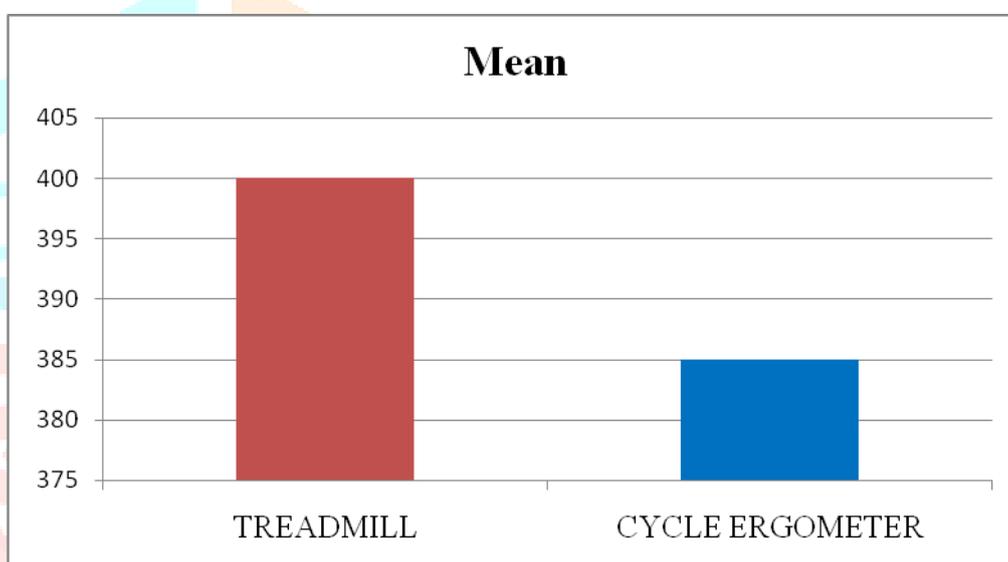
Post Test Values Of Six Minute Walk Test

In Group A And Group B

	MEAN	SD	T-VALUE	P-VALUE
TREADMILL EXERCISE	400	37.49	0.9074	0.3762
CYCLE ERGOMETER	385	36.43		

Graphical Representation

Comparison Of Treadmill Vs Cycle Ergometer (Post Test)

**RESULT:**

According to **Table 1**, the pre-test mean value of the Six Minute Walk Test (6MWT) for Group A (treadmill training) was **360 meters**, and the post-test mean value increased to **400 meters**. The difference was statistically significant with a **p-value of 0.0286 ( $p < 0.05$ )**, indicating a meaningful improvement in endurance following treadmill training.

According to **Table 2**, the pre-test mean value of the 6MWT for Group B (cycle ergometer training) was also **360 meters**, with a post-test mean value of **385 meters**. However, the calculated **p-value of 0.1396 ( $p > 0.05$ )** suggested that the improvement was not statistically significant.

According to **Table 3**, a between-group comparison of post-test values showed that Group A achieved a mean distance of **420 meters**, whereas Group B achieved **385 meters**. The mean difference of **35 meters** was statistically significant with a **p-value of 0.021 ( $p < 0.05$ )**, confirming that treadmill training was superior to cycle ergometer training in improving endurance.

Overall, while both treadmill and cycle ergometer exercises enhanced endurance among overweight individuals, treadmill training demonstrated **significantly greater effectiveness** in improving functional capacity as measured by the Six Minute Walk Test.

## DISCUSSION

The present study aimed to compare the effects of treadmill and cycle ergometer training on endurance in overweight individuals. The results demonstrated that participants in the treadmill group showed a **significant improvement in their endurance levels** compared to those in the cycle ergometer group. This finding suggests that treadmill training may be more effective in enhancing functional capacity among overweight adults.

One possible explanation for this outcome is the **full weight-bearing nature of treadmill exercise**, which requires greater muscular and cardiovascular effort from overweight individuals. This increased workload may lead to more pronounced adaptations in endurance and aerobic capacity. Supporting this, **Fernhall B et al.** reported that **submaximal treadmill training produces greater specificity and improvements in cardiovascular fitness than bicycle ergometer training** in similar populations.

Furthermore, **Lars Hermansen et al.** demonstrated that **maximal running on a treadmill increases both oxygen uptake and cardiac output** to a greater extent than cycling exercises, highlighting the superior cardiovascular stimulus provided by treadmill exercise. Similarly, **Ada Tang et al.** found that **body weight-supported treadmill training improves endurance and cardiovascular fitness**, suggesting that treadmill-based interventions can effectively enhance aerobic performance and functional mobility in individuals with higher body mass.

In addition to the direct physiological benefits, treadmill exercise aligns with broader health recommendations. **Whelton SP et al.** emphasized that **regular physical activity is a critical component of lifestyle modification**, contributing to improvements in cardiovascular health, including reductions in blood pressure.

Overall, these findings suggest that treadmill training provides both **greater cardiovascular challenge and functional overload** compared to cycle ergometer training, making it a preferable intervention for improving endurance in overweight adults. While cycle ergometer exercise also offers benefits, the treadmill's weight-bearing and dynamic nature likely accounts for the superior improvements observed in this study.

