

A Study of Correlation of Pulmonary Function Tests and Body Mass Index in Adults on the Basis of Region and Gender

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Received: 25th May, 2026; Revised: 7th June, 2026; Accepted: 11th June, 2026; Available Online: 15th June, 2026

ABSTRACT

Aim

To evaluate the correlation between BMI and Pulmonary function test on the basis of region and gender.

Material & Methods

A total of 318 subjects were selected for the study having the age range 20-85 years. Among them 170 was male and 147 were female. All the subjects were classified into country side area and city area groups.

Results

The results showed that the PFT values were higher in city area than that in country side area for both sexes ($p < 0.001$). There was a significant difference ($p < 0.05$) in PFT parameters among all age groups for male subjects. There was a significant correlation ($p < 0.05$ or lesser) between PFT parameters and height, weight and BMI for both sexes and for different regions.

Conclusion

It was concluded that there was a clear cut country side area and city area difference in pulmonary function efficiency parameters. PFT parameters were significantly correlated with height, weight, and BMI parameters.

Keywords: Body Mass Index (BMI), Pulmonary Function Test (PFT), Forced Vital Capacity.

How to cite this article: Das D, Behera NK, Naik LK. A Study of Correlation of Pulmonary Function Tests and Body Mass Index in Adults on the Basis of Region and Gender. *Int J Drug Deliv Technol.* 2026;16(60s):623-626.

DOI: 10.25258/ijddt.16.60s.72

Source of support: Nil.

Conflict of interest: None

Introduction

Obesity is a major health problem all over the world including the country side area and city area of India. [1] Obesity is a result of rapidly changing life style which involves consumption of fast food with lack of physical activity. Obesity for prolonged period results in decreasing the lung volume and its capacities by affecting both lung and chest wall compliance. [2] BMI is considered as one of the important parameter in diagnosis of overweight and obesity in clinical fields. [3] Female individuals found to have lower PFT values because of their inspiratory and expiratory muscle endurance and chest wall compliance. [4] Obesity affects respiratory parameters because it causes small airway dysfunction, expiratory flow limitation, respiratory mechanics change, chest wall and lung compliance reductions, decreased respiratory muscle strength, lower breathing control and limitations in exercise capacity. [5] Impairment of

respiratory function occurs and lung expansion decreases if the fat deposits over diaphragm, abdomen and intercostals muscles. It leads to decreased functional residual capacity (FRC), expiratory reserve volume (ERV), forced expiratory reserve volume in 1sec (FEV1), and total lung capacity (TLC). [6] Generally vital capacity (VC) and total lung capacity (TLC) remains normal but it may be decreased by $\geq 30\%$, if obesity is severe. There is an increased breathing effort, if there is "abnormal chest wall resistance" or if there is increased airway resistance. [7] It is seen that if BMI is between 20 and 30kg/m² then the changes in FRC and ERV are quite similar and there is no big difference in these BMI groups. [8] Thus, the aim of this study was to evaluate the prevalence of deranged BMI, pulmonary function tests and correlation between BMI and pulmonary function test.

Material & Methods

A Study of Correlation of Pulmonary Function Tests and Body Mass Index in Adults on the Basis of Region and Gender

A cross-sectional study was done on 200 MBBS Students including 100 from country side area and 100 from city area populations in the age group of 18-25 years. Prior informed, written consent for the study was obtained from all the subjects. For this study equipment used were Spiro Excel (Medicaid systems), Weighing scale, and Flexible metallic tape. Required measurements such as weight (kg) and height (m) were measured according to anthropometric standards. Three readings of each of the measurements were taken and then their average was calculated to ensure accuracy.

$$\text{BMI} = \text{Weight (kg)} / \text{Height (m}^2\text{)}$$

Pulmonary functions were recorded on a computerized portable Schiller lung function unit SP1 (RS 232). The recorded parameters were compared with the inbuilt pulmonary function norms for the Indian population depending upon the age, sex, height, and weight. The spirometer was calibrated daily using calibration syringe of 2 liters. Recording of static and dynamic pulmonary function tests was conducted on motivated young healthy volunteers in standing position.

