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EFFECT OF MODERATE INTENSITY EXERCISE TRAINING ON PULMONARY FUNCTIONS IN YOUNG NORMAL AND OBESE ADULTS

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ABSTRACT

Obesity has become a major health issue in India. This study proposed to perform moderate intensity exercise training on pulmonary functions in young normal and obese adults. It was carried out among 60 subjects. The study group included 30 obese subjects and the control group included 30 normal weight subjects. There were 15 females and 15 males in each group. 15 minutes of exercise of moderate intensity was performed by subjects. Pulmonary Function Testing values were then taken. Obesity has a negative effect on pulmonary function test in young adult males, but not so in young adult females. There was a significant decrease in Pulmonary Function Testing values measured before exercise in obese young adult males and but not in obese young adult females. There was a significant increase in Pulmonary Function Testing values measured after exercise in both groups. Thereby study shows the need of exercise in improving the pulmonary function in both obese and non-obese young adults.

KEYWORDS: Obesity, Pulmonary Function Test, Exercise, Young Male Adults, Young Female Adults.

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INTRODUCTION

Obesity has become a worldwide health issue. In developed countries and also in developing countries, which is a serious problem led to epidemic. The majority of people are either overweight or obese. WHO defines obesity as `A condition with excessive fat accumulation in the body to the extent that the health and well being are adversely affected`. Medically meaningful distinction between lean and obese is somewhat arbitrary. There is no clear cut difference between normal and abnormal fat levels. That is why obesity is quantitatively defined as the level of adiposity, which leads to adverse health effects[1].The healthy Body Mass Index (BMI) range varies with age and sex of the individual. Obesity in children and adolescents is defined as a Body Mass Index greater than the 95th percentile. It can also be defined as a body weight at least 20% higher than a healthy weight for a child of that height or a body fat percentage above 25% in boys or above 32% in girls[2]. Obesity can cause deleterious effects, such as decrease in pulmonary gas exchange, lower control of breathing, and limitations in pulmonary function tests and exercise capacity. These changes are caused due to extra adipose tissue in the chest wall and abdominal cavity, compressing the thoracic cage, diaphragm and lungs[3]. Overweight children and adolescents are at a risk for health problems during their youth and as adults. As Adolescents reach adulthood, they add to the spiraling number of diseases like diabetes, heart problems and hypertension[4]. The consequences of industrialization and urbanization, which lead to decrease in physical activity, together with substantial dietary changes and overall pattern of lifestyle, promote weight gain.Hence, appropriate interventions, such as prescribed physical activity programs, may prevent lung function deterioration in these young subjects. Therefore, we proposed this study to explore the effect of obesity on the changes in Pulmonary Function values in depth between the obese and non obese subjects, and also to investigate differences in Pulmonary Function Testing between males and females produced by exercise in both obese young adult males and females and non obese adult males and females of age between 18-25 years. An understanding of these factors leads to newer sex and age specific preventive and therapeutic strategies for the diseases of the respiratory system and also helps in early detection, treatment and prevention of obesity related respiratory problems in young adults.

MATERIALS AND METHODS

Study was undertaken by 60 students from SRM University. Study consists of 2 groups - Experimental group with 30 obese individuals with BMI ≥ 25 (15 males and 15 females) and control group with 30 normal weight individuals with BMI 18 – 25 (15 males and 15 females). Both the groups consist of subjects with 18-25 years of age. And subjects were excluded if they had any pre-existing respiratory disorders, cardiac diseases, neurological disorders and allergic disorders. Institutional ethical clearance had been obtained and informed consent obtained from all subjects. Following which Medical history and family history about obesity, hypertension, respiratory and allergic diseaseswere collected from all subjects. Anthropometry assessment and pulmonary function test were performed on all the study subjects as per the methodology. Measurement of blood pressure was done with the subjects in sitting posture after the subjects were well rested and relaxed for 5 minutes. Pulse rate was counted using radial artery pulse. Both the group, subjects underwent 25 minutes of Aerobic exercise with a cycle ergo meter of moderate intensity (heart rate 100-125 beats per minute). Cycling was carried out while breathing room air through the nose, with mouth closed. Each of the subjects was instructed to signal with his/her hand as soon as he/she felt adverse symptoms in the form of intolerable breathlessness, fatigue, and pain in the chest. Breathing exercise was performed before the start of cycle ergometer and also after aerobic exercise as a warm up and cool

down procedure. Blood pressure and pulse rate were measured before and immediately after exercise.