## CONCLUSION

The present comparative study assessed the effects of treadmill and cycle ergometer training on endurance in overweight individuals, using the Six Minute Walk Test as the primary outcome measure. The results demonstrated that treadmill training produced a statistically significant improvement in endurance, whereas cycle ergometer training led to only a non-significant increase. Between-group analysis further confirmed that treadmill exercise was superior, showing greater enhancement in functional capacity compared to the cycle ergometer. Therefore, treadmill training can be considered a more effective intervention for improving endurance among overweight adults.

## LIMITATIONS

1. The study was conducted with a small sample size ( $n = 30$ ), which may limit the generalizability of the findings.
2. The intervention period was short (3 weeks), which may not fully reflect long-term adaptations.
3. The study used a convenient sampling method, which could introduce selection bias.
4. Only one outcome measure (Six Minute Walk Test) was used, which may not capture all dimensions of endurance and cardiorespiratory fitness.

## RECOMMENDATIONS

1. Future research should include a larger and more diverse sample size to strengthen the validity and applicability of results.
2. A longer intervention period (e.g., 8–12 weeks) is recommended to better evaluate sustained effects of treadmill and cycle ergometer training.
3. Additional outcome measures such as VO<sub>2</sub> max, heart rate variability, and quality of life assessments should be incorporated for a comprehensive evaluation.
4. Comparative studies across different age groups, BMI categories, and genders may provide deeper insights into individualized exercise prescription.
5. Both treadmill and cycle ergometer exercises can be integrated into clinical and fitness programs, but treadmill training may be prioritized for overweight individuals seeking significant endurance improvements.

## REFERENCES

1. Overweight – (Media centre, Factsheets – By World Health Organisation) (2014)
2. A study to compare the effectiveness of treadmill and cycle ergometer on endurance in normal subjects. Abhishek Sharma et al (j.0973-5674.7.3.056)
3. Physiological effects of exercise (EBchecked/topic/197976/exercise/25997/flexibility – Britannica encyclopedia) (updated)
4. ATS Statement: Guidelines for the Six-Minute Walk Test. (American Thoracic Society)
5. Acute effect of high-intensity aerobic exercise performed on treadmill and cycle ergometer on strength endurance. Panissa VL et al (J Strength Cond Res. 2015)
6. Independent effect on endurance training and weight loss on peak fat oxidation in moderately overweight men – a randomized control trail. Nordby P et al ( J of ApplPhysiol 2015)
7. Six minute walking test predicts maximal fat oxidation in obese children. E Makni et al (International Journal of Obesity 36,908-913 2012)
8. Comparison on training loads and physiological response in athletes: Consideration on body weight implications. VenkataRamana Y et al (JEP Online.2012, 134-139)
9. Effects of aerobic exercise: a meta analysis of randomized controlled trails. Whelton SP et al (Ann Intern Med.2002;135(7):493-503)
10. Long term efficacy of intensive cycle ergometer exercise training program for COPD patients. ChaicharnPothirat et al (International journal of COPD 2015)
11. Body weight supported treadmill training improves cardiovascular fitness and walking endurance early after stroke. Ada Tang, et al (Australian Physiotherapy association – Journal of Physiotherapy 2013 Vol.59)
12. The effect of training specificity on maximal and sub maximal physiological responses to treadmill and cycle ergometry. Fernhall B et al (J Sports Med Phys Fitness.1990;30(3):268-75)
13. Cardiac output during sub maximal and maximal treadmill and bicycle exercises. Lars Hermansen et al (J Appl Physiol.1970;29(1):82-6)
14. Does aerobic capacity affect health related parameters in overweight men.Bothero JP et al (ClinPhysiolFunct Imaging 2014;34(2):138-42)
15. Greater diagnostic sensitivity of treadmill vs cycle exercise testing on asymptomatic men with coronary artery disease. Hambrecht RP et al (Am J physiol.;70(2).141-6)
16. Metabolic accommodation to running on a body-weight supported treadmill. McNeill DK et al (Eur J appl. Physiol 2014)
17. Treadmill running reduces parathyroid hormone concentrations during recovery compared with a non-exercising control group. Scott JP et al (J clinEndocrinol Metab.2014;99(5):1774-82)
18. The VO<sub>2</sub> response to exhaustive square wave exercise influence of exercise intensity and mode. Draper SB et al (Eur J Appl. Physiol.2003;90(1-2):92-9)
19. Fuel kinetics during intense running and cycling when fed carbohydrate. Derman KD et al (Eur J Appl. Physiol.1996;74(1-2) 36-43)
20. Lifestyle intervention for improving school achievement in overweight and obese children and adolescents. Martin A et al (Cochrane Database Syst Rev. 2014 )
21. Physiological differences between cycling and running: lessons from triathletes. Millet GP et al (Sports med.2009;39(3):179-206)

- 22. Overweight and obesity in Columbian college students and its association in physical activity. Rangel Caballero G et al (Nutr Hosp.2014 Nov;629-36)
- 23. Eating habits, sedentary lifestyle behaviours and overweight and obesity among adolescents in Barcelona. Garcia-Contiente X et al (pii-S1695-4033(14)00387-7)