These tests were recorded at noon before lunch, as expiratory flow rates are highest at noon (11). For each volunteer three satisfactory efforts were recorded according to the norms given by American Thoracic Society (12). The essential parameters obtained were, tidal volume (VT), expiratory reserve volume (ERV), inspiratory capacity (IC), forced vital capacity (FVC), timed vital capacity (FEV1), maximum ventilator volume (MVV) and peak expiratory flow rate (PEFR). All the records i.e. anthropometric measurements and recording of pulmonary function tests were conducted in one sitting on the same day

Statistical analysis:

Data were summarized in to mean and standard deviation values using Microsoft Excel. For performing t-tests and one way ANOVA SPSS were used. Correlation coefficient between height, weight, BMI and PFT parameters were determined by employing product moment correlation coefficient through MS Excel.

The study was approved from the Institutional ethical committee.

Results

Table1: Comparison of height, weight & BMI Between male and female subjects

Gender	Height(cm)	Weight(Kg)	BMI(Kg/ m ²)
MALE(n=170)	160.5±6.87	59.2±5.08	23.0±2.10
FEMALE(n=147)	150.5±6.13	48.1±1.84	21.1±4.66
t-value	13.725**	5.721**	0.638 NS

Table 2: Comparison of height, weight and BMI between city area and country side area subjects

Gender	Country side area / city area	Height (cm)	Weight (Kg)	BMI(Kg/m ²)
Male	City area(n=113)	162.3±5.86	60.3±9.16	22.9±3.08
	Country side area(n=58)	158.1±7.70	45.8±8.72	18.3±2.84
	T value	4.037**	9.997**	9.475**
Female	City area(n=85)	152.0±5.8	54.0±10.2	23.4±4.23
	Country side area(n=63)	148.7±6.36	40.0±8.79	18.0±3.20
	T-value	3.183*	8.667**	8.391**

Table 3: Comparison of Different parameters of Pulmonary Function Test (PFT) between male and female healthy population

PFT Parameters	Male (n=171)	Female (n=147)
FVC (Lit)	2.57±0.74	1.93±0.81
FEV1 (Lit)	2.21±0.61	1.68±0.58
PEF (Lit/Sec)	3.78±1.74	2.96±1.41

Table 4: Comparison of different parameters of Pulmonary Function Test (PFT) between country side area and city area subjects among the selected population

PFT Parameters	Male		Female		t value	
	Cit y area (n=113)	Co untr y side area	Ci ty ar ea (n	Co untr y side area	Male	Femal e

	(n=58)	(n=85)	(n=63)			
FVC(Lit)	2.62±0.58	2.46±1.00	1.93±0.74	1.86±0.90	1.370	0.56
FEV ₁ (Lit)	2.31±0.58	2.00±0.63	1.74±0.61	1.53±0.49	3.230**	2.217NS
PEF(Lit/Sec)	4.18±1.88	2.93±1.06	3.30±1.47	2.38±0.98	4.689**	4.269**

Discussion

The anthropometric characteristics of the subjects and BMI have been presented in Table 1. The results, which showed the comparison of anthropometric characteristics and BMI between male and female subjects, indicated that there was a significant difference ($p < 0.001$) of height and weight between male and female subjects. In case of BMI no significant difference was noted between male and female subjects.

The comparison of anthropometric characteristics and BMI between country side area and city area areas indicated that there was a significant difference ($p < 0.001$) of all the parameters between subjects of city area and country side area areas (Table 2). It was observed from the results that in city area areas anthropometric characteristics and BMI values were higher than that of country side area areas for the respondents of both sexes. The finding of the present study was not similar to some previous studies which reported that the above mentioned parameters were higher in country side area areas than in city area areas (22, 23) but it is in line with the study of Piyali et al.

Table 3 showed the comparison of different pulmonary function test (PFT) parameters between male and female subjects and it was observed from the results that the PFT parameters were significantly higher ($p < 0.001$) in males than that in females. Budhiraj et al (8) also reported lower pulmonary function values in female than the male subjects in similar age group. The sex difference in lung function may be attributed to various factors including of sex hormone, sex hormone receptor, or intracellular signaling pathway in addition to physiological and anatomical differences in respiratory system of male and female (19,20). This study also supports the hypothesis of the study of Salome et al (17).

It was observed from table 4 that there were a significant differences ($p < 0.001$) of PFT parameters between country side area and city area subjects. The results showed that the PFT values were higher in the subjects of city area areas than that in country side area areas. The finding of the present study

was in line with the study of Batool et al (24).

Conclusion

Prevalence of deranged BMI was significantly higher in city area population. There was a significant difference of height and weight between male and female subjects. In case of BMI no significant difference was noted between male and female subjects. City area anthropometric characteristics and BMI values were higher than that of country side area. Negative correlation found between BMI with Pulmonary function tests in both population.

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