PROCEDURE

Spirometry

Computerized equipment ("EASYONE PRO") was used in this study. Subjects were to breathe in fully by deep inspiration with nostrils closed and the lips sealed around the sterile mouthpiece of spirometer and forcefully blow out air, as fast as possible. Best of three readings was recorded and interpreted.

Limitations of test

The maneuver is highly dependent on patient cooperation and effort, and is normally repeated at least three times to ensure reproducibility. Since results are dependent on patient cooperation, Forced Vital Capacity (FVC) can only be underestimated, never overestimate. Forced Expiratory Volume in one second (FEV1) may sometimes be overestimated in people with some diseases-a softer blow can reduce the spasm or collapse of lung tissue to elevate the measure. This test is not suitable for patients who are unconscious, heavily sedated, or have limitations that would interfere with vigorous respiratory efforts. Another major limitation is the fact that many intermittent or mild asthmatics have normal spirometry between acute exacerbation, limiting spirometry`s usefulness as a diagnostic. It is more useful as monitoring tool: a sudden decrease in Forced Expiratory Volume in one second (FEV1) or other spirometric measure in the same patient can signal worsening control, even if the raw value is still normal. Patients are encouraged to record their best measures.

STATISTICAL ANALYSIS

The data collected were entered in the MS excel spreadsheet. Descriptive table was generated and appropriate statistical analysis was done using SPSS 19.0 software. ' t' test was applied to compare the Pulmonary Function Test values between obese and non-obese young adult males and females and to analyze the difference in Pulmonary Function Test values before and after exercise in both the groups. A significance level of p value < 0.05 was considered for the student t tests. All data were expressed as a mean ±standard deviation.

RESULTS

TABLE 1
DESCRIPTIVE CHARACTERISTICS OF THE STUDY POPULATION

Group N=15	Age	Height	Weight	BMI
Normal weight males	21.67 ±2.24	172.33±4.6	70.2±5.28	23.61±1.15
Normal weight females	21.47±2.37	163.33±5.54	57.6±5.31	21.54±0.85
Obese males	20.4±2.34	168.80±7.36	87.13±7.59	30.54±1.03
Obese females	20.67±2.09	162.67±4.67	85.87±5.19	32.43±0.9

