ORIGINAL ARTICLE

The Impact of Aerobic Training on Exercise Tolerance and Obstructive Sleep Apnoea (OSA) in Obese People

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ABSTRACT

Introduction: Obstructive sleep apnoea (OSA) is characterised by recurrent pharyngeal collapses that occur five or more times per hour of sleep or more and reduce or completely block airflow for at least 10 seconds. Obesity predisposes individuals to and potentiates OSA. **Materials and methods:** As a pre- and post-training activity measure, 30 obese people between the ages of 25 and 45 were asked to complete the STOP-BANG questionnaire and a 6-minute walk test. After that, they engaged in aerobic activity. **Results:** The scores for the six-minute walk test and the stop-bang questionnaire were 0.0005 and 0.0003, respectively with a "p" value- ≤0.001 (significant). In our investigation, the effects of aerobic exercise on exercise tolerance and obstructive sleep apnoea were significantly different. **Conclusion:** Aerobic exercise is a better intervention for increasing exercise tolerance and obstructive sleep apnoea in obese patients. This intervention may be a significant contributor to cardiorespiratory fitness and can be considered a useful tool for enhancing quality of life.
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INTRODUCTION

Obstructive sleep apnea (OSA) is characterized by recurrent pharyngeal collapses that occur five or more times per hour of sleep or more and reduce or completely block airflow for at least 10 seconds. These episodes are associated with sympathetic activation, exacerbated negative intrathoracic pressure fluctuations, intermittent oxygen desaturation of the blood, hypercapnia, and awakening from sleep.

Obesity and OSA have a shaky but important link. It has been determined that there is a mystical connection between OSA and certain mechanisms and circumstances. (1). OSA affects 1% of the adult population and is more common in obese individuals. With equal weight loss, there has been reported to be a more than 20% improvement in OSA severity. In individuals with moderate OSA, the condition worsens even with a 10% increase in weight. (2). The prevalence of OSA in adults is considered to be around 25%, and it can reach 45% in obese people. (3). Obesity predisposes to and potentiates OSA.

Patients with OSA frequently have visceral obesity, which aggravates the illness by depositing fat in certain regions of the upper airway. It results in a narrower lumen and raises the risk of the upper airway collapsing, which may result in apnoea. Truncal obesity, or the accumulation of fat around the thorax, can reduce functional residual capacity and chest compliance, which can increase oxygen demand. (2). obesity and central adiposity can congest the pharyngeal lumen and raise surrounding tissue pressures, which can result in elevated pharyngeal collapsibility when neuromuscular activity declines during sleep. 9 to 25% of persons have obstructive sleep apnea (OSA), a prevalent sleep breathing problem.(2). It is associated with metabolic issues, deteriorated neurocognitive function, cardiovascular disorders, and cerebrovascular diseases. (4). As the intensity rises, patients frequently experience daily fatigue/tiredness, cognitive deficiencies (short-term memory, focus), decreased attention, morning agitation, and changes in temperament and mood, such as sadness and anxiety. Patients frequently feel worn out or exhausted during the day. Given the prevalence of mild

OSA and the positive benefits of even slight weight loss on OSA severity and OSA risk, lifestyle interventions like weight loss provide a realistic option for the treatment of patients with moderate OSA. (5,6). Regular exercise provides positive effects in OSA patients beyond weight loss(7). Exercise programs for OSA patients offer several significant benefits, including reducing the extent of the condition and everyday tiredness, improving sleep quality, and increasing maximum oxygen uptake. Those who are physically active have lower OSA risk than those who are sedentary, which is recognized to be an indicator of risk for the development of obesity. (8) The most significant risk factor for the onset of OSA is likely obesity. (9) . Visceral obesity, insulin resistance, and sleep apnea are all strongly independently correlated. Lifestyle changes have resulted in an upsurge in the prevalence of OSA among the Indian population. Regular exercise can help prevent and treat obesity and metabolic syndrome because it improves cardiorespiratory fitness and adiponectin expression. (11) Behavioral lifestyle changes have been proven to be successful in causing significant weight loss and a decrease in the severity of OSA. (12). Sleep apnea can be treated, sleep architecture can be improved, and daytime hypersomnolence can be reduced with moderate weight loss alone. (13). Exercise has positive effects on body composition and OSA(14).

Along with the overall health benefits of exercise, OSA patients who regularly engage in an aerobic exercise program have shown improvements in peak oxygen uptake and sleep efficiency, regardless of weight loss, as well as a decline in disease severity and daytime sleepiness. (15).

MATERIALS & METHODS

Study design: Experimental study. Ethical clearance: The Institutional Review Board of the Faculty of Physiotherapy, Dr.MGR Educational & Research Institute approved the study. Reference number: MPT (Cardiovascular and Pulmonary)-05/PHYSIO/IRB/2020-21). Methodology: Those who attended the obesity clinic at the ACS Medical College and Hospital, Dr MGR Educational and Research Institute, Chennai, India, were included in the study. Subjects: Using a straightforward random sampling technique, 30 obese volunteers were chosen from the age range of 25 to 45 years, representing both genders. About 8 weeks were spent on the project. Subjects who met the following exclusion criteria were not included in the study: those who are obese, underweight, have a normal BMI, are uncooperative, have recent injuries or surgeries, are pregnant, have nasal congestion, have a visual or auditory disorder, or have a balance disorder.

