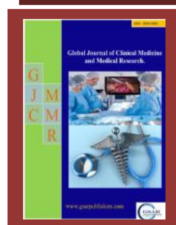


Global Journal of Clinical Medicine and Medical Research [GJCMMR]
ISSN: 2583-987X (Online)
Abbreviated key title: Glob.J.Clinic.Medici.Medica.Res.
Frequency: Monthly
Published By GSAR Publishers
Journal Homepage Link- https://gsarpublishers.com/journal-gjcmmr-home/

Impact of Obesity on Forced Vital Capacity among Adult Males: A Cross-Sectional Study

By

Dr. Kanavi Roopa Shekarappa[1] Dr. Smilee Johncy S.[2], Dr. Basavaraj S Mannapur[3]

[1] Professor and HOD, Department of Physiology, B.G.S Global Institute of Medical Sciences Bangalore
[2] Professor and HOD, Department of Physiology, J. J.M. Medical College, Davangere, Karnataka.
[23] Professor, Department of Community Medicine, S. Nijalingappa Medical College, Bagalkot , Karnataka.

Article History

Received: 25/04/2026
Accepted: 28/04/2026
Published: 30/04/2026

Vol – 4 Issue – 4

PP: -14-17

DOI:10.5281/zenodo.19999266

Abstract

Background: *Obesity has a substantial impact on respiratory physiology and is a rapidly growing global health concern. Excess adipose tissue deposition, particularly in the thoracic and abdominal regions, alters lung mechanics and results in reduced lung volumes. One important measure of pulmonary function that captures lung capacity and chest wall mechanics is forced vital capacity, or FVC.*

Objective: *To evaluate the impact of obesity on Forced Vital Capacity in adult males aged 30–60 years.*

Methods: *A cross-sectional comparative study was conducted on 200 healthy male subjects aged 30–60 years, who were divided into obese (BMI ≥30 kg/m², n=100) and non-obese groups (BMI 18.5– 24.9 kg/m², n=100). FVC was measured using computerized spirometry, and the best of three acceptable manoeuvres was recorded. Statistical analysis included Student's unpaired t-test, Pearson's correlation coefficient, 95% confidence intervals, and effect size estimation.*

Results: *The mean FVC in non-obese subjects was 2.76 ± 0.50 L, whereas in obese subjects it was 1.94 ± 0.30 L. The mean difference was 0.82 L (95% CI: 0.70–0.94), which was statistically significant ($t = 15.1$, $p < 0.001$). Percentage predicted FVC was also significantly lower in obese subjects (71.0 ± 6.2% vs 87.5 ± 4.5%, $p < 0.001$). A significant negative correlation between BMI and FVC ($r = –0.56$, $p < 0.001$) was observed.*

Conclusion: *Obesity is associated with a significant reduction in Forced Vital Capacity, indicating restrictive pulmonary changes.*

Keywords: *Obesity, Body Mass Index, Forced Vital Capacity, Pulmonary Function.*

Introduction

Obesity is defined as excessive accumulation of adipose tissue that impairs health and is commonly assessed using Body Mass Index (BMI)[1]. It has become a major global health issue due to its rising prevalence and association with increased morbidity and mortality.[2]

The respiratory system is one of the many organ systems impacted by obesity. Reduced chest wall compliance and limited diaphragmatic movement are caused by excess adipose tissue in the thoracic and abdominal regions.[3] Reduced lung volumes and increased breathing effort are the results of these mechanical alterations.

Forced Vital Capacity (FVC) is an important parameter in pulmonary function testing that reflects the maximum volume of air exhaled after maximal inspiration.[4] Reduced FVC is typically seen in restrictive lung conditions and is commonly observed in obese individuals.

Studies have shown that obesity produces a restrictive pattern of pulmonary impairment characterized by reduced lung volumes.[5] The reduction in FVC is mainly due to mechanical restriction imposed by adipose tissue accumulation.

Understanding the relationship between obesity and lung function is important, as reduced pulmonary function may contribute to respiratory morbidity. Thus, the purpose of this

*Corresponding Author: **Dr. Smilee Johncy S**

© Copyright 2026 GSAR Publishers All Rights Reserved
This work is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License.

study was to assess how obesity affects adult males' forced vital capacity.