FIGURE 1
BLOOD PRESSURE AND PULSE RATE OF THE STUDY POPULATION BEFORE AND AFTER EXERCISE

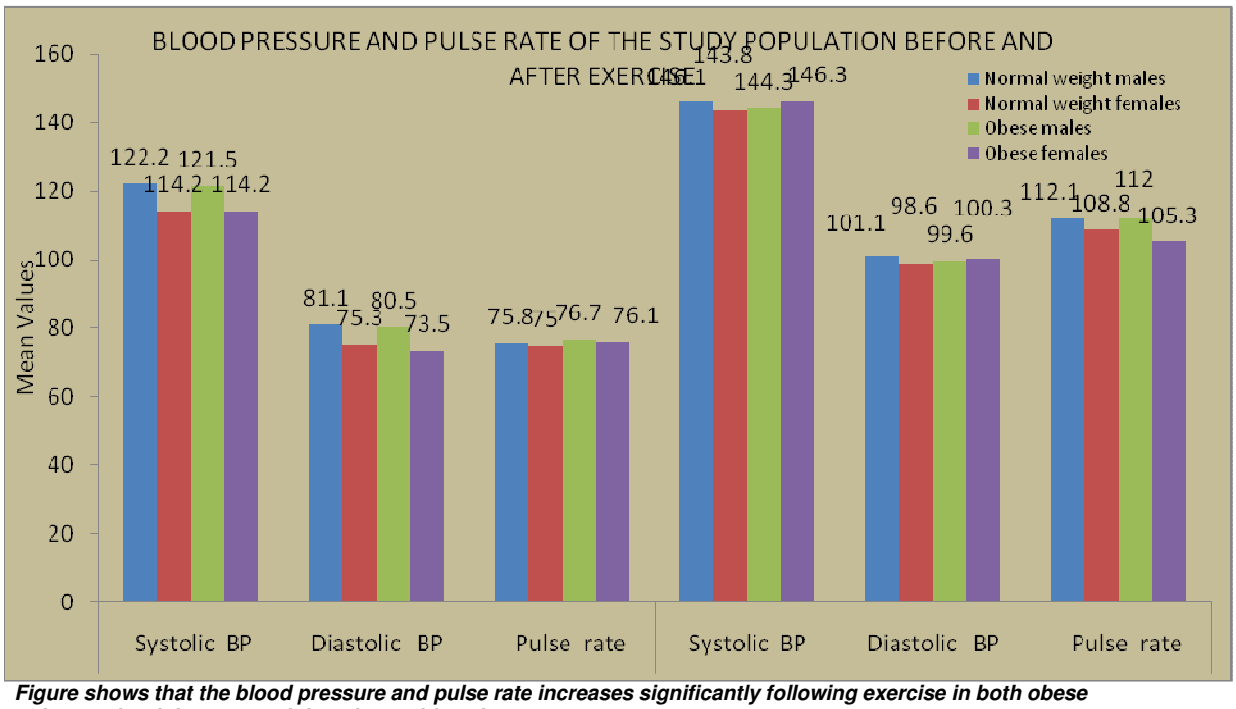


Figure shows that the blood pressure and pulse rate increases significantly following exercise in both obese and normal weight young adult males and females

TABLE 2
COMPARISON OF PFT VALUES BEFORE AND AFTER EXERCISE IN NORMAL WEIGHT ADULT MALES & FEMALES

Parameter	Before exercise		After exercise		P value	
	Males	Females	Males	Females	Males	Females
FEV1	3.73±0.59	2.2±0.2	4.19±0.46	3.06±0.33	.026	.000
FVC	4.16±0.55	2.65±0.24	4.53±0.33	3.5±0.3	.036	.000
PEF	7.46±1.96	4.63±0.98	9.78±2.19	5.61±0.82	.005	.007
PIF	3.31±0.76	2.73±0.79	5.18±1.21	4.33±1.2	.000	.000
FEF	5.16±1.53	2.32±0.7	6.47±0.86	4.25±0.68	.008	.000

TABLE 3
COMPARISON OF PFT VALUES BEFORE AND AFTER EXERCISE IN OBESE YOUNG ADULT MALES AND FEMALES

Parameter	Before exercise		After exercise		P value	
	Males	Females	Males	Females	Males	Females
FEV1	3.20±0.34	2.2±0.2	3.45±0.33	2.97±0.4	.054	.000
FVC	3.55±0.34	2.65±0.24	3.99±0.39	3.33±0.36	.003	.000
PEF	5.29±0.35	4.87±0.28	5.82±0.57	5.25±0.57	.005	.031
PIF	3.21±0.67	2.69±0.73	5.15±0.97	4.27±1.07	.000	.000
FEF	3.99±0.64	2.84±0.57	4.84±0.57	4.09±0.34	.001	.000

