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FVC in Smokers in Relation to BMI: A Comparative Study with Non Smokers

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Abstract

Introduction: Forced vital capacity (FVC) is the maximum volume of air that can be expired, when a subject tries as forcefully and rapidly as possible, after a maximal inspiration to total lung capacity. A maneuver performed similarly beginning at residual volume and inspiring as forcefully as possible is called forced inspiratory vital capacity. *Methodology:* The tests are done by selecting chronic smokers of different age group from 30-70 years from out patient, and impatient from the department of TB & chest diseases, medical college. Control groups are selected from patient who does not smoke. The instrument used was a portable small-computerized spirometer called "Compact Vitalograph". *Results:* In smokers with overweight the mean is 61.14 and the standard deviation is 22.93. When this values are tested using chi-square test, it is found that there is significant difference, according to the chi-square test the P value is less than 0.05. *Conclusion:* The effect of smoking on FVC is more affected in overweight group of subjects than the normal weight group of subjects.

Keywords: Forced Vital Capacity; Compact Vitalograph; Overweight.

Introduction

Evaluation of pulmonary function dates back to the 17th century. John Hutchinson wrote in 1846 that, Borelli is the earliest physiologist (1679) who established an experimental enquiry into the quantity of air received by a single inspiration. In 1800 Humphrey Davy used his Mercurial Air Holding Machine; and a Hydrogen dilution technique to measure his own residual volume. Then Hutchinson in 1846 devised the spirometer and described and measured vital capacity [1]. In his treatise entitled 'On the capacity of the lungs and on Respiratory Functions' he defined the functional subdivisions of lung volume. He defined the vital capacity as the greatest voluntary expiration following the deepest inspiration. He also reported the result of vital capacity measurements in more than 1700 "healthy cases". He related these values to the age, height and weight of his subjects and thus established a basis of predicting normal values. The simplicity and rapidity with which vital capacity could be measured led to an abundance of subsequent reports with tables of normal standards and formula for prediction. Reports were published by Peabody and Wentworth (1917), LundsGaard and Van Slyke (1918) Dreyer (1919), West (1920), Hewlett and Jackson (1922), Myers (1923) etc. They related vital capacity to various physical parameters like body surface area, height, body weight, chest circumferences, sitting height etc [2,3].

Forced vital capacity (FVC) is the maximum volume of air that can be expired, when a subject tries as forcefully and rapidly as possible, after a maximal inspiration to total lung capacity. A maneuver performed similarly beginning at residual volume and inspiring as forcefully as possible is called forced inspiratory vital capacity [4]. Both maneuvers are often performed in sequence to provide a continuous flow-volume loop. Both are recorded in liters, BTPS. FVC normally equals the slow vital capacity (SVC), within 5% of each other. They can differ substantially in subjects with severe airway obstruction. The FVC can be lower than the SVC in subjects who have obstructive disease if forced expiration causes bronchiolar

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collapse. The FVC can ne reduced in emphysema, because of mucus plugging and bronchiolar constriction (chronic bronchitis, chronic or acute asthma, bronchiectiasis, and cystic fibrosis), and in subjects with large airway obstruction (tumours). Decreased FVC is a common feature of restrictive diseases, resulting from increase in fibrotic tissue (pulmonary fibrosis), vascular congestion (pneumonia or pulmonary edema), space occupying lesions, neuromuscular disorders and chest deformities. Normal values — Males > -4.0L, Females > -3.0L. These values provide an indirect measure of the flow resistive properties of the lung [5,6].

Methodology

The study was conducted at department of TB &chest diseases, medical college. Tests were carried out in the laboratory and these tests were done in chronic smokers who attend in the smoker's clinic at morning hours. Here pulmonary function test are done using spirometry. The tests done are FVC, FEV1, FEF, FEV1/FVC and FEF 25-75%. These studies were done to find out the effects of smoking on lung function tests by comparing smokers with non-smokers in relation to body mass index. The tests are done by selecting chronic smokers of different age group from 30-70 years from out patient, and impatient from the department of TB & chest diseases, medical college. Control groups are selected from patient who does not smoke. The instrument used was a portable small-computerized spirometer called "Compact Vitalograph". Here mouthpiece is attached to resistant pneumatochograph, which contains parallel rows of resistant wire. Airflow through these procedures a pressure gradient across the resistant element, which is converted to electrical, signal and measured by the computer system. Results were displayed on the screen. This can be printed on an electro sensitive paper for a permanent record. The test was done in 100 subjects and another 100 as control. The subjects were chronic smokers and then they are divided into two groups as

A. Chronic smokers with normal body weight (50 numbers).
B. Chronic smokers with overweight/Obesity (50 numbers).

The control arenon smokers and also they were divided into two groups:-

A. Nonsmokers with normal weight (50 numbers).
B. Nonsmokers with overweight/Obesity (50 Numbers). The control was selected from the college campus.