Materials and Methods

After obtaining institutional ethical approval, this cross-sectional comparative study was carried out with the aim of assessing the impact of obesity on pulmonary function, specifically Forced Vital Capacity (FVC). A total of 200 apparently healthy adult male participants between the ages of 30 and 60 years were recruited for the study. The subjects were divided into two groups based on their Body Mass Index (BMI): a non-obese control group comprising 100 individuals with BMI ranging from 18.5 to 24.9 kg/m², and an obese group consisting of 100 individuals with BMI ≥30 kg/m². Participants were selected after careful screening to ensure they met the predefined inclusion and exclusion criteria. Only healthy males within the specified age group were included to avoid gender-related physiological variations in lung function. To remove potential confounding factors, people with a history of smoking, respiratory conditions like asthma or chronic obstructive pulmonary disease, heart related illness diseases, and a BMI between 25 and 29.9 kg/m² were excluded.

Standardised methods were used to record anthropometric measurements, such as height and weight. BMI was computed by dividing weight in kilograms by the square of height in meters. A computerised spirometer was used to test pulmonary function in a controlled laboratory setting. In order to guarantee correct technique, subjects were given instructions about the process and given the opportunity to practise the manoeuvre before the test. In compliance with standard spirometry guidelines, each participant executed a minimum of three acceptable and repeatable forced expiratory manoeuvres. In order to avoid fatigue, sufficient rest was given in between attempts. To guarantee measurement accuracy and dependability, the highest value among the three technically acceptable readings was taken into account for analysis. Strict adherence to procedural guidelines was maintained throughout the study to reduce variability and guarantee data quality, and all tests were performed in a sitting position with the use of a nose clip to prevent air leakage.

Statistical Analysis

Standard techniques were used for statistical analysis, and all data were expressed as mean ± standard deviation (SD). The unpaired t-test was used to evaluate differences between the non-obese and obese groups. The relationship between variables like BMI and FVC was assessed using Pearson's correlation coefficient (r). Cohen's d was computed to evaluate effect size, and the 95% confidence interval (CI) was used to determine the precision of the results. Statistical significance was defined as a p-value of less than 0.05.

Results

Table 1: Comparison of Forced Vital Capacity between non-obese and obese subjects

Parameter	Non-obese (n=100)	Obese (n=100)	Mean Difference	95% CI	t value	p value
FVC (L)	2.76 ± 0.50	1.94 ± 0.30	0.82	0.70–0.94	15.1	<0.001 HS
FVC (% predicted)	87.5 ± 4.5	71.0 ± 6.2	16.5	14.8–18.2	21.7	<0.001 HS

All values expressed as Mean ± SD

Analysis for all parameters done by Unpaired' test

HS – Highly Significant, S – Significant and NS – Not Significant.

Table 2: Age-wise comparison of Forced Vital Capacity between non-obese and obese subjects

Age Group (years)	Non-obese FVC (L)	Obese FVC (L)	p value
31–40	2.82 ± 0.50	1.98 ± 0.20	<0.001 HS
41–50	2.79 ± 0.70	1.95 ± 0.30	<0.001 HS
51–60	2.73 ± 0.30	1.90 ± 0.30	<0.001 HS

All values expressed as Mean ± SD

Analysis for all parameters done by Unpaired' test

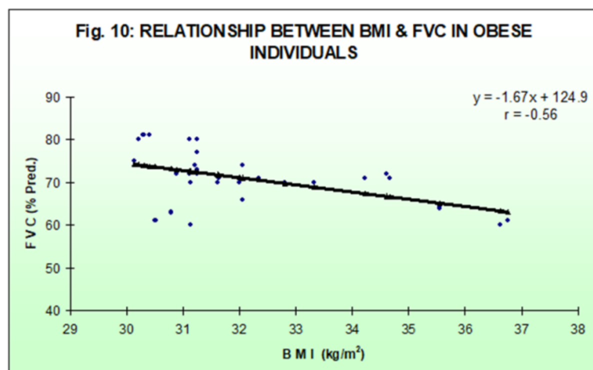
*Corresponding Author: **Dr. Smilee Johncy S**

© Copyright 2026 GSAR Publishers All Rights Reserved

This work is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License.