FIGURE 2
COMPARISON OF PFT VALUES BEFORE AND AFTER EXERCISE IN NORMAL WEIGHT YOUNG ADULTS

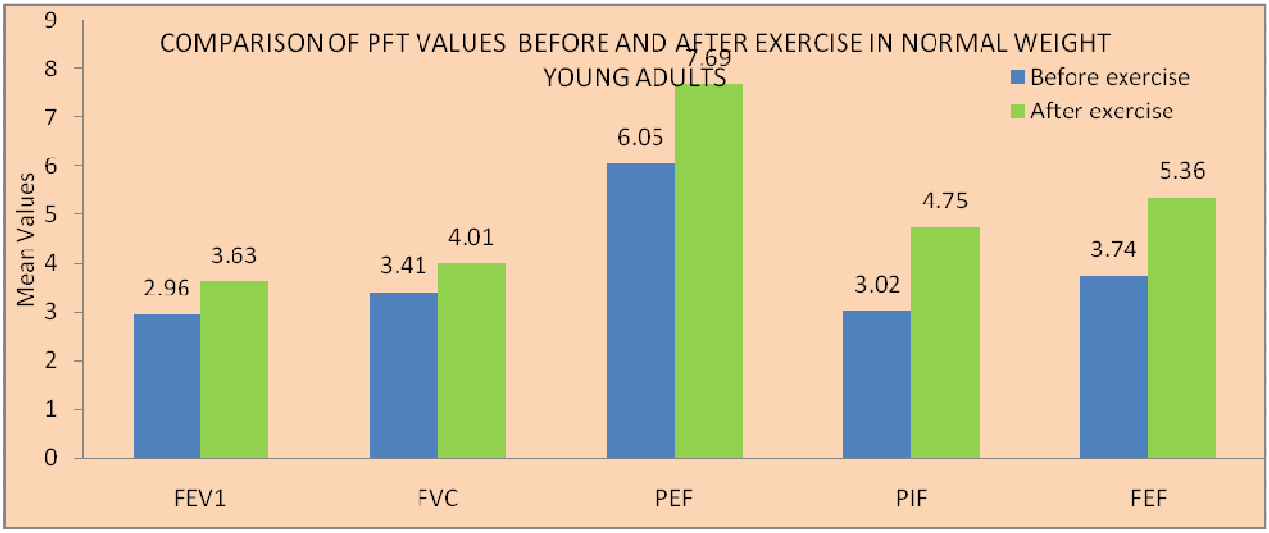
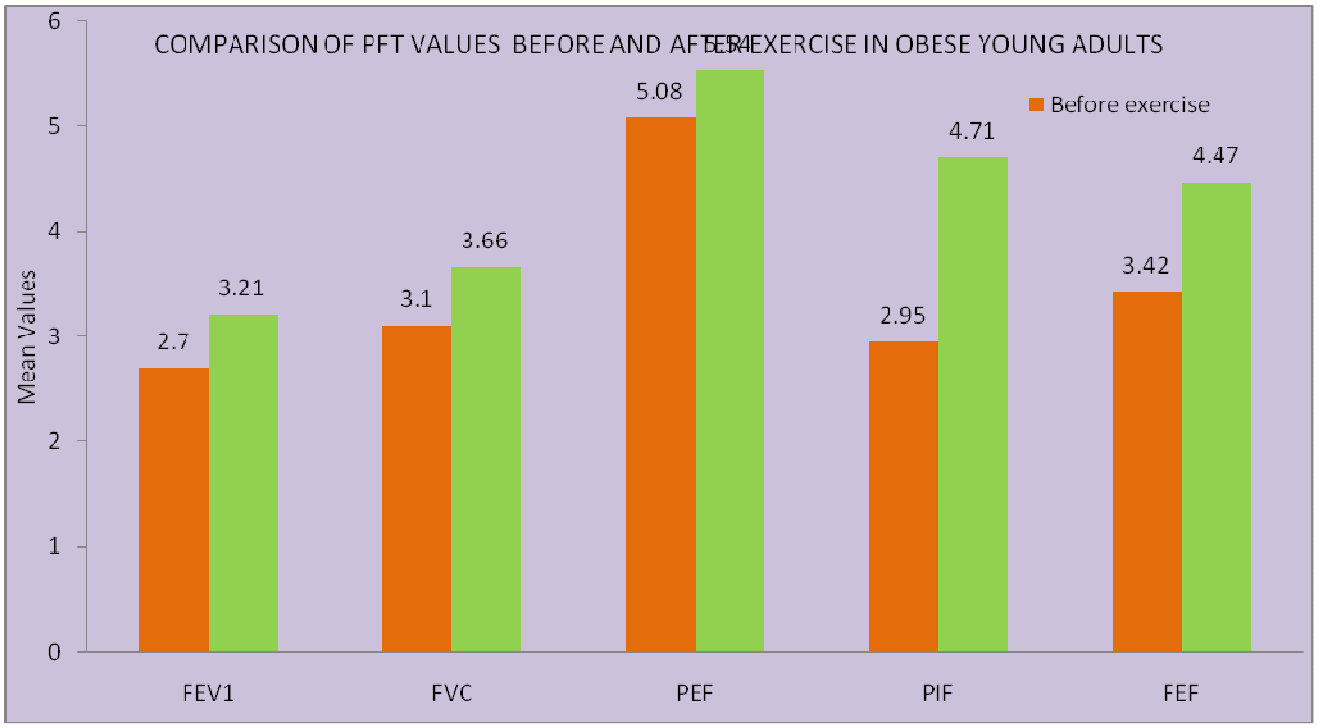


FIGURE 3
COMPARISON OF PFT VALUES BEFORE AND AFTER EXERCISE IN OBESE YOUNG ADULTS



DISCUSSION

Obesity influences on respiratory system directly or indirectly, it exerts various changes on the respiratory mechanics which is known to reduce the lung volumes and capacities, and also

strength and endurance of the respiratory muscles which further complicates by increasing the work of breathing. The total respiratory compliance in obesity may be reduced due to increase in intra abdominal pressure caused by mass loading on the diaphragm which results from excess truncal fat mass[5]. And also due to increased pulmonary blood volume and increased closure of the dependent airways of patients who are obese. These physiologic changes are more pronounced during recumbence in patients who are obese compared with normal-weight patients. BMI has a significant negative correlation with Pulmonary Function Test values in young adult males, but not in females. In obese females the measured Pulmonary Function Test values before exercise did not show significant reduction. The Pulmonary Function Test values like FEV1 (. 000), FVC (. 000), PEF (. 031), PIF (. 000), FEF (. 000) measured after exercise in obese females showed significant improvement. In non-obese females also the measured PFT values like FEV1 (. 000), FVC (. 000), PEF (. 007), PIF (. 000), FEF (. 000) showed significant improvement. In the present study Pulmonary Function Test values measured after exercise in obese and non-obese groups showed significant improvement. In obese individuals the measured Pulmonary Function Test values after exercise showed significant improvement. In obese male subjects there was significant reduction in FVC and FEV1 values measured before exercise, and it improved after exercise, but there was no pronounced improvement in PFT values of obese like non-obese subjects. FEV1 reflects conductive/resistive properties of the large airways, FVC is related to the contractility of the expiratory muscles. Various studies have reported that as the body weight increases lung volumes will decrease. Severely obese patients may also demonstrate dyspnea due to inefficiency of the respiratory muscles mainly diaphragm. Obese individuals with the higher age group are associated with various co morbidities like cardiovascular diseases[2]. Thereby this study included subjects of the younger age group to thoroughly exclude age related complications and to specifically investigate on the lung volumes and its changes after exercise among obese individuals.

CONCLUSION

From our study, we conclude that

- Obesity has a negative effect on pulmonary function test (PFT) in young adult males, but not so in young adult females.
- There was a significant decrease in PFT values measured before exercise in obese young adult males and but not in obese young adult females.
- BMI has a significant negative correlation with PFT in young adult males and not in females.
- There was a significant increase in PFT values measured after exercise in both groups.

Thus, obesity has effects on lung function that can reduce respiratory well-being, even in the absence of specific respiratory disease, and may also exaggerate the effects of existing airway disease. Given the importance of exercise and regular physical activity in weight management, greater care should be taken when working with these patients to refer them to appropriate weight management specialists helping them control and safely reduce their weight. This study shows the need of exercise in improving the lung function as well as total improvement of life style in both obese and non-obese young adults.

List of Abbreviations

BMI – Body Mass Index
PFT – pulmonary Function Test
FVC – Forced Vital Capacity
FEV1 – Forced Expiratory Volume in one second
PEF – Peak Expiratory Flow
PIF – Peak Inspiratory flow
FEF – Forced expiratory Flow

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