EFFECT OF 10 MINUTETRADEMILL WALKING EXERCISE ON PEFR IN HEALTHY YOUNG ADULT IN RELATION WITH BMI

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Abstracts: **Background and Objectives**: Peak expiratory flow rate (PEFR) is the largest expiratory flow rate achived with a maximally forced effort from a position of maximal inspiration(1).PEFR is particularly susceptible to dynamic compression of the extrapulmonary airways and fat laid down in mediastinum, around the heart & pleural space, above diaphragm. The main objective of the present study was to see the effect of exercise on PEFR and also to compare the changes in different groups of BMI. **Materials and Methods:** In the present study 200 healthy subjects of 18-24yrs of age were selected &their BMI were measured. The subjects then went through 10 minutes of treadmill under Bruce protocol and their PEFR were recorded before and after exercise with spirometer. **Results:** In the present study it had been found that there was significant increase in PEFR after exercise. The mean PEFR before and after exercise were 6.01±1.18 L/sec and 6.90±1.12 L/sec respectively. When the PEFR of the study population was compared with the BMI of the study population it showed a negative relation with BMI i.e with increase in BMI there was decrease in PEFR. This relation was present both before and after exercise. The correlation coefficient between BMI and PEFR before and after exercise were r value -0.8192($p<0.0001$) and -0.8086($p<0.0001$) respectively. **Conclusion:** From these we can conclude that BMI has a significant negative effect on the pulmonary ventilation which can overcome by exercise. Regular physical activities should be encouraged in school and colleges for a better health and better future of the young generation.

Key Words: Body Mass Index (BMI), Peak Expiratory Flow Rate (PEFR), Cortisol

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Introduction:

Exercise is the body's most common physiologic stress, and it places major demands on the cardiopulmonary system. For this reason, exercise can be considered the most practical test of cardiac perfusion and function and also to assess the respiratory function. Pulmonary function test is the most convenient test to measure ones respiratory function. Normal oxygen consumption for a young man at rest is about 250ml/min. However in maximal condition the oxygen consumption increased to 3600ml/min in untrained average male and 4000ml/min in athletically trained average male(2).

Peak expiratory flow rate (PEFR) is the largest expiratory flow rate achived with a maximally forced effort from a position of maximal inspiration.The flow reflects the strength of the expiratory muscles, the mechanical properties of the lungs and the inertia , resistence and sensitivity of the recording equipment. PEF is particularly susceptible to dynamic compression of the extrapulmonary airways because whilst such airways are subjects to pleural pressure, their wall are not supported by traction from lung tissue.

It has been found that the mechanism of ventilation and transfer of oxygen from blood to the tissue are also affected by the body size and composition. Compared with a small person or one with much fat and little muscle, a larger, leaner or more athletic person is likely to have a larger total lung capacity, transfer factor, cardiac stroke volume and quantity of skeletal muscle. Fat laid down in mediastinum, around the heart & pleural spaces, above diaphragm severely compromise the ventilation.(3) Even uncomplicated or "simple" obesity exerts substantial effects on pulmonary gas exchange, oxygenation of the blood, and the work of breathing; and it has modest effects on ventilatory drive and the pattern of breathing. Obese patients often complain of exercise intolerance and dyspnoea during exertion. Obesity can be evaluated in three contexts: simple obesity, in which individuals are eucapnic with no pulmonary compromise; morbid obesity, in which pulmonary complications are present andobesity hypoventilation, in which there is morbid obesity with carbon dioxide retention. During spirometry in individuals with obesity hypoventilation syndrome (OHS) usually reveals a more severe

restrictive pattern with reductions in TLC, VC, MVV, and peak inspiratory flow rate. This appears to be related to weakness of the respiratory muscles.(4)

Material and Methods:

In the present study 200 healthy young adult male of 18-24yrs of age group were selected. Before performing the exercise test proper physical examination and detailed history of any medical or surgical illness were taken.The subjects with known respiratory and cardiovascular disease were excluded from the study.The study subjects were devided into different group of BMI according to classification of weight by BMI in adult Asian(5). The full consent of the study population was taken. The spirometry test is performed in the standing position after applying the nose clip, before this demonstration of the procedure was given. The subjects were instructed to take deep breath and then place the mouth piece into the mouth and then exhale force fully without any jerk.

Table1: Classification of weight byBMI in adult asian:

classification	BMI(kg/m^2)	Risk of co-morbidity
Underweight	<18	Low
Normal	18.5-22.9	Average
Overweight	>23	
At risk	23-24.9	Increased
Obese1	25-29.9	Moderate
Obese2	>30	Severe

. After that the subject were asked to go through treadmill test for 10 mins. The tread mill run under BRUCE protocol the speed and inclination change every 3mins interval.