HS – Highly Significant, S – Significant and NS – Not Significant.

Fig : 1 Relationship between Body Mass Index (BMI) and Forced Vital Capacity (FVC).



Comparison of Forced Vital Capacity between obese and non-obese subjects showing a statistically significant reduction in FVC among obese individuals. (Table-1)

Age-wise comparison demonstrating significantly lower FVC values in obese individuals across all age groups. (Table-2)

Scatter plot showed the relationship between Body Mass Index (BMI) and Forced Vital Capacity (FVC). A significant negative correlation was observed ($r = –0.56$, $p < 0.001$), indicating that FVC decreases as BMI increases. (Fig -1)

Discussion

The present study clearly demonstrates a significant reduction in Forced Vital Capacity (FVC) among obese individuals when compared to their non-obese counterparts. The drop demonstrated the significant effect of increased body mass on pulmonary function and was both statistically and clinically significant. FVC is an important indicator of lung capacity and respiratory efficiency, and its decline in obese individuals reflects underlying restrictive changes in lung mechanics. These results highlight that obesity is not just a metabolic condition but also brings about serious respiratory effects that can affect total well-being and. quality of life.

The conclusions drawn from the present research align with prior studies carried out in this area. Rubinstein et al. reported a marked reduction in lung volumes, including FVC, in obese individuals, suggesting that excess body weight adversely affects pulmonary function[8]. Similarly, Chen et al. found that increasing body weight was associated with a progressive decline in various pulmonary parameters, including FVC[9]. Furthermore, Jones and Nzekwu demonstrated that lung volumes decrease consistently with increasing BMI, reinforcing the concept that obesity has a dose-dependent effect on respiratory function[10]. The evidence that obesity is a major factor in decreased lung capacity is strengthened by the findings' consistency across several studies.

The observed decrease in FVC in obese people can be explained by a number of physiological processes. The buildup of adipose tissue in the abdominal and thoracic areas , which places mechanical restrictions on the respiratory system, is one of the main causes. It is more difficult for the lungs to expand during inspiration when there is excess fat in the chest wall because it decreases chest wall compliance. As a result, the total lung capacity is reduced, which lowers FVC. Furthermore, abdominal obesity is important because it restricts the diaphragm's ability to descend. Restricting diaphragmatic excursion reduces inspiratory capacity because it is necessary for efficient ventilation. and contributes to lower lung volumes.[11]

The detrimental effects of obesity on lung function are further supported by recent research. According to a study by van Huisstede et al., mechanical restriction and altered respiratory mechanics are the main reasons why obesity is associated with significant reductions in lung volumes, including Forced Vital Capacity. [12].

Similarly, Forno et al. reported that increasing adiposity is independently associated with reduced lung function parameters, including FVC, highlighting the role of both mechanical and inflammatory pathways[13]. In addition, a large population-based study by Baffi et al. confirmed that obesity contributes to a restrictive pattern of lung impairment with reduced FVC, even in otherwise healthy individuals[14].

The increased effort required to breathe in obese people is another significant contributing factor. In order to achieve proper ventilation, respiratory muscles like the diaphragm and intercostal muscles must exert more force due to the additional mechanical load from adipose tissue. Breathing requires more energy as a result of this increased effort, which could lead to early respiratory muscle fatigue. This may eventually lead to a decline in pulmonary function and respiratory efficiency. Furthermore, rapid and shallow breathing, which is a characteristic of the altered breathing pattern frequently seen in obesity, further impairs effective gas exchange and lowers FVC.

Body weight and lung function have an inverse relationship which is further supported by the study's finding where BMI and FVC were found to have a negative correlation. As BMI increases, the degree of mechanical restriction on the lungs becomes more pronounced, leading to a progressive decline in FVC.

