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An Observational Study of Peak Expiratory Flow Rate Variations Across Gender and Height in Young Adults

Dr. Shaikh Nilofar[1*], Dr. Tanweer Alam[2], Dr. Ataullah Fahad[3], Dr. Nazmeen[4]

[1]Research Scholar, Department of Munaf -ul -Aza (Physiology), A & U Tibbia College, Karol Bagh, New Delhi, Delhi, India
[2]Assistant Professor, Department of Mahiyatul Amraz (Pathology), Z.H Unani Medical College & Hospital,Naya Quilla,Siwan, Bihar 841226, India
[3]Professor, Department of Mahiyatul Amraz (Pathology), Ajmal Khan Tibbia College,Aligarh, India
[4]Assoc. Professor, Department of Physiology, A & U Tibbia College, Karol Bagh, New Delhi, Delhi, India

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***Corresponding author:** Dr. Shaikh Nilofar
Research Scholar, Department of Munaf -ul -Aza (Physiology), A & U Tibbia College, Karol Bagh, New Delhi, Delhi, India

Abstract **Original Research Article**

Ventilatory function tests, such as PEFR, provide a better understanding of lung changes from a diagnostic perspective. The European Respiratory Society has defined the PEFR as the maximal flow achieved during expiration and delivered with maximal force, starting from the level of maximal lung inflation, following the maximal inspiration expressed in liters/min. Factors such as age, sex, body surface area, Body mass index (BMI), posture, physical activity, ethnicity, etc, can influence Peak Expiratory Flow Rate (PEFR) as well as vital capacity. ***Material and methods:*** Healthy medical students (18-25 years) were enrolled in the study. PEFR was assessed using a Helios 702 spirometer. The data were analyzed statistically. ***Results:*** This study aimed to investigate the variations in Peak Expiratory Flow Rate (PEFR) based on gender and height. The findings revealed significant differences in PEFR values between males and females, with males exhibiting better lung function (mean PEFR = 8.33 ± 1.40) compared to females (mean PEFR = 6.19 ± 1.10), likely due to physiological differences such as lung volume and muscle mass. In terms of height, a positive correlation was observed, with taller individuals (≥170 cm) showing the highest mean PEFR (9.02 ± 1.71), indicating superior lung function associated with greater stature. PEFR values also improved progressively with increasing height, suggesting that taller individuals tend to have larger lung volumes and better respiratory capacity. These findings support the hypothesis that both gender and height significantly influence PEFR values, with males and taller individuals demonstrating superior lung function.

Keywords: Gender, Height, PEFR, Spirometry, Lung Function.

INTRODUCTION

A major function of the respiratory system is the exchange of gases between the atmosphere and blood. The main processes involved in the process are ventilation (movement of air in and out of lungs), distribution of ventilated gases into various lobes, segment lobules, and diffusion of gases between the alveoli and plasma. Inspiration is an active process. Quiet expiration is passive [1].

In recent times, the measurement of PEFR has become a useful tool. From a diagnostic viewpoint, it provides a better understanding of lung changes [2].

Peak expiratory flow rate (PEFR) is considered the simplest index of pulmonary function. The European Respiratory Society defines PEFR as the maximal flow that is achieved during expiration, which is delivered with maximal force, starting from the level of maximal lung inflation, following the maximal inspiration, which is expressed in liters/min (Pedersen, 1997; Quanjer *et al.,* 1997). The average PEFR of healthy Indian males and females is found to be around 500 and 350 l/min, respectively (Ebomoyi and Iyawe, 2005) [3,4]. Peak expiratory flow rate (PEFR) primarily reflects large airway flow and depends on the voluntary effort and muscular strength of the subject [5].

RANGE OF NORMAL VALUES FOR A PEFR:

According to Gender:

Males have larger lung sizes, more respiratory bronchioles, and wider airways thanfemales, leading to gender differences in static lung volumes and capacities. Males typically exhibit larger measurements and increased lung volumes [6].

