



Original Article

Spirometric Indices in Healthy Adults

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Abstract

Background: Pulmonary function tests are of prime importance in the diagnosis and prognosis of a large number of respiratory disorders. Normative values of lung functions of healthy population are affected by multitude of factors like geographic, ethnic, climatic and demographic factors. So it is essential to have a reference value of the sample population to prevent under diagnosis and over diagnosis of any disease.

Objectives: Present study was designed to derive normative values of spirometric indices, forced vital capacity (FVC), forced expiratory volume in 1 sec (FEV₁), FEV₁ as a percentage of FVC (FEV₁%), mid expiratory flow rate (FEF_{25-75%}) and peak expiratory flow rate (PEFR) in both sexes.

Material and Methods: Pulmonary function tests were carried out in a total of 160 non-smoking healthy adult subjects, of age group between 21-60yrs. 80 each of them were from opposite sex

Results and Conclusion: Values of the above spirometric parameters were obtained which were comparable with that of other South Indian studies. Male sex had higher spirometric values compared to female sex except for FEV₁/FVC ratio. The differences in all parameters FEV₁/FVC ratio were statically significant. These values may be used as reference values in this geographical area.

Keywords: FVC, FEV₁, FEV₁/FVC, FEF, PEFR, sex.

Introduction

Pulmonary function tests (PFT) are a group of diagnostic tests that provide measurable feedback about the function of the lungs. Among spirometric measurements the most useful test are Forced Vital Capacity (FVC), Forced Expiratory Volume in one second (FEV₁) and their ratios (FEV₁/FVC). These parameters measures the volume of air exhaled at specific points of time

during a forceful and complete exhalation after a maximum inhalation. Spirometry is extremely useful as a screening test of general respiratory health. Inspired and expired lung volumes measured by spirometry are useful for detecting, characterizing and quantifying the severity of lung disease.

The wide range of geographical and climatic conditions may be associated with regional

differences in lung function in healthy individuals. Differences in pulmonary function in normal people may be due to ethnic origin, physical activity, environmental conditions, altitude, tobacco smoking, age, height, sex, or socioeconomic status¹. Several reference values for pulmonary function tests have been published from different parts of the world, such as pulmonary functions in Europeans^{2,3}, North American populations⁴, studies from different parts of India^{5,6,7}, China⁸ and other non-Caucasian population^{9,10}. India is a subcontinent with a large multi-ethnic population. Differences in lung functions in healthy Indians dwelling in different geographical regions of the country can be expected. The present study is an attempt to find out various spirometric indices in northern kerala.

Material and Methods

This Cross sectional study was conducted in Institute of Chest Diseases, Government Medical College Kozhikode. 160 non-smoking healthy adults between 21 to 60 years of age were enrolled in the study. 80 each of them belongs to opposite sex. Informed consent obtained from each subject. People with Structural deformity of thoracic cage, chronic medical illness like Diabetes mellitus or hypertension history of any cardio respiratory disease as assessed by detailed history and physical examination, history of existing obstructive or restrictive type of respiratory diseases were excluded from the study. Subjects with respiratory infections and taking treatment for the same, people with history of surgeries in the eyes, abdomen or head. Persons with BMI below 18.5 and above 30 were also excluded. The equipment used for spirometry in this study was

Spiro excel spirometry system. The system comprises of a windows personal computer for data collection, analysis, storage and display; Spiro excel software programme for the PC, and a hand held pneumotach with reusable variable-orifice core and a USB interface. The following parameters were measured; forced vital capacity (FVC), forced expiratory volume in first sec (FEV₁), FEV₁ as a percentage of FVC (FEV₁%), forced mid expiratory flow rate (FEF_{25-75%}) and peak expiratory flow rate (PEFR). The results were tabulated and analyzed using statistical package for social sciences (SPSS) version 18 software of Windows. The mean and standard deviation of various parameters were calculated and the results were expressed as Mean \pm SD (Descriptive statistics).

Observations & Results

The present study, "spirometric indices in healthy adult population" was done on 160 non-smoking healthy adults. Age group was between 21-60yrs, and 80 each of them belongs to opposite sex. FVC, FEV₁, FEV₁/FVC, FEF (25-75%) and PEFR were obtained from each individual. Results were tabulated analysed using statistical package for social sciences (SPSS) version 18 software of Windows. FVC was more in males when compared to females and the difference was statically significant. FEV₁, FEF (25-75%) and PEFR also showed similar trends with statistically significant high values in males when compared to females (Table-1). the sole exception is FEV₁/FVC ratio, which is more in females even though value were statistically not significant. The mean values for each parameter and standard deviation was given in Table- 1

Table 1: Mean of spirometric parameters in both sexes.

	Male		Female		P value
	Mean	S.D	Mean	S.D	
FVC	3.47	0.57	2.32	0.46	<0.001
FEV ₁	2.91	0.52	1.96	0.42	<0.001
FEV ₁ /FVC	82.87	4.92	83.14	9.58	0.823
FEF(25-75%)	3.76	1.07	2.81	0.81	<0.001
PEFR	5.53	1.08	4.52	1.27	<0.05

Discussion

Spirometry is the most frequently performed lung function test. Accuracy of the interpretation of lung function tests depends primarily on reference ranges which distinguish the effects of disease from a normal range of spirometry results. Since a number of physiological factors affect lung volumes, predicted values are important in establishing whether the volumes measured in an individual fall within a range to be expected, in a healthy person of the same gender. The present study was undertaken in order to assess the pulmonary function parameters in healthy people of age group between 21- 60 years of both genders in Northern Kerala. The spirometric parameters, forced vital capacity (FVC), forced expiratory volume in first sec (FEV₁), FEV₁ as a percentage of FVC (FEV₁%), forced mid expiratory flow rate (FEF_{25-75%}) and peak expiratory flow rate (PEFR) were studied in both males and females of age group between 21-60 years. The normative values for different parameters for males and females, in the studied population were given Table -1. The study clearly showed that FVC, FEV₁, FEF (25-75%) & PEFR were higher in males compared to females. It is also found that these differences were statistically significant (P value <0.001).

A study by H. I. Chen, C. S. Kuo showed that except for FEV₁/FVC, men had greater pulmonary functions than women¹¹. In yet another study by Amit Bandyopadhyay, the pulmonary function measurements exhibited significantly higher values among males than the females¹². The gender difference in lung function parameters is attributed to many factors. The volume of adult female lungs is typically 10-12% smaller than that of males who have the same height and age¹³. Maturation of the airways and lungs continues through childhood and adolescence during which time, males continue to have larger lungs than females. Further the conducting airways of adult males are larger than those of adult females, even when lung or body sizes are equivalent^{14,15}. Gender difference is also attributed to greater

respiratory muscle strength and greater compliance in males compared with females^{16,17}.

Even though statically insignificant (P value 0.82), FEV₁/FVC ratio was higher in females when compared to males. Similar finding was observed in the study done by Soundariya and Neelambikai where the difference in FEV₁/FVC ratio between males and females were found not to be significant¹⁸. Higher mean FEV₁/FVC ratio in females was also observed in study done by Mohan Rao and they attributed it to small lung volume in females which results in quick emptying during blowing out¹⁹.

Conclusion

This study was an attempt to collect normative values of spirometric parameters of normal healthy adults of both sexes of age group between 21- 60 years in northern Kerala. The spirometric parameters studied were FVC, FEV₁, FEV₁/FVC, FEF (25-75%) & PEFR. Normal values of the above spirometric parameters were obtained for both sexes. The values were comparable with that of other South Indian studies. Male sex had higher spirometric values compared to female sex except for FEV₁/FVC ratio. As reported from the various studies, across the world, it is evident that multitude of factors influences the spirometric values. Reference values are of great clinical value both in diagnosis and treatment of various diseases and to study the impact of various hazards like pollution, occupational exposure of many toxic agents which in turn will lead to diseases. So the values derived in this study can be used as a reference data in this area.

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