

## Comparison of Peak Expiratory Flow Rate Measurements Using A Flow Metre and Spirometer

Jai Ram Singh<sup>1</sup>, Rajni Kant<sup>2</sup>, Krishna Kant Prasad Singh<sup>3</sup>

<sup>1</sup>Associate Professor, Department of Physiology, Anugrah Narayan Magadh Medical College, Gaya, Bihar, India

<sup>2</sup>Assistant Professor, Department of Physiology, Anugrah Narayan Magadh Medical College, Gaya, Bihar, India

<sup>3</sup>Professor and HOD, Department of Physiology, Anugrah Narayan Magadh Medical College, Gaya, Bihar, India

Received: 10-06-2021 / Revised: 04-07-2021 / Accepted: 14-08-2021

Corresponding author: Dr. Rajni Kant

Conflict of interest: Nil

### Abstract

**Aim:** Evaluate the Peak flow meter and digital spirometer. **Methods:** This cross-sectional comparative study conducted in the Department of Physiology, Anugrah Narayan Magadh Medical College, Gaya, Bihar, India, for 11 months. 180 healthy male students in the age group of 18-25 years were selected. After taking a detailed personal history, anthropometric parameters such as height and weight were measured using standard methods and from this, body mass index was calculated. **Results:** Our study comprised 180 healthy male students, aged between 18 and 25 years. The mean PEFr measured by peak flow meter and spirometer was  $342.1 \pm 121.98$  L/Min and  $297.88 \pm 119.12$  L/Min, respectively, as shown in Table 2. PEFr value is significantly greater when measured by peak flow meter than by spirometer ( $P < 0.05$ ). **Conclusion:** Even though the value measured by both instruments varies, still the peak flow meters as they are not expensive, easy to handle, and perform, as it also gives consistent readings, therefore, it can be recommended for measuring PEFr in healthy individual and daily monitoring of symptoms in asthma and COPD patients.

**Keywords:** COPD, PEFr, Spirometer.

This is an Open Access article that uses a fund-ing model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

### Introduction

Peak expiratory flow rate (PEFR) can be explained as the maximal expiratory flow rate by a subject for at least 10 milliseconds expressed in Litre per minute (L/min). PEFR is a simple, reliable, reproducible and easily measurable ventilatory lung function test. This simple test can be performed by different types and shapes of instruments for long since and there is large availability of these instruments which are also inexpensive, portable devices and which has made PEF

monitoring easier & feasible[1]. PEFR are the dimensions of the large intra and extra thoracic airways[2], the force generated by the expiratory muscles, the speed with which maximal alveolar pressure is[3] and how prior to PEFR manoeuvres, the lung was stretched. PEFR has also been well correlated with maximum expiratory pressure which is a representation of respiratory muscle. Most of the digital spirometers measures PEF along with FEV1 (Force expiratory volume in one

second) and FVC (Forced vital Capacity). It has been recorded in previous studies that different spirometers and different Peak Flow Meters can record PEF differently with some error rates which can be up to 26% in laboratory calibration tests.

PEFR is highly sensitive and accurate index of airway obstruction. It can be used as a guideline of admission and discharge of asthma when PEFR value >60% of expected admission is probably unnecessary, 40-60% of expected consider admission and <40% of expected-admission is probably necessary[6]. Peak flow measurement is sensitive indicator to measure the strength of muscles of respiration[5]. Most of the peak flow meter uses a traditional Wright scale to record PEF whilst after 2004 Peak flow meters. It has not formally been assessed whether the PEF values measured with digital spirometer are in close agreement with the PEF values measured with other peak flow meters.

#### Material and methods:

This cross-sectional comparative study conducted in the Department of Physiology, Anugrah Narayan Magadh Medical College, Gaya, Bihar, India, for 11 months. 180 healthy male students in the age group of 18-25 years were selected. The subjects with a history of major respiratory, cardiac illness, or neurological disorders or with a history of major surgery or injury in the recent past, smoking, alcohol consumption, obesity, and pregnant females will be excluded from our study. Informed and written consent was taken from all the participants. After taking a detailed personal history, anthropometric parameters such as height and weight were

measured using standard methods and from this, body mass index was calculated. General physical and systemic clinical examination was done to rule out any pathology. All the recordings were done between 10 and 11 am to avoid diurnal variations.

The subjects were instructed about the procedure for recording PEFR. All the subjects were made acquainted with peak flow meter and spirometer before actual recording. PEFR was recorded in sitting position.

First, the PEFR was recorded using the mini-Wright's peak flow meter and the value was obtained in L/min. Three readings are taken at a time from each subject and the best among these is taken as final value. Similarly, for spirometry, Spiro lab 3 computerized spirometer was used and the PEFR value is noted along with other values like FVC. It is also expressed as L/min.

#### Statistical Analysis

All results were expressed as mean  $\pm$  standard deviation SD. Student's paired *t*-test was used to analyze the data using the SPSS software 21.0. *P* < 0.05 was considered as statistically significant.

#### Results

Our study comprised 180 healthy male students, aged between 18 and 25 years. Table 1 shows the anthropometry parameters of the subjects. The mean PEFR measured by peak flow meter and spirometer was  $342.1 \pm 121.98$  L/Min and  $297.88 \pm 119.12$  L/Min, respectively, as shown in Table 2. PEFR value is significantly greater when measured by peak flow meter than by spirometer (*P* < 0.05).