TABLE3: Distribution of the population according to BMI:

	BMI(kg/m^2)	No of subjects	Mean BMI(kg/m^2)	SD
Under weight	<18.5	14	18.15	±0.83
Normal	18.5-22.9	67	21.17	±1.19
At risk	23-24.9	58	23.97	±0.57
Obese 1	25-29.9	52	26.69	±1.19
Obese 2	>30	9	31.21	±1.10

. The subject were instructed to step in to the belt when it is moving using the hand rails for support and to start walking on the belt of the tread mill without giving their own effort by keeping their head erect, eyes looking forward and as naturally as possible. The exercise was continued for 10 mins and during that time the blood pressure, heart rate, SpO_2 were monitored with help of Xscribe system which appeared on the computer screen so that if any abnormal sign appear the exercise could be terminated. The subjects were instructed to press the recovery button present on the front bar of the tread mill if they fill any discomfort or became unable to continue the exercise.After 10 mins of treadmill exercise spirometry test was again performed .The PEFR were recorded after exercise.

Table 2: physical parameter of the study population:

	AGE(yrS)	HEIGHT (m)	WEIGHT (kg)	BMI(kg/m^2)
MEAN	19.91	1.64	63.53	23.67
SD	±1.48	±0.08	±8.18	±3.22

Result:

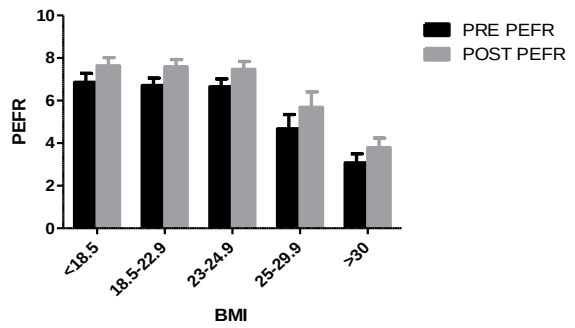
After going through 10 min tread mill exercise pulmonary function was assessed with the help of spirometry. The mean age of the study population was 19.91±1.48 yrs. The mean height was 1.64 ± 0.08 m and weight was 63.53±8.18 kg and the average BMI of the study population was 23.67±3.22kg/m^2.

Out of the 200 subjects 14 subjects had BMI<18.5kg/m^2(underweight) with mean BMI 18.15±0.83 kg/m^2, 67 had BMI (18.5-22.9) kg/m^2 with mean BMI 21.17±1.19 kg/m^2, 58 subjects had BMI in the range of (23-24.9) kg/m^2 with mean BMI of 23.97±0.57 kg/m^2 and 52 subjects fall in the BMI group of(25-29.9) kg/m^2 with mean BMI of 26.69±1.19 kg/m^2, 9 had BMI >30 kg/m^2 with average BMI of 31.21±1.10 kg/m^2.

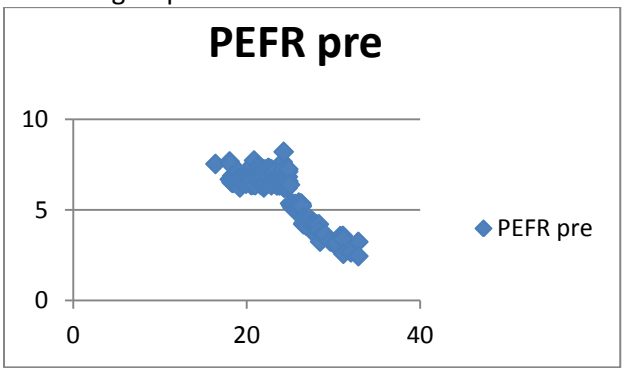
In the underweight (BMI<18.5kg/m^2) the mean (±SD) PEFR before exercise was 6.86 ±0.42 L/sec and after exercise it became 7.64±0.38 L/sec which showed a significant increase in PEFR after exercise with p value<0.0001.

In normal BMI group (BMI18.5-22.9kg/m^2) the mean (±SD) PEFR before and after exercise were 6.71±0.34 L/sec and 7.60±0.33 L/sec respectively which showed a significant increase in PEFR after exercise withp value<0.0001.