The subjects were given a thorough explanation of the study's purpose before being included as participants with their agreement and desire to participate.About 8 weeks were spent on the project. The outcome measures were Exercise tolerance and incidence of sleep apnoea which were measured using a six-minute walk test and STOP-BANG Questionnaire respectively.

Outcome Measure and tools

Obstructive sleep apnoea (OSA) was assessed using the STOP-BANG Questionnaire, and exercise tolerance was assessed using the 6-minute walk test (6mwt).

The subjects performed a six-minute walk test [as outlined by the American Thoracic Society (ATS)] and STOP BANG QUESTIONNAIRE as pre and post-intervention measures.

The respondents' radial pulse was initially measured, and then they were asked to walk a 30-meter hallway with markers every 3 meters and yellow traffic cones marking the turnaround locations. Afterwards, individuals were told to begin and stop at the designated times. The test was halted until the participant was comfortable if they experienced any discomfort brought on by exercise intolerance, such as shortness of breath, lightheadedness, difficulty walking, etc. The duration and cause of termination were reported(16)

The STOPBANG Questionnaire Includes Eight Questions About Snoring, Fatigue, Sleepiness, Breathing Stops During Sleep, And High Blood Pressure. It Measures BMI, Age, Neck Circumference, And Gender. Scores Range From 0 To 8, With Answers Ranging From 0 To 8. Questionnaires Were Scored Using A Simple Yes/ No Format, With High-Risk Answers And Low-Risk Responses(17,18)

The respondents then engaged in static cycling and brisk walking at a heart rate between 55% and 75% of the maximum after completing the 6-minute walk and stop-bang questionnaire as a pre-test assessment. For eight weeks, these exercises were provided once every four days for 30 minutes. They were examined for the post-test 6-minute walk test and STOP-BANG Questionnaire 8 weeks after the exercise, and the findings were recorded.

DATA ANALYSIS

The acquired data was tabulated and analyzed using descriptive and inferential statistics. All of the factors were evaluated using the Statistical Software for Social Science (SPSS) version 24. The Shapiro Wilk test was used to determine the normality of the data. $P>0.05$ indicates that dependent variable data are regularly distributed. To determine the statistical difference between groups, a paired t-test was used.

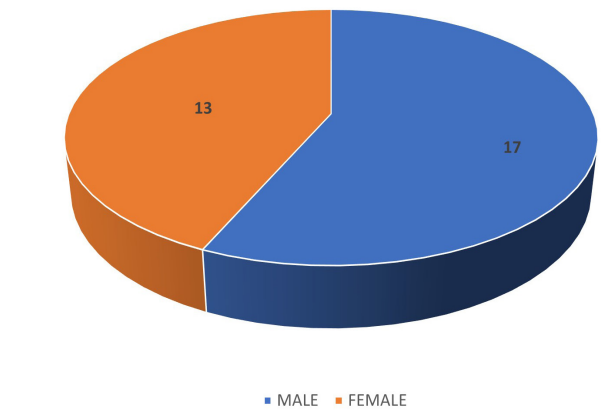


Fig. 1: Demographic data.

RESULTS

The subjects' mean distance traveled throughout the six-minute walk test within their group exhibited a statistically significant difference among the pre-test and post-test mean values at $p \leq 0.001$ after aerobic exercise.

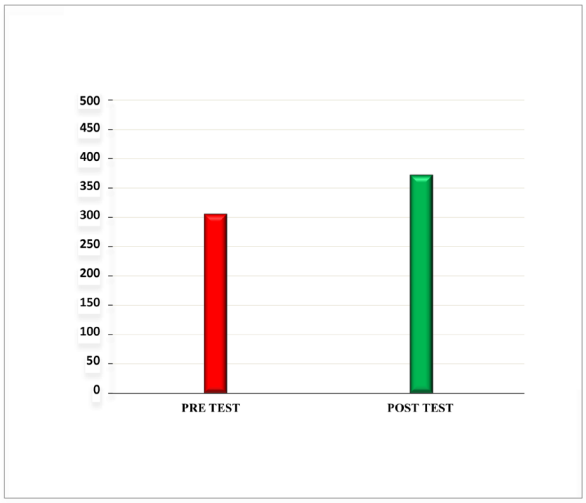
Table I: Participants' mean distance covered on a six-minute walk test (pre and post-)

# 6MWT	MEAN DISTANCE		STANDARD DEVIATION		t - value	p- value
	PRE	POST	PRE	POST		
GROUP	305.96	372.70	54.42	48.04	-13.00	$p \leq 0.001$

The table above shows the mean, standard deviation (SD), t-value, and p-value differences between the pre-test and post-test for each group. Within the Group, there was a statistically significant difference in pre and post-test values ($P \leq 0.001$).

