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## Effect of Gender on the Peak Expiratory Flow Rate in Diabetic Population: A Pilot Study

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### ABSTRACT

The diabetic population is expected to increase to 366 million by 2030 from the estimated 171 million in 2000. Studies on the lung functions, especially, the peak expiratory flow rate in diabetics are very less in Chennai, South India. To measure the Peak Expiratory Flow Rate (PEFR) among Diabetics and to study the effect of gender on it Institutional Ethical Committee clearance obtained. Questionnaire was administered, written consent obtained and anthropometry measured. PEFR was measured using Wright's Peak Flow meter as per ATS/ERS protocol. Data analysis done using SPSS software, statistical significance taken at  $p < 0.05$ . Out of 51 subjects, 24 were men and 27 were women. RBS was  $216 \pm 96.10$  mgs% and  $206.11 \pm 61.06$  mgs% and PEFR was  $5.97 \pm 1.92$  (L/sec) and  $3.82 \pm 1.38$  (L/sec) in men and women respectively. Using unpaired students "t" test, PEFR were lower in women than men and found to be statistically significant ( $p < 0.0001$ ). Decreased PEFR in females could be due to hormonal influences, sedentary lifestyle, and poor respiratory muscle strength. Periodic assessment of lung functions including PEFR is mandatory to reduce morbidity and mortality of pulmonary complications.

**Keywords:** Diabetes mellitus, PEFR, Gender difference, blood sugar

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## INTRODUCTION

Type II Diabetes mellitus (DM) is being increasingly diagnosed everyday. Worldwide many researchers have studied the effects of DM on various organs. Being an important metabolic disorder in both genders, DM has been a disease of great interest to researchers in India too. Studies have shown reduced pulmonary functions among both males and females in India. But, in Chennai, South India, not many studies have been done to show the effect of gender on the peak expiratory flow rate.

Peak expiratory flow rate (PEFR) is defined as the maximal flow rate during expiration after maximal inhalation of the lungs starting from expiration. It is easily reproducible, less expensive, non-invasive test used mainly in asthmatics to assess the prognosis of the disease and to study the effect of bronchodilators on the lungs. PEFR is an indicator of air flow in larger airways and is influenced by respiratory muscle strength and voluntary effort of the patient.

Pulmonary functions vary with age, height, BMI and geographical location. Literature review shows proofs for many of these parameters. But the influence of gender on pulmonary parameters has been less studied in South Indian population. These factors have initiated us to proceed with our study.

## MATERIALS AND METHODOLOGY

Institutional Ethical Committee clearance was obtained. Type II DM patients attending the OPD of SreeBalaji Medical College and Hospital were recruited after informing them the benefits of our study.

Definitions and cut-offs: Diabetes mellitus was diagnosed as per the World Health Organisation criteria or already known diabetics on treatment [1].

DM patients in the age group of 45-65 years, both male and females were included. Patients with H/O asthma, breathlessness and early morning continuous cough were excluded from our study. Study questionnaire administered, anthropometry measured and detailed examination of the respiratory system was carried out. Blood samples were collected and random blood sugar levels were assayed.

Wright's peak flow meter was used to measure PEFR after demonstrating the procedure with the help of trained personnel. Patients were seated comfortably with loose fitting clothing and measurement was done as per ATS/ERS criteria. PEFR was measured uniformly for all patients between 10 am to 12 noon to avoid diurnal variations in the results. Three measurements with adequate rest between them were made.

## RESULTS

54 DM patients enrolled for our study between April and June 2015 and 3 were excluded due to H/O asthma. 24 men and 27 women were included.

Table 1 show the baseline characteristics of our study population where anthropometric parameters like height, BMI and Waist hip Ratio (WHR) were significantly higher in male Type II DM than females. The random blood sugar levels among males and females were  $216 \pm 96.10$  mgs% and  $206.11 \pm 61.06$  mgs% respectively with no significant gender difference between them as shown in Table 2. In our study, there was no significant correlation between blood glucose levels and PEFR.

**Table 1: Baseline characteristics of the study population**

Parