

Original Research Article

# Effect of body positions on peak expiratory flow rates in adult asthmatics

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	International Archives of Integrated Medicine, Vol. 3, Issue 5, May, 2016. Copy right © 2016, IAIM, All Rights Reserved. Available online at <a href="http://iaimjournal.com/">http://iaimjournal.com/</a> ISSN: 2394-0026 (P) ISSN: 2394-0034 (O)
	Received on: 21-04-2016 Accepted on: 02-05-2016 Source of support: Nil Conflict of interest: None declared.
<b>How to cite this article:</b> Tipnis NA, Shah S. Effect of body positions on peak expiratory flow rates in adult asthmatics. IAIM, 2016; 3(5): 101-105.	

## Abstract

**Background:** The National Institute of Health asthma guidelines recommend assessing PEF during hospitalization including improvement to a PEF of >70% of the predicted value before discharge. The Global Initiative for asthma recommends monitoring of PEF in hospitalized patients. Current guidelines for correct PEF maneuver include standing, but it has been observed that many respiratory therapists and patients use supine position.

**Aim:** To determine which one of the 3 different positions i.e. standing, lying back at 45° angle on pillows and sitting up slumped forward 10° with legs extended generates higher peak expiratory pressure and can be used as optimal position for generating peak expiratory flow in asthmatics.

**Materials and methods:** A cross sectional study was performed in 20 asthmatic subjects aged 18-50 years in whom correct instructions for PEF technique were given according to guidelines of National Institute of Health. The steps were repeated 3 times in each position and the best of 3 attempts in each of the 3 positions were used for analysis. Level of significance kept at 5%.

**Results:** Mean and SD of lying back at 45° was 254.5±29.28, sitting up with slumped forward 10° was 281±28.26 and that of standing was 302.5±27.88. Statistically significant result was found using nonparametric test i.e. Friedman test where  $\chi^2=40$  and  $p=0.0001$ .

**Conclusion:** There is significant difference between PEFR values in standing, sitting with slump forward 10° and lying back 45° position. Standing position is the best option for adult asthmatics to measure their PEF values as it generated maximum PEF.

## Key words

Peak expiratory flow rate, Asthma, Body position, Standing, Supine.

## Introduction

As part of objective monitoring of asthma patients, peak expiratory flow rate (PEFR) is helpful in ambulatory as well as hospitalized patients [1]. The National Institute of Health asthma guidelines recommend assessing PEF during hospitalization including improvement to a PEF of  $\geq 70\%$  of the predicted value before discharge [1]. The Global Initiative for asthma recommends monitoring of PEF in hospitalized patients [2]. Current guidelines for correct PEF maneuver include standing [1]. However, it has been observed that respiratory therapists sometimes do not ask patient to get up and stand and monitor PEF with patient lying back in bed or sitting slumped forward with legs extended in bed.

### Null hypothesis

There is no effect of three body positions on peak expiratory flow rate in adult asthmatics.

### Alternative hypothesis

There is effect of three body positions on peak expiratory flow rate in adult asthmatics.

## Materials and methods

**Study design:** Cross sectional (observational) study.

**Sample size:** 20 asthmatic patients (10 males, 10 females).

**Study duration:** 4 weeks

**Sampling method:** Purposive sampling

**Study subjects:** Adult asthmatics of age 18-50 years, both male and female.

### Inclusion criteria

- Those diagnosed with asthma.
- 18-50 years of age.
- Those willing to participate.

### Exclusion criteria

- Smokers and alcoholics.
- Orthopedic or neurological deficits.
- Uncooperative individuals.
- Those not able to follow command.

Subjects were explained about the nature of study prior to assessment and written consent of each subject was taken. A demonstration of correct and incorrect PEF was shown prior to assessment. A portable peak flow meter also known as mini wright flow meter was used. The correct instructions for PEF technique were given according to guidelines of National Institute of Health [1], they were as follows.

- Move indicator to the bottom of numbered scale.
- Stand up.
- Place mouthpiece into your mouth and close your lips around it; do not put your tongue inside hole [3]. Place nose clip on the nose.
- Blow out as hard and as fast as you can in a single blow.

The steps were repeated 3 times and the best of 3 attempts were used for analysis. The same manoeuvre was performed in lying back  $45^{\circ}$  and sitting slumped forward  $10^{\circ}$  with legs extended. A 5 second rest period was given in between each attempt in each position. (Photo – 1, 2)

## Results

Level of significance was kept at 5%. SPSS version 16.0 was used. Mean of standing, lying back at  $45^{\circ}$  angle on pillows and sitting up slumped forward  $10^{\circ}$  with legs extended was taken in both males and females individually as well as together. In nonparametric test, friedman test was used. (Table – 1, 2 and Figure – 1)

**Table – 1:** Descriptive statistics.

Position	Subjects	Minimum (L/MIN)	Maximum (L/MIN)	Mean (L/MIN)	S.D
Lying back $45^{\circ}$	20	200	300	254	29.28
Sitting $10^{\circ}$ protracted	20	220	320	281	28.26
Standing	20	250	350	301	27.88