GRAPH I

COMPARISON OF THE RESULTS OF THE SIX-MINUTE WALK TEST WITHIN GROUP (PRE- AND POST-TEST)



The Stop-Bang Questionnaire responses from the subjects within the Group also revealed a statistically significant difference among Pre-test and Post-test mean values at $p \leq 0.001$.

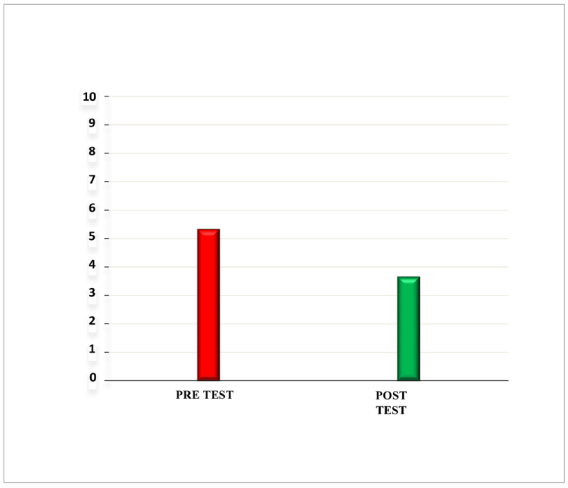
Table II: Participants score for stop-bang questionnaire (pre & post)

TEST	MEAN		STANDARD DEVIATION		t - value	p-value
	PRE	POST	PRE	POST		
STOP -BANG QUESTIONNAIRE	5.33	3.66	1.39	1.39	9.89	$p \leq 0.001$

The table above shows the mean, standard deviation (SD), t- t-value, and p-value differences between the pre-test and post-test for each group.
Within the Group, there was a statistically significant difference in pre- and post-test values ($P \leq 0.001$).

GRAPH II

COMPARISON OF STOP-BANG QUESTIONNAIRE SCORE WITHIN GROUP(PRE & POST-TEST)



The study's primary objective was to figure out how aerobic exercise affected obese people's exercise tolerance and OSA. With a p-value of $p \leq 0.001$, the results demonstrated a considerable difference in the scores.

DISCUSSION

The goal of this research was to determine the effects of aerobic exercise training on obese individuals' capacity for exercise tolerance and risk of developing obstructive sleep apnea. The six-minute walk test and stop-bang questionnaire were employed as outcome measures. The results showed a substantial difference in exercise tolerance and obstructive sleep apnea after implementing aerobic training program (p=0.0005, p=0.0003). According to Mendelson et al. (2018), obstructive sleep apnea and obesity both lowers exercise tolerance. Nevertheless exercise training increases exercise capacity in obese individuals with obstructive sleep apnoea.(19). Aerobic exercise promotes weight

loss. Reduced collapsibility of the upper airway and improved sleep airway function after weight loss. The benefits of physical activity have been examined, and it has been determined that they result from the respiratory muscles working more actively, which in turn causes metabolic and anatomical changes that raise fatigue resistance. Additionally, exercise enhances the recruitment of the respiratory muscles, and endurance exercise may result in less fluid retention in the neck and a reduced risk of airway collapse during sleep. (15). Aerobic Exercise can improve exercise tolerance by improving muscular strength, endurance, and cardiovascular fitness. This enables people who are obese to engage in longer and more intense physical exercise, which helps them manage their weight and improve their health in general. Aerobic exercise exerts anti-inflammatory benefits by lowering the synthesis of pro-inflammatory cytokines and encouraging the release of anti-inflammatory compounds. (20). This may lessen the inflammation brought on by obesity and OSA. Ifthikar et al. (2014) noted the benefits of exercise in reducing the severity of sleep apnea in individuals with OSA with few changes in body weight, and the subjects reported ease during sleep following exercise sessions. The management of OSA can benefit greatly from exercises (21).

Physical activity decreases body mass and fat mass, improves sleep efficiency, and lessens daytime sleepiness, according to a study by Rodrigo Torres Castro et al., 2021. Regular cardiovascular exercise can therefore lengthen and increase the quality of sleep. It can improve sleep quality, balance circadian cycles, and lessen the symptoms of insomnia. While aerobic exercise can improve OSA and exercise tolerance in obese people, it should be used in conjunction with a complete strategy that also includes other lifestyle changes such a healthy diet and weight management techniques. The study was limited by the use of just one exercise tolerance test and solely aerobic activity.

The future Recommendations of the study can include various exercise tolerance tests as outcome indicators, Different workout types might be compared and compared with different types of OSA.

CONCLUSION

It is clear from our study that aerobic exercise helps obese people with their obstructive sleep apnoea and exercise tolerance. Additionally, together with other strategies, it can be incorporated into the lifestyle management program.

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