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COMPARISON OF PRE- & POST-EXERCISE CHANGES IN PULMONARY FUNCTION TEST PARAMETERS IN YOUNG ADULTS.

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ABSTRACT

Background & Objectives: The study was conducted to assess any significant change in post-exercise values of pulmonary function test parameters and to study its correlation with the body mass index.

Material & Methods: 40 subjects (30 males and 10 females) in the age group of 18 to 35 years underwent spirometric evaluation. Respiratory parameters (FVC, FEV_1, FEV_1% and PEFR) were measured at rest and after step exercise. Data tables were prepared and statistical tests were carried out to test the significance.

Results: Post-exercise values of pulmonary function test increased significantly ($p < 0.01$) for FVC, FEV_1 and PEFR. When these data were evaluated on the bases of body mass index the post-exercise values of FVC and PEFR were reduced than the baseline values in pre-obese (BMI 25-29.99 kg/m^2) subjects. This result was found to be statistically significant ($p < 0.01$).

Conclusion: Considering the effect of acute exercise, respiratory parameters FVC, FEV_1 and PEFR significantly increased in males and females but in subjects with higher body mass index the values of FVC and PEFR decreased. This may be due to the increased body fat percentage imposing a mechanical restraint to the movement of abdomen and thorax and increased airway resistance in pre-obese individuals.

KEYWORDS : Body mass index, pulmonary function test, exercise.

Introduction:

Exercise is an important part of keeping persons healthy. It represents a state of physical exertion of the body and it is associated with extensive alterations in the circulatory and respiratory systems [1]. Pulmonary function testing has been a major step forward in assessing the functional status of the respiratory system. The pulmonary function testing during exercise is often used for assessment and determining the degree of airway impairment. Studies have shown some improvement in post-exercise values of FVC, FEV_1 and PEFR[2]. Post-exercise evaluation of PFT may help to identify individuals with poor functional reserve capacity. In addition, post-exercise spirometric values may differ between normal and obese individuals[3]. There are several studies reporting inverse association between lung function and measures of central adiposity such as the waist circumference and the waist-to hip ratio [4-9].

Aims and objectives:

In our current study we have aimed

1. To assess for any significant change in post-exercise values of pulmonary function test.
2. Correlation of body mass index with post-exercise values of pulmonary function test.

Material and Methods:

In this study, total 40 subjects (30 males and 10 females) in the age group of 18 to 35 years took part. They underwent pre- and post-exercise evaluation of pulmonary function test. The spirometric evaluation was done at P.F.T. Laboratory, Department Of Physiology, B.J. Medical College, Ahmedabad and computerised spirometry was carried out using SPIROEXEL 7.1 designed by Medicaid Chandigarh. For pre-exercise evaluation subjects were asked to take rest for at least 5 minutes. After that they were evaluated for respiratory parameters (FVC, FEV_1, FEV_1% and PEFR). Following which subjects had to perform exercise using Harvard steps. In which they had to step up and down for 2 steps at a time as many time as possible in 5 minutes. Immediately after completion of exercise task, again spirometric evaluation was done. All the patients having respiratory diseases like COPD & asthma, with history of exercise induced asthma, recent hospitalization for any medical or surgical illness and who are doing regular exercise or yoga and with history of smoking were excluded from the study.

In this way we obtained data of 40 subjects with pre- and post-exercise values and predicted values for the particular subject of FVC, FEV_1, FEV_1% and PEFR. The significance in change in the post-exercise values of PFT parameters were studied using paired T- test. Subjects were divided based on BMI into two groups, one with normal BMI and the other having pre-obese individuals. The data was studied for significance of post-exercise changes in PFT parameters between normal BMI group and pre-obese group.

Result:

A total of 40 (30 males and 10 females) subjects took part in this cross sectional study. Table 1 and 1.1 shows the baseline characteristic of the study participants. In the study we found that after exercise pulmonary function test parameters such as FVC, FEV_1 and PEFR increased significantly ($p<0.01$). However in females increase in value of PEFR was less as compared to the males ($p<0.05$). When these PFT parameters were compared on the bases of BMI there was significant decrease in the values of FVC and PEFR in pre-obese as compared to normal BMI subjects. These results are summarized in Table-2 and 3 and Figure -1.