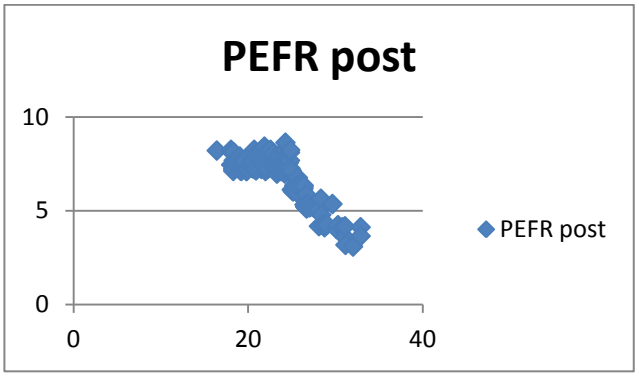
In at risk group BMI (23-24.9kg/m^2) the mean (±SD) PEFR before and after exercise were 6.65±0.37 L/sec and 7.47±0.37 L/sec respectively which showed a significant increase after exercise with p value <0.0001. In the obese1 group BMI (25-29.9kg/m^2) the mean (±SD) PEFR before and after exercise were 4.68±0.67 L/sec and 5.69±0.72 L/sec respectively which showed a significant increase after exercise with p value<0.0001. In the obese2 (BMI≥30kg/m^2) the mean (±SD) PEFR before and after exercise were 3.08 ±0.42 L/sec and 3.80±0.44 L/sec respectively with significant increase after exercise with p value0.0003



dig1: mean PEFR before and after exercise in different groups of BMI



Dig2:frequency diagram showing relation between BMI and PEFR before exercise



Dig3: frequency diagram showing relation between BMI and PEFR after exercise

Discussion:

The primary objective of the present study was to assess the effect of exercise on the pulmonary function test and to see whether any adjustments occur or not after a short duration of submaximal exercise. In this study the effect of BMI on the pulmonary function was also assessed to see how one's body compositions effect the adaptation that would occur in respiratory function after exercise.

Table4: PEFR before and after exercise in different groups of BMI:

BMI(kg/m^2)	PEFR before exercise (L/sec)		PEFR after exercise in male(L/sec)		Significance (p)
	MEAN	SD±	MEAN	SD±	
<18.5	6.86	0.42	7.64	0.38	<0.0001
18.5-22.9	6.71	0.34	7.60	0.33	<0.0001
23-24.9	6.65	0.37	7.47	0.37	<0.0001
25-29.9	4.68	0.67	5.69	0.72	<0.0001
≥30	3.08	0.42	3.80	0.44	0.0003

In the present study it had been found that there was significant increase in PEFR after exercise. The mean PEFR before and after exercise were 6.01±1.18 L/sec and 6.90±1.12 L/sec respectively. When the PEFR of the study population was compared with the BMI of the study population it showed a negative relation with BMI i.e with increase in BMI there was decrease in PEFRboth before and after exercise. The correlation

coefficient between BMI and PEFR before and after exercise were rvalue-0.8192($p<0.0001$)and 0.8086($p<0.0001$) respectively.

The study conducted by Chaitra B et.al on 80 apparently healthy medical student of 17-20yrs shows a significant increase in the PEFR after 16 wks of exercise programme. There was 17% improvement of PEFR after exercise .In their study population which was divided into control group and experimental group. The experimental group went for 16 wks of exercise training programme At baseline, PEFR (L/min) values of experimental and control group were 437.8± 64 (mean S.D.) and 429.7± 53 respectively. After 4 months of aerobics training, the PEFR values in experimental and control groups were 512.9± 62 (P=0.007), and 431.5± 59 (P=0.491) respectively.(6)

In another study conducted by Chaitra B, PandurangNarhare et.al on 20 apparently healthy medical students of 17-20 yrs of age showed a significant increase in PEFR after16 wks of aerobic exercise. The mean PEFR before and after exercise were 465.8±44 L/min and 532.9±42 L/min respectively.(7)

In another study conducted by Anupama N1 et.al on 120 healthy sedentary employees of 30-40yrs shows a decrease in PEFR in the subjects with high BMI when compared with the normal subjects. The mean PEFR in the normal BMI group was 8.94±1.68L/sec and that in high BMI group was 8.54±1.13L/sec. This study shows the effect of BMI on PEFR, which is also one of the objectives of the present study which also showed decrease in PEFR with increase in BMI. The present study thus showed that pulmonary ventilation and respiratory mechanics can be strengthen by regular exercise and the negative effect of increase in BMI and obesity can also be decreased by exercise(8).

Conclusion:

The present study mainly showed the acute effect of exercise on PEFR in relation with BMI. Increase in BMI have negative relation with PEFR, obese people and those with high BMI have low PEFR after exercise as compared with the normal subjects. From these we can conclude that BMI has a significant negative effect on the pulmonary ventilation which can be overcome by exercise. Regular physical activities should be encouraged in school and colleges for a better health and better future of the young generation

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