Results

As per the Table 1 non-smokers with normal weight is having mean FVC of 77.11 with a standard deviation of 16.63 and non-smokers with over weight the mean is 79.12 and standard deviation is 15.26. This values are tested using chi-square test and it is found that the difference actually observed does not have significance since the p value is more than 0.05.

In smokers, the smokers with normal weight the mean is 64.12 and the standard deviation is 20.47. In smokers with overweight the mean is 61.14 and the standard deviation is 22.93. When this values are tested using chi-square test, it is found that there is significant difference, according to the chi-square test the P value is less than 0.05 and it shows that the effect of smoking on FVC is more affected in overweight group of subjects than the normal weight group of subjects.

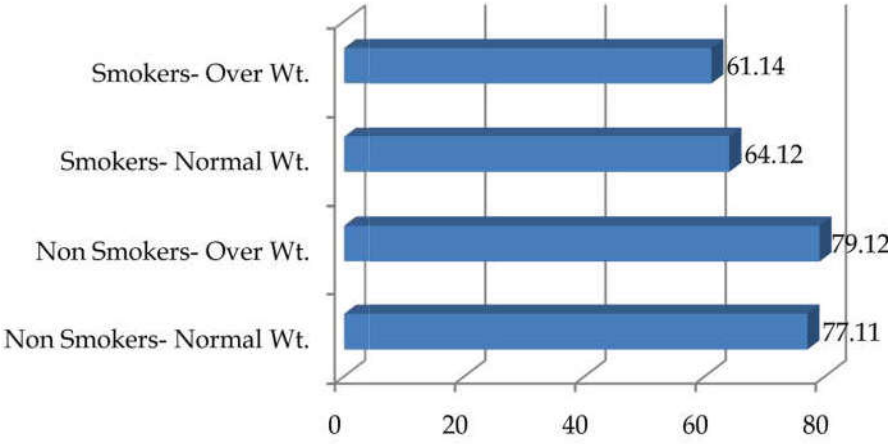

Fig. 1: Comparison of FVC

Table 1: Comparison of FVC in relation to BMI

Category	Mean	Std Deviation 1
Non Smokers- Normal Wt.	77.11	16.63
Non Smokers- Over Wt.	79.12	15.26
Smokers- Normal Wt.	64.12	20.476
Smokers- Over Wt.	61.14	22.93

Discussion

Cigarette smoking is addictive; smoking nearly always begins in adolescence for psychosocial reasons and then it becomes a regular habit. Some says that nicotine present in the cigarette conferring some advantage to the smoker's mood; but later it adversely affects every organ system of the body. Most often it will affect respiratory system first with a variety of respiratory diseases. Cigarette smoking causes increased sputum production followed by airflow limitation. If this person continues smoking it leads to decreased effort tolerance and ultimately causes chronic bronchitis and emphysema. The toxic effect is because cigarette smoke contains polycyclic aromatic hydrocarbons and nitrosamines, which are potent carcinogens and mutagens. It causes release of enzyme from macrophages, which are capable of destroying elastin, leading to lung damage. Like nicotine, obesity/over weight is another major factor, which adversely affects health by affecting each organ system of the body. The cause of obesity is nutritional abundance or sedentary life style. Obesity affects pulmonary system by reducing pulmonary compliance, rise airway resistance and reduces small airway caliber which in turn leads to increased work of breathing, increased minute volume, decreased total lung capacity, decreased functional residual capacity, and is associated with sleep apnea syndrome. Obesity is the adiposity, which can be measured by the method called body mass index (BMI) [7,8].

The normal BMI is 18.5 to 24.9. Obesity is not directly related to respiratory diseases, but it reduces pulmonary compliance and decreases the caliber of the small airways, which in turn increases the risk of respiratory diseases in smokers. The pathological changes in the respiratory system are slow and only a minor proportion of smokers show progressive deterioration, and the knowledge of natural history is insufficient to identify those individuals who are at risk. Smokers at risk can be identified only by doing pulmonary function tests (PET) [9]. Investigations and laboratory assessments are important adjuncts to confirm variable airflow obstruction. Although there is a wide range of different methods to assess the level of airflow obstruction, pulmonary function tests (spirometry) is the only test widely used, because it is the simplest, easiest and most reliable test. Pulmonary function tests are used to differentiate obstructive pulmonary diseases from restrictive pulmonary diseases, to make an objective assessment of severity of disease, and also to monitor response to treatment. Spirometry shows different types of readings; but only 5 values are taken. They are FVC, FEV1, FEF, FEV1/FVC and FEF25- 75%. PFT changes in obesity and smoking In this spirometric study, only 5 measurements were taken and analysed, i.e.:- FVC, FEV1, FEF, FEV1/FVC and FEF 25-75%. The spirometric evaluation was done in chronic smokers with normal weight and over weight and was compared with non-smokers.

The statistical analysis of the present study showed that there was significant reduction of FVC in over weight smokers when compared to normal weight smokers. The reduction of FVC observed in over weight smokers is statistically significant.

Conclusion

Effect of smoking on FVC is more affected in overweight group of subjects than the normal weight group of subjects.

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