Table 1: PEFR Value According to Gender

ADULT GENDER	PEFR VALUE
Male	**400-700L/min**
Female	**300-500L/min**

According to Height:

PEFR values can vary based on height. Tall stature is linked to higher lung volumes, while obesity generally lowers them.Central obesity notably impacts chest wall compliance, reducing FRC and ERV. The waist-to-hip ratio may better indicate fat distribution than BMI. In athletes, increased muscle mass can enhance lung volumes, suggesting total body fat is a more accurate obesity indicator than BMI [7,8].

Table 2: PEFR Values in young healthy adults according to height

HEIGHT	MALE(L/min)	FEMALE (L/min)
5'0" (152 cm)	500L/min	300L/min
5'3" (167 cm	580L/min	400L/min
5'6" (183 cm)	620L/min	430L/min
5'9" (198 cm)	640L/min	450L/min
6 (183 cm)	660 L/min	470L/min
6’3’(190cm)	670L/min	

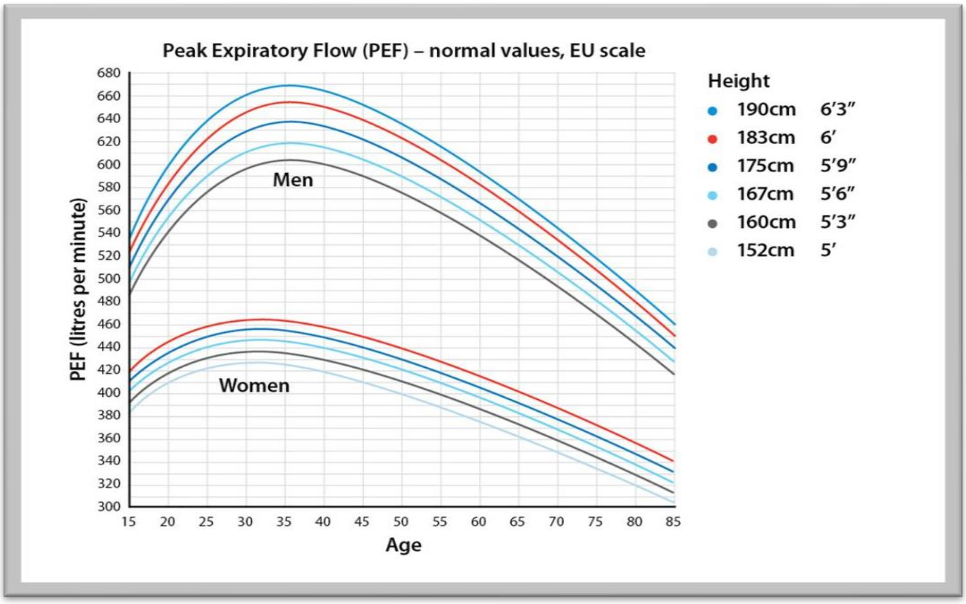


FIG-1: Normal PEFR values (L/min) based on height and gender, indicating the expected peak expiratory flow rates for males and females of different heights [9].

AIMS AND OBJECTIVES:

Aim: The primary aim of this study is to investigate the impact of gender and height on Peak Expiratory Flow Rate (PEFR) values, and to explore potential variations in PEFR across different gender and height categories.

Objectives:

1. To compare PEFR values between males and females.
2. To assess the relationship between height and PEFR values.
3. To analyze gender-based differences in PEFR after controlling for height.
4. To evaluate whether height alone significantly influences PEFR, independent of gender.
5. To identify potential trends or patterns in PEFR values across different height ranges within each gender group.
6. To contribute to a better understanding of how physical characteristics such as gender and height may affect respiratory function, specifically PEFR.

NEED FOR STUDY

This study is essential for understanding the influence of gender and height on Peak Expiratory Flow Rate (PEFR), a key indicator of pulmonary function. Variations in PEFR values, influenced by these factors, are crucial for improving the accuracy of pulmonary assessments and the early detection of respiratory conditions. By investigating the relationship between gender, height, and PEFR, this study aims to refine reference values for diverse populations, enhancing diagnostic precision. Additionally, the findings will support the development of personalized healthcare approaches, allowing for more tailored interventions in managing respiratory health. This research will contribute valuable data to the existing body of knowledge, informing the creation of population-specific guidelines and advancing clinical practices.