Table 1: Baseline characteristics of the study participants

	n	AGE (years)	BMI (kg/m^2)
Males	30	26.9 ± 8	25.5 ± 4.5
Females	10	25.7 ± 8	23.3 ± 3.8

Values are expressed as mean ± S.D , n - No of study participants , BMI – Body mass index .

Table 1.1: Number of subjects having normal BMI and pre-obese

Total number of subjects	Normal BMI (18.50 to 24.99 kg/m^2)	Pre-obese (25 to 29.99 kg/m^2)
40	23	17

Table-2: Comparison of pulmonary function test parameters in males and females following exercise.

	Exercise	Males	Females	Total
FVC	Pre-exercise	3.36 ± 0.58	2.6 ± 0.35	3.17 ± o.61
	Post-exercise	3.48 ± 0.5	2.72 ± 0.35	3.29 ± 0.57
FEV_1	Pre-exercise	2.86 ± 0.57	2.27 ± 0.31	2.71 ± 0.47
	Post-exercise	2.96 ± 0.49	2.4 ± 0.28	2.82 ± 0.54
FEV_1%	Pre-exercise	85.11 ± 3.68	88.78 ± 2.9	85.48 ± 2.55
	Post-exercise	85.29 ± 2.92	86.03 ± 1.7	86.02 ± 3.41
PEFR	Pre-exercise	7.58 ± 1.97	5.83 ± 0.93	7.14 ± 1.73
	Post-exercise	7.94 ± 1.46	6.06 ± 0.73	7.47 ± 1.9

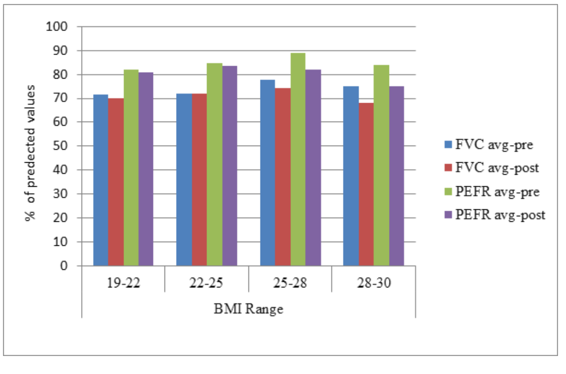
Values expressed as mean ± S.D, FVC – Forced vital capacity, FEV_1 – Forced expiratory volume in first second, FEV_1%= FEV_1 / FVC ratio, PEFR – Peak expiratory flow rate

Table-3: Comparison of pulmonary function test parameters in subjects with normal B.M.I and pre-obese following exercise.

	Normal BMI		Pre-obese	
	Pre-exercise	Post-exercise	Pre-exercise	Post-exercise
FVC	3.26±0.42	3.20±0.58	3.32±0.54	3.12±0.73
FEV1	2.80±0.44	2.74±0.41	2.86±0.43	2.67±0.47
FEV_1%	86.13±4.7	85.84±2.89	85.88±3.0	84.99±2.12
PEFR	7.39±1.37	7.30±1.30	7.58±1.78	6.91±1.92

Values expressed as mean ± S.D, BMI – Body mass index, FVC – Forced vital capacity, FEV_1 – Forced expiratory volume in first second, FEV_1%=FEV1 / FVC ratio, PEFR – Peak expiratory flow rate

Figure–1: Post-exercise values of pulmonary function test inversely related to the body mass index. x-axis – body mass index, y-axis - % of predicted values.