**Table 1: Anthropometric parameters**

Variables	Mean $\pm$ SD
Height (m)	155.21 $\pm$ 5.3
Weight (kg)	55.77 $\pm$ 5.8
BMI (9 kg/m <sup>2</sup> )	21.98 $\pm$ 3.6

SD: Standard deviation, BMI: Body mass index

**Table 2: Recording of PEFR by peak flow meter and digital spirometer**

PEFR		P value
Peak flow meter	Digital spirometer	
342.1±121.98	297.88±119.12	<0.05

### Discussion

In the present study, the mean PEFR measured by peak flow meter and spirometer was  $342.1 \pm 121.98$  L/Min and  $297.88 \pm 119.12$  L/min, respectively. The PEFR value recorded by peak flow meter was significantly high than the PEFR value recorded by spirometer. Similar studies have been done. One of the studies that go in accordance with our study was a study done by Tiwari et al.,[7] which showed a high value of PEFR values in normal subjects and lower values in chronic obstructive pulmonary disease (COPD) patients and almost identical values in asthma patients, and there was no significant difference in the mean values of peak flow meter and spirometer. A similar study done by Takara et al.[8] showed that the PEFR value obtained from peak flow meter was higher when compared to that obtained from spirometer, whereas the value from Gale Med meter was lower than the spirometric value. These differences in values were shown to be statistically significant.

However, few other studies do not show any significant difference in PEFR value measured by both instruments[9,10]. A similar study done by Dr. Shubhi Thomar on comparison of PEFR values using peak flow meter and spirometer correlates with each other and the mean difference between PEF using peak flow meter and spirometer was statistically significant ( $P < 0.05$ )[11].

This difference in PEFR value shows peak flow meters even though they are simple and cost effective, they cannot totally replace the spirometer for measuring PEFR, this does not mean that the peak flow meter performs poorly or not validated. Spirometer is used to diagnose

asthma, determine its severity, and also helpful to monitor the progress of asthma. However, due of its high cost, it cannot be made available at all centers, especially in peripheries, even patients cannot use it for self-monitoring of symptoms. As our study was done on healthy individuals, there was difference in the value. Further study can be taken on asthmatic and those having COPD to know if the difference exists in them also or not.

PEFR being highly sensitive and an accurate index of airway obstruction and also an indicator to measure the strength of respiratory muscles, it would be preferably better to use device, which is more handy, simple, reliable, and convenient to use. The peak flow meter is cost effective, and patients can perform on own and can be made available in public and private health-care systems, compared to spirometry which is of higher cost and mainly it is available only in hospital set up and the patients need to go to hospital for every follow-up. In our study, limitation is that only Wrights peak flow meter was used, and values are not compared with other type of peak flow meters available. The study was done on normal individuals and not on asthma or COPD patients.

### Conclusion

Even though the value measured by both instruments varies, still the peak flow meters as they are not expensive, easy to handle, and perform, as it also gives consistent readings, therefore, it can be recommended for measuring PEFR in healthy individual and daily monitoring of symptoms in asthma and COPD patients.

### Reference

1. Dhillon S, Kaur H, Kaur N. A Comparative Study of Peak Expiratory

- Flow Rates of Rural and Urban Males. Indian Journal of Fundamental and Applied Life Sciences. 2011 October-December: 1 (4) ;255-258.
2. Mellissnos CG, Mead J. Maximal expiratory flow changes induced by longitudinal tension on trachea in normal subjects. Journal of Applied Physiology: Respiratory Environmental Exercise Physiology .1977; 43: 537-544.
  3. Potter WA, Olafsson S, Hyatt RE. Ventilatory mechanics and expiratory flow limitation during exercise in patients with obstructive lung disease. Journal of Clinical Investigations. 1971; 50:910-918.
  4. Jain SK, Kumar R, Sharma DA. Factors influencing peak expiratory flow rate in normal subjects. Lung India. 1983; 3:92-97.
  5. Dikshit M.B., Raje S And AgrawaL. M. J. Lung Functions with Spirometry: An Indian Perspective-I. Peak Expiratory Flow Rates. Indian J Physiol Pharmacol 2005; 49 (1) : 8–18.
  6. Mridha M, Amin MR, Kabir A. Peak Expiratory Flow Rate (PEFR)-A Simple Ventilatory Lung Function Test. J Shaheed Suhrawardy Med Coll, 2011;3(2): 44-47.
  7. Tiwari VK, Bansal S, Sood S, Kumar A, Shukla R. Comparative evaluation of peak expiratory flow rate between computerized spirometry and peak flow meter. Int J Adv Integr Med Sci 2016; 1:93-4.
  8. Takara GN, Ruas G, Pessoa BV, Jamami LK, Di Lorenzo VA, Jamami M. Comparison of five portable peak flow meters. Clinics (Sao Paulo) 2010; 65:469-74.
  9. Imbruce RP. Standardized testing of four commercially available peak flow meters. Immunol Allergy Pract 1991; 13:49-54.
  10. Eichenhorn S, Beauchamp RK, Harper A, Ward JC. An assessment of three portable peak flow meters. Chest 1982; 82:306-9.
  11. Tomar S. Comparison of PEF measurements using peak flow meter and digital spirometer among people of Udupi District; a cross sectional study. Indian J Sci Res 2014; 9:102-4.