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Original Article

An Indian Study of Peak Expiratory Flow Rates in a Group of Young Adults

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Abstract

Background. Peak Expiratory Flow Rate (PEFR) reflects the strength and condition of respiratory muscles and the degree of airflow limitation in large airways. PEFR shows postural variation that follows a specific pattern in asthmatics and healthy individuals has been identified. Adequate data is not available for the postural variation in normal individuals who are students in professional courses and had a sedentary life style. Lung volumes in normal subjects were significantly higher in standing position. Others have reported that in healthy subjects spirometric indices were higher in the standing in comparison with the sitting position whereas other studies have reported no differences between spirometric values obtained in lying, sitting and standing positions.Hence this study is undertaken to study the postural variation in peak expiratory flow rates in healthy adult female subjects in South India.

Method. Peak expiratory flow rate was recorded in 50 adult healthy female students aged 18-23 years and studying in professional courses . Mini wright's peak flow meter was used to measure the peak expiratory flow rate. Three readings were taken PEFR in standing and lying posture. Best of three recordings taken as the final value.

Results. PEFR is decreased in lying posture compared to standing posture in subjects studied and the quantum of difference was noted.

Conclusion. In postural changes, peak expiratory flow rate measurements significantly differ based on whether the measurements are taken in the standing or in the lying posture in healthy participants. The effect of posture may be of importance in recording peak expiratory flow rate and changing to a better posture may be especially useful for those patients with weak expiration.

Keywords: *peak expiratory flow rate, postural variation, south Indian female.*

Introduction

Peak Expiratory Flow Rate (PEFR) reflects the strength and condition of respiratory muscles and the degree of airflow limitation in large airways. PEFR shows postural variation that follows a specific pattern in asthmatics and healthy individuals has been identified. Adequate data is not available for the postural variation in normal individuals who are students in professional courses and had a sedentary life style. Hence this study is undertaken to study the postural variation in peak expiratory flow rates in healthy adult female subjects in South India.

Peak expiratory flow rate is one of the pulmonary function tests that provide a quantifiable measure of lung function. It is relatively a simple and easy procedure

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to evaluate respiratory function when compared with pulmonary function testing. Peak expiratory flow is measurement of the movement of air into and out of the lungs during various breathing manoeuvres[1].

In effect of postural changes, lung volumes in normal subjects were significantly higher in standing position[2]. Other studies reported that in healthy subjects spirometric indices were higher in the standing in comparison with the sitting position[3] whereas some other studies have reported no differences between spirometric values obtained in lying, sitting and standing positions[4].

Aims & Objectives: This study is undertaken to study the postural variation in peak expiratory flow rates in healthy adult female subjects in South India.

Material & Method: Present study was conducted in the pulmonary function lab on 50 apparently healthy sedentary female subjects aged 18-23 years and studying in professional courses using wright's peak flow meter was used to measure the peak expiratory flow rate. Three readings were taken PEFR in standing and lying posture. Best of three recordings taken as the final value.

Ethical Clearance was obtained from institution ethical committee.

Before starting the actual study subjects were briefed about the protocol and informed consent was obtained. Thorough history regarding suitability as per the above inclusion and exclusion criteria was elicited. Basic clinical examination was done to rule out any cardiopulmonary or other illness.

Precautions observed, during the manoeuvre:

It was ensured that the subject was comfortable and relaxed.

Apparatus was sterilized and cleaned properly.

Subject was trained adequately to perform different maneuvers.

Subject was instructed to hold the instrument in such a way that the hand did not obstruct the movement of the pointer.

The pointer was kept at the lower most level. Both the nostrils were clipped while blowing into the equipment.

Body mass index (BMI)

BMI was calculated from height and weight of the subject by using following formula.

BMI= weight (kg)/ height $(m)^2$.

Body surface area (BSA)

BSA was calculated by using Dubois' Formula as follows.BSA (m^2) = weight (kg) $^{0.425}$ × height (cm) $^{0.725}$ ×0.007184 (Dubois 1916).

Statistical Analysis

To analyze the diurnal variation of PEFR, the maximum out of the 3 recordings was taken as the final value.

PEFR was measured in standing and lying position were analyzed by using one way ANOVA followed by Tukey's test with $p< 0.05$ was taken as the level of significance.

Results

The anthropometric values of the subjects are given in table 1.On analysis of PEFR records of individual subjects, it was seen that there was an overall dip in PEFR values in lying down posture (Table 2)

Table 1: Basic subject information

	Number	Age (years)	Height (cm)	Weight(kg)	BMI	BSA (m^2)
Female	50	18.14±2.05	172.2 ± 8.48	66.79± 16.54	21.84 ± 3.51	1.94 ± 2.69

Table 2: Mean PEFR values of standing and lying posture for female subjects

Female	7-8am	10-11am	1-2pm	4-5pm	7-8pm
Standing	346.6±48.6	345.4±48.71	361.5±52.5	353.3±45.9	350.2±43.45
Lying	317.7±44.02	319.3±48.06	329.2±49.6	326.3±49.7	322±42.6

Discussion

In this study postural change of healthy female individuals was studied. Our results show that PEFR is decreased in lying posture compared to standing posture in female subjects studied. These study findings are in contrast to the findings reported by Baduraddin *et al* 2010[4]. They have reported that there was no significant difference of PEFR in standing, sitting and lying position.

Our study findings are similar to the reports of Fiz *et al* 1991 where they have reported that maximum inspiratory and expiratory pressures values decreased in the supine posture with respect to standing and sitting positions[5].

In the erect posture the diaphragm descends, therefore, the capacity of the thoracic cage increases. In the supine position, the diaphragm is pulled upward because the abdominal viscera push the diaphragm. Therefore, the capacity of the thoracic cage decreases. Hence, vital capacity is greater in the erect posture than in the supine position. In the supine position due to elimination of the effect of gravity, the blood flow to the lung increases. This decreases vital capacity. In the standing posture, blood is pooled in the lower extremities, therefore venous return decreases. This decreases pulmonary blood flow, thus vital capacity increases on standing.

Increased lung volumes in the standing position appear to be related to the increased thoracic cavity volume[4]. Increased lung volume leads to greater elastic recoil. Following a deep inspiration (as in preparation for a maximal expiratory manoeuvre), a larger amount of potential energy is stored in the tissue of the chest wall. Further, the contracting diaphragm increases pressure on abdominal contents pushing them forward and distending the abdominal cavity. This places the abdominal muscles at a slight stretch. Expiratory muscles attain their optimal length during standing and at more stretched lengths, the abdominal muscles may be more capable of stronger contractions and thus help in the generation of higher maximum expiratory pressure (MEP).

During a forced expiration in standing, the greater recoil of the lung and chest wall is combined with higher pressures generated by abdominal contraction. This combined action pushes the air at high speeds through narrowing airways resulting in the higher MEP and PEFR. Other factors that may have influenced the results in the standing position could include subject comfort and a higher arousal level.

Conclusion

In postural changes, peak expiratory flow rate measurements significantly differ based on whether the measurements are taken in the standing or in the lying posture in healthy participants. The effect of posture may be of importance in recording peak expiratory flow rate and changing to a better posture may be especially useful for those patients with weak expiration.

Conflict of Interest: None

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