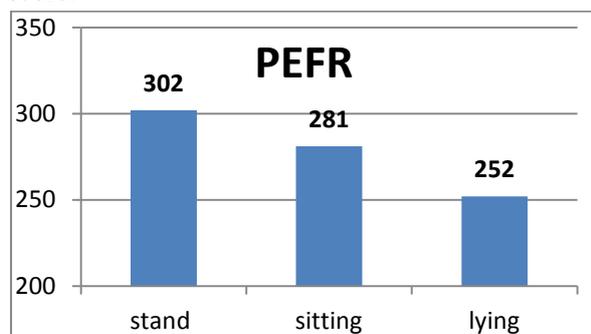
## Discussion

Purpose of this study was to see effect of 3 body positions i.e. standing, lying back at 45° angle on pillows and sitting up slumped forward 10° with legs extended on PEF of adult asthmatics. Mean of PEF in standing (302±29 L/min) was significantly higher than lying back at 45° (254±29L/min). Sitting up slumped forward 10° with legs extended (281±29L/min) was higher than lying back at 45° (254±29L/min). There was no significant difference between standing and sitting slumped forward 10° with legs extended. Males had higher mean PEF than females in all 3 positions. Thus, standing position can be recommended to all asthmatics for regular monitoring to measure PEF as it generates the maximum flow.

**Table – 2:** Non-parametric Friedmann statistical test.

<b>Subjects</b>	<b>20</b>
Chi square	40
df	2
Asymp. Significance	0.0001

**Figure – 1:** PEF of all subjects with the mean score.



Haffejee, et al. [4] in year 1988, studied effect of supine position on PEF values of in asthmatic children, aged 4-11 years. The child was kept in supine position for 30 minutes every 4 hours. The results showed significant decrease in PEF in asthmatic children in supine position. Conclusion was that airflow obstruction can be induced by supine posture in asthmatic children. Similarly Jessica Wallace, et al. [5] in the year 2013, studied PEF of normal subjects in 3

different positions and recorded for 3 attempts in all 3 positions. The mean PEF in males in standing (669±42 L/min) was significantly higher than in lying back (621±42 L/min) and sitting (615±42 L/min) (p<0.001). Similar results were seen in females where standing (462±42 L/min) was significantly higher than lying back (422±42 L/min) or sitting (447±42 L/min) (p<0.05).

It was concluded that it should be ensured by the clinicians that PEF should be taken with patients in standing position. During forced expiration, in standing there is greater recoil pressure generated by the lung and chest wall combined with higher pressure generated by abdominal contractions. This combined action pushes air at high speed through narrowed airways resulting in higher PEF. Also in standing there is greater arousal level, which may lead to higher PEF [6].

Nagasaki, et al. [7] in the year 1996, performed a study in 74 people in Japan out of which 32 had asthma. No differences were found in the measurements of standing and sitting peak expiratory flow rate. However, healthy patients did have higher average PEF measurements than the ones with asthma.

Vaswani, et al. [8] in the year 2005 evaluated peak flow measurements in both sitting and standing positions for men and women aged 18-58 years. Asthmatic patients were excluded. No significant differences between sitting and standing were seen.

N. Siva Jyothi, et al. [9] in the year 2015, performed study on effect of different postures on peak expiratory and inspiratory flow rate in healthy individuals. Supine, prone, sitting and standing positions were used. The peak expiratory flow was highest in standing than in sitting, supine and prone (p<0.05).

Heloisa, et al. [10] in the year 2013, studied effect of dorsal and lateral decubitus position on peak expiratory flow in healthy subjects. They concluded that body position affects values of

PEF and that left lateral decubitus position can be used as an alternative to sitting position.

Jenny Jayapal, et al. [11] in the year 2016 studied effect of diurnal variations on peak expiratory flow rates in healthy females in south India. Both lying and standing position was used. Peak

expiratory flow rate was more in standing than lying position. ( $p < 0.05$ ) and it was concluded that effect of posture maybe of importance in recording PEFR and changing to a better posture maybe useful for patients with weaker expiration.

**Photo – 1:** Measurement of PEFR in all 3 positions. A - standing, B - lying back  $45^\circ$ , C - sitting with shoulders protracted  $10^\circ$ .



**Photo – 2:** The mini wright peak flow meter used for the study.



### Limitations

- Small sample size.
- Age was between 18-50 years only. Both extremes of age i.e. children and elderly asthmatic population were not included and further studies are needed for this population.
- Portable peak flow meter was used. Spirometry would give more accurate results along with values of  $FEV_1$  and FVC.
- Asthmatic medications, particularly bronchodilators can affect the PEFR, and information regarding whether patient has taken it before testing has not been taken prior to measurements.

## **Conclusion**

Body position has significant effect on PEF values in adult asthmatics. Standing position generated maximum PEF in both adult males as well as females. Thus, all healthcare providers should encourage patients when performing PEF manoeuvre to use standing position if able to do so.

## **Clinical implication**

- The respiratory therapist measuring the PEF should state in record which position was used when PEF was determined.
- In patients who cannot stand up, sitting would be the next convenient option.

## **Acknowledgement**

We would like to thank all the individuals who cooperated and participated in the study.

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