Discussion:

In our study we found that the post-exercise values of FVC, FEV_1 and PEFR increased significantly. In another study conducted by Bhavsar SD et al. similar results were found [12]. In addition, Ikram MH et al, who showed that release of catecholamines during exercise, cause a significant rise only in FEV_1 after exercise in both the sexes[3]. However, these results are contradictory to some studies which showed no significant post-exercise difference[2]. Actually, when a person begins to exercise, a large share of the total increase in ventilation begins immediately on initiation of the exercise, before any blood chemicals have had time to change. The presumed reason that the ventilation forges ahead of the buildup of blood carbon dioxide is that the brain provides an "anticipatory" stimulation of respiration at the onset of exercise, causing extra alveolar ventilation even before it is necessary [14]. Respiration is stimulated mainly by neurogenic mechanisms during exercise, part of this stimulation results from direct stimulation of the respiratory center by the same nervous signals that are transmitted from the brain to the muscles to cause the exercise. An additional part is believed to result from sensory signals transmitted into the respiratory center from the contracting muscles and moving joints. All this extra nervous stimulation of respiration is normally sufficient to provide almost exactly the necessary increase in pulmonary ventilation required to keep the blood respiratory gases-the oxygen and the carbon dioxide-very near to normal[14]. But when the effect of BMI was considered, the post-exercise values decreased in inverse association for FVC and PEFR. This result was similar to Keplan et al. and Lazarus R et al. [7,13].The reason for this may be increased body fat percentage causing mechanical restraint to the movement of abdomen and thorax and increased airway resistance in overweight and obese individuals[2].

Conclusion:

The results of the present study indicate that pulmonary function tests are altered with acute exercise in healthy young adults, however exercise induced changes may be significantly influenced negatively by higher body mass index. This may be due to the increased body fat percentage imposing a mechanical restraint to the movement of abdomen and thorax and increased airway resistance in pre-obese individuals. So we can say that pursuing exercise regularly will improve pulmonary function and cause a decline in morbidity and mortality due to pulmonary causes. Though the effects of regular exercise has been proven, the use of exercise testing for screening of morbid changes in lung functions are yet to be studied. Larger sample size can provide better understanding for this.

References:

1) Ganong WF. Respiratory adjustments in health and disease. In: Ganong WF (Ed.), Review of medical physiology, 22nd ed., United states of America:McGrawHill, 2005: 681.
2) Influence of Exercise on Pulmonary Function tests in young individuals Soundariya K1,*, Neelambikai N2
3) Ikram MH. Evaluation of pre and post-exercise pulmonary function tests in medical students. Professional Med J. 1998; 5(1):77.
4) Wannamethee SG, Shaper AG, Whincup PH. Body fat distribution, body composition, and respiratory function in elderly men. Am J Clin Nutr. 2005; 82: 996–1003.
5) Cotes JE, Chinn DJ, Reed JW. Body mass, fat percentage, and fat free mass as reference variables for lung function: effects on terms for age and sex. Thorax 2001;56:839–44.
6). Collins LC, Hoberty PD, Walker JF, Fletcher EC, Peiris AN. The effect of body fat distribution on pulmonary function tests. Chest 1995;107: 1298–302.
7). Lazarus R, Sparrow D, Weiss ST. Effects of obesity and fat distribution on ventilatory function. Chest 1997;111:891–98.
8). Lazarus R, Gore CJ, Booth M, Owen N. Effects of body composition and fat distribution on ventilatory function in adults. Am J Clin Nutr 1998; 68:35– 41.
9). Santana H, Zoico E, Turcato E, et al. Relation between body composition, fat distribution, and lung function in elderly men. Am J Clin Nutr 2001;73:827–31.
10) Saxena Y, Saxena V, Divedi J, Sharma RK. Evaluation of dynamic function tests in normal obese individuals. Indian J Physiol Pharmacol. 2008; 52(4): 375-382.
11) Lakshmi PVV, Reddy KS. A study on cardiopulmonary changes with exercise in adolescent boys and girls. J of Evolution of Med and Dent Sci. 2015;4(13);2164-71.
12) Bhavsar SD,Abhange RS, Afroz S. A comparative study on effect of acute exercise onpulmonary function tests of first year MBBS students. International Journal of Recent Trends in Science and Technology .2015;13(3): 484-489.
13) Kaplan TA, Montana E. Exercise-induced bronchospasm in nonasthmatic obese children. Clinical pediatrics. 1993, 32(4):220-5
14) Guyton, hall. textbook of medical physiology.12th ed. elseveir Publishers, 2011, 510. 1037.