The decrease in FVC among obese people has significant clinical consequences. Breathlessness, decreased exercise tolerance, and early exhaustion during physical activity are some signs of decreased lung capacity. Daily functioning and quality of life may be severely hampered by these symptoms. Moreover, lower FVC is linked to a higher chance of respiratory disorders like obesity hypoventilation syndrome and obstructive sleep apnoea. If left untreated, these conditions may worsen respiratory compromise and cause major complications.

The current study has a number of noteworthy advantages that strengthen the reliability of its conclusions. The results' statistical power and dependability are enhanced by the comparatively large sample size. Strict inclusion and exclusion criteria ensured that obesity was the primary cause

*Corresponding Author: Dr. Smilee Johncy S
© Copyright 2026 GSAR Publishers All Rights Reserved
This work is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License.

of the observed variations in FVC by reducing confounding variables. Additionally, the use of a computerised spirometer allowed for the objective and consistent measurement of pulmonary function, improving the data's accuracy and repeatability.

But it's also important to recognise some limitations. Because only men participated in the study, the results cannot be applied to the female population. Similar studies with female participants are required because gender differences in fat distribution and respiratory physiology may affect pulmonary function. The study's cross-sectional design is another drawback since it makes it impossible to establish a causal link between obesity and decreased FVC.

To overcome these limitations, future research should include a more varied population that includes both males and females. Larger sample sizes and multi-center research would further enhance the generalisability of the results. Longitudinal studies are particularly important when assessing how weight gain or loss affects pulmonary function because they can provide insight into the reversibility of respiratory changes linked to obesity.

Conclusion

People who are obese have a markedly lower Forced Vital Capacity. Impaired pulmonary function is indicated by a negative correlation between increasing BMI and FVC.

These results underline the necessity of preventive measures to lessen obesity-related respiratory impairment and the significance of early evaluation of lung function in obese people.

References

1. World Health Organization. Obesity: Preventing and managing the global epidemic. Geneva: WHO; 2000.
2. Haslam DW, James WP. Obesity. Lancet. 2005; 366:1197–1209.
3. Vaz M, Kurpad A, Raj T. Guyton and Hall textbook of medical physiology. 4th South Asia ed. New Delhi: Elsevier India; 2024.
4. West JB. Respiratory Physiology: The Essentials. Lippincott; 2012.
5. Salome CM, King GG, Berend N. Physiology of obesity and effects on lung function. J Appl Physiol. 2010;108: 206–211.
6. Zerah F, Harf A, Perlemuter L. Effects of obesity on respiratory resistance. Chest. 1993;103:1470–1476.
7. Schachter LM, Salome CM, Peat JK. Obesity is a risk factor for asthma and reduced lung function. Thorax. 2001;56:4–8.
8. Rubinstein I, Zamel N, DuBarry L. Airflow limitation in morbidly obese nonsmoking men. Ann Intern Med. 1990; 112:828–832.
9. Chen Y, Horne SL, Dosman JA. Body weight and weight gain related to pulmonary function decline in adults. Chest. 1993; 103:1773–1777.
10. Jones RL, Nzekwu MMU. The effects of body mass index on lung volumes. Chest. 2006;130:827–833.
11. Sahebjami H. Dyspnea in obese healthy men. Chest. 1998;114:1373–1377.
12. Van Huisstede A, Cabezas MC, Birnie E, van de Geijn GJ, Rudolphus A, Mannaerts G,et al. Systemic inflammation and lung function impairment in morbidly obese subjects. Respir Med. 2020; 161:105846.
13. Forno E, Han YY, Mullen J, Celedón JC. Overweight, obesity, and lung function in children and adults: a meta-analysis. J Allergy Clin Immunol Pract. 2020; 8(10): 3395–3406.e3.
14. Baffi CW, Wood L, Winnica D, Strollo PJ, Gladwin MT, Que LG, Holguin F.
Metabolic syndrome and the lung: a review of the literature. Eur Respir Rev. 2021;30(159):200268.

*Corresponding Author: **Dr. Smilee Johncy S**

© Copyright 2026 GSAR Publishers All Rights Reserved

This work is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License.