HYPOTHESIS

- **Primary Hypothesis:** There is a significant difference in Peak Expiratory Flow Rate (PEFR) values between males and females, with males exhibiting higher PEFR due to physiological differences in lung size and capacity.
- **Secondary Hypothesis:** Height is positively correlated with PEFR, with individuals of greater height demonstrating higher PEFR values due to larger lung volumes and airway dimensions.
- **Null Hypothesis:** There is no significant difference in PEFR values between males and females, and height does not have a significant impact on PEFR.

MATERIALS AND METHODS

Study area: Healthy students from A &U Tibbia College Karol Bagh, NewDelhi.110005
Study Design: Randomized Observational cross-sectional study.
Sample Size: 100
Duration of the study: 6 months

Inclusion Criteria:

- Healthy young adults aged 18–25 years.
- Both males and females.
- Participants who consent to the study after understanding the purpose and procedure.

Exclusion Criteria:

- Individuals with chronic respiratory conditions (e.g., asthma, COPD).
- Any abnormalities of the vertebral column and thoracic cage
- Smokers or individuals with significant exposure to environmental pollutants.
- Those with any comorbidity that may affect pulmonary function (e.g., cardiovascular diseases, neurological disorders).
- Pregnant women.

MATERIALS AND EQUIPMENT:

1. **Spirometer**: A calibrated digital spirometer will measure PEFR.
2. **Demographic and Health Questionnaire**: To collect personal information (age, sex, height, weight, occupation) and medical history, ensuring participants meet the inclusion criteria.
3. **Statistical Software**: SPSS software for data analysis, including comparison of means and correlation analysis.

METHODOLOGY:

1. **Participant Recruitment and Consent:** Participants will be recruited and briefed about the study's purpose, procedures, and potential risks. Written informed consent will be obtained from each participant before participation.
2. **Sampling method:** Using simple random sampling in Delhi (India), hundreds (119) of college students from Ayurvedic and Unani Tibbia College and Hospital, Karol Bagh, were selected as per inclusion and exclusion criteria and asked to complete the questionnaire. The data collection process started on 2nd March 2023 and ended on 17 Sept 2023. The participants were adequately informed about all relevant aspects of the survey, including the objective and interview procedures. All participants voluntarily participated in the survey, and the survey was anonymous.
3. **Pulmonary Function Testing (Spirometry):** Each participant will undergo spirometry testing to measure their Peak Expiratory Flow Rate (PEFR). The test will be conducted following standard protocols to ensure accurate results, with participants instructed to exert maximum effort during forced exhalation. To ensure the reliability and reproducibility of the measurements, at least three attempts will be made by each participant. The highest value from these attempts will be recorded as the final PEFR measurement, ensuring that the data reflects consistent and accurate performance during the test.
4. **Data Collection:** Demographics and spirometry results will be recorded.
5. **Statistical Analysis:** All data were entered into MS EXCEL and then analyzed with the help of SPSS (Statistical Package for Social Sciences) version 23. Descriptive statistics (mean, standard deviation) will summarize the data. The PEFR will be compared between the different Genders and different height groups using one-way ANOVA, depending on the data distribution. A p-value of <0.05 will be considered statistically significant.

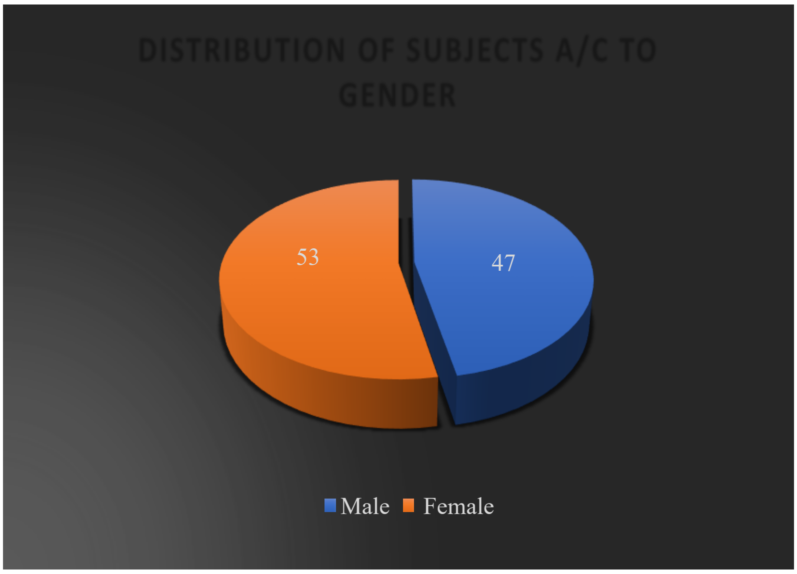
RESULT & OBSERVATION

7. DISTRIBUTION OF SUBJECTS ACCORDING TO THE GENDER

100 subjects were selected for the study, of which 47 are males (47%) and 53 are females (53%). This distribution ensures a balanced representation of bothgenders in the sample, providing a diverse group for analysis

Table: 3

• GENDER	• SUBJECTS	• PERCENTAGE
• MALE	• 47	• 47%
• FEMALE	• 53	• 53%
• TOTAL	• 100	• 100%

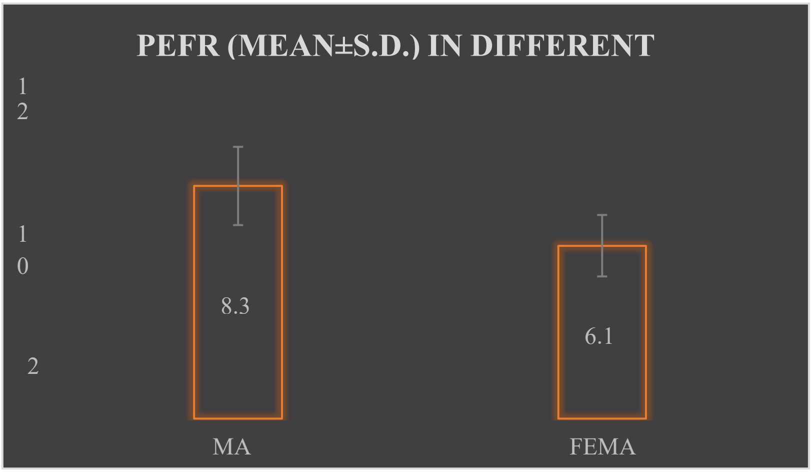


DISTRIBUTION OF MEAN STANDARD DEVIATION OF MEAN PEFRVALUE IN DIFFERENT GENDERS

The Male subjects have a higher mean PEFR value of 8.33 (S.D. = ±1.40), withmoderate variability.
The Female subjects have a lower mean PEFR value of 6.19 (S.D. = ±1.10), suggesting slightly reduced lung function, but with less variability compared to males.

Table: 4

GENDER	MEAN PEFR VALUE (MEAN ±S.D.)
MALE	8.33 ± 1.40
FEMALE	6.19 ± 1.10

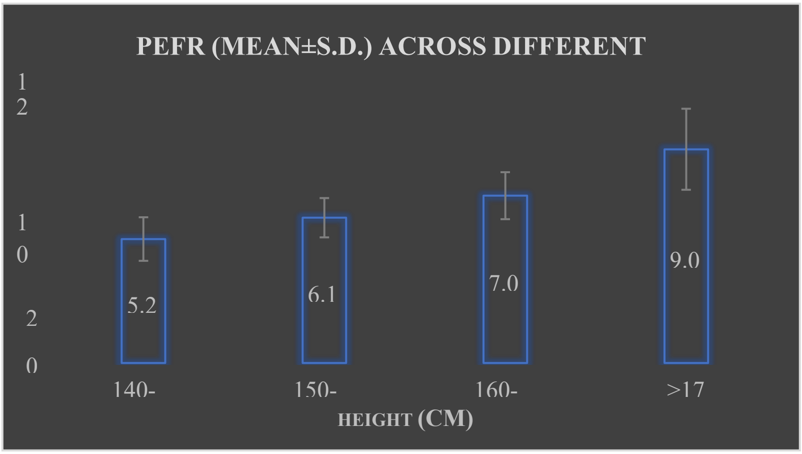


DISTRIBUTION OF MEAN ± STANDARD DEVIATION OF MEAN PEFRVALUE ACROSS DIFFERENT HEIGHT CATEGORIES

≥170 cm: The tallest group has the highest mean PEFR value of 9.02 ± 1.71 with thehighest variability.
160-169 cm: This group has a mean PEFR of 7.06 ± 0.99, with moderate variability.
150-159 cm: The mean PEFR for this group is 6.13 ± 0.82, with moderate variability.
140-149 cm: The shortest group has the lowest mean PEFR of 5.23 ± 0.92, with moderate variability.

Table: 5

HEIGHT	NO. OF PERSON	PEFR (MEAN±S.D)
140-149 cm.	7	5.23 ± 0.92
150-159 cm.	29	6.13± 0.82
160-169cm.	39	7.06 ± 0.99
≥170cm.	25	9.02 ± 1.71



DISCUSSION

The present study helped to assess the association of height and Gender with PEFR. This study showed that males had a significantly higher PEFR compared to females (p-value <0.05). Similar results were noted in the studies conducted by Behera et al [10]. and Ranjith et al [11]. among healthy adults. This could be due to the increased size of the lungs for the same height as well as the increased muscularity in males compared to females who have reduced muscle mass due to increased fat deposition. Another factor that can contribute to this result could be the influence of sex hormones, sex hormone receptors, or intracellular signaling pathways. Low stature, increased fat mass as well as decreased muscle build can contribute to reduced PEFR in females [12,13].

MEAN AND STANDARD DEVIATION OF MEAN PEFR VALUE IN DIFFERENT GENDER

Male (Mean PEFR = 8.33 ± 1.40):

The mean PEFR for males is 8.33, which indicates relatively good lung function. This could be attributed to physiological factors, such as larger lung volumes and higher muscle mass typically observed in males, which support better respiratory performance.

Female (Mean PEFR = 6.19 ± 1.10):

The mean PEFR for females is 6.19, which is lower than that of males, indicating generally weaker lung function.This could reflect physiological differences such as smaller lungvolumes and differences in airway size between genders. However, the smaller standard deviation also indicates more consistency in lung function acrossfemale participants.

MEAN ± S.D. PEFR VALUE BASED ON HEIGHT

140-149 cm (Mean ± S.D. = 5.23 ± 0.92): PEFR (5.23) is the lowest among the height categories, indicating that individuals in the 140-149 cm range generallyhave lower peak expiratory flow rates. This is likely due to smaller lung volumesassociated with shorter stature.

150-159 cm (Mean ± S.D. = 6.13 ± 0.82): For individuals in the 150-159 cm height range, the mean PEFR increases to 6.13, indicating an improvement in lung function compared to the 140-149 cm group.

160-169 cm (Mean ± S.D. = 7.06 ± 0.99): The mean PEFR of 7.06 for individuals in the 160-169 cm range is higher than in both previous groups, indicating further improvement in lung function with increasing height.

≥170 cm (Mean ± S.D. = 9.02 ± 1.71): The tallest individuals (≥170 cm) have the highest mean PEFR of 9.02, indicating superior lung function. The standard deviation (1.71) is the highest among all groups, suggesting that the average lung function is the best in this group.

CONCLUSION

Males demonstrate significantly better lung function compared to females, with a higher average PEFR of 8.33 compared to 6.19. The greater variability in male lung function (as indicated by a higher standard deviation) might be due to factors suchas body size, lung capacity, and other individual differences. In contrast, the more consistent but lower PEFR values in females suggest that while their lung functiontends to be more uniform, it is generally lower than that of males, which aligns with known gender-based physiological differences in respiratory health

PEFR increases with height, indicating that taller individuals generally have better lung function, likely due to larger lung volume and airway capacity. The variation in PEFR also increases as height increases, suggesting that taller individualson average show better lung function. This highlights a trend where height seems to play a role in respiratory capacity, with taller individuals showing the highest lung function.

Based on the results of the study, the primary hypothesis, which posited a significant difference in Peak Expiratory Flow Rate (PEFR) values between males and females, with males exhibiting higher PEFR due to physiological differences in lung size and capacity, was accepted. Additionally, the secondary hypothesis, suggesting a positive correlation between height and PEFR, with individuals of greater height demonstrating higher PEFR values due to larger lung volumes and airway dimensions, was also accepted. However, the null hypothesis, which stated that there is no significant difference in PEFR values between males and females and that height does not significantly impact PEFR, was rejected. These findings underscore the importance of gender and height as factors influencing PEFR.

Ethical Considerations: Ethical approval and informed consent will be obtained, with confidentiality maintained for all participant data.

Limitations: This study has many limitations. First, this study has been conducted as a single-center, hospital-based study, and hence, the study population may not be truly representative of the community.

- The study's cross-sectional nature limits the ability to infer causality.
- Environmental and lifestyle factors (such as diet and physical activity) may influence pulmonary function but may not be fully controlled in the study.

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Conflict of Interest: There are no conflicts of interest to declare. No financial, personal, or professional benefits were received in connection with the preparation of this research paper.

REFERENCE

1. Chakraborty A, Deka J. PEFR and its variation with respect to gender and anthropometric parameters among subjects of the age group 18–35 years. Natl J Physiol Pharm Pharmacol. 2024;14(11):2341-2344. doi: 10.5455/NJPPP. 2024.v14.i11.2. Available from: https://www.njppp.com/fulltext/281717169381.pdf?1737783332
2. Pederson O. The peak flow working group: Physiological determinants of Peak expiratory flow. Eur. Respir J. 1997;10(1):11s-16.
3. Ebomoyi, M.I. and Iyawe, V.I. 2005. Variations of peak expiratory flow rate with anthopometric determinants in a population with healthy adult Nigerians. Nijerian J Physiol Sci 20, 85–89.
4. Quanjer PH, Lebowiz MD, Gregg I, Miller MR, Pederson OF. Peak expiratory flow. Conclusion and recommendations of a working party of the European Respiratory Society. Eur Respir J. 1997;10(24):25-85.
5. Pederson O. The peak flow working group: Physiological determinants of Peak expiratory flow. Eur. Respir J. 1997;10(1):11s-16.
6. Enright PL, Linn WS, Avol EL, Margolis HG, Gong H Jr, Peters JM. Quality of spirometry test performance in children and adolescents: Experience in a large field study. Chest 2000; 118:665 71.
7. Nystad W, Samuelsen SO, Nafstad P, Langhammer A. Association between level of physical activity and lung function among Norwegian men and women: the HUNT study. Int J Tuberc Lung Dis. 2006;10(12):1399– 1405. [PubMed] [Google Scholar]
8. Pellegrino R, Crimi E, Gobbi A, Torchio R, Antonelli A, Gulotta C, et al. Severity grading of chronic obstructive pulmonary disease: the confounding effect of phenotype and thoracic gas compression. J Appl Physiol. 2015;118(7):796–802. doi: 10.1152/japplphysiol.00801.2014.
9. https://upload.wikimedia.org/wikipedia/commons/thumb/b/ba/Normal_values_for_peak_expiratory_flow_-_EU_scale.png/800px-Normal_values_for_peak_expiratory_flow_-_EU_scale.png
10. Behera AA, Behera BK, Dash S, Mishra S. Variation of pulmonary function tests with relation to increasing age in healthy adults. Int J Health Sci Res 2014; 4:3641.
11. Babu KR, Mohit M, Kolekar D. A Comparative Study of Peak Expiratory Flow Rate (PEFR) and BMI in Male and Female Medical Students. Int J Health Sci Res.2015:5:273-78.
12. Card JW, Zeldin DC. Hormonal influences on lung function response to environmental agents. Proc Am ThoracSoc 2009; 6:58895.
13. Algadir A, Aly F, ZafarH. Sex-based difference in lung functions of Saudi adults. J PhysTherSci 2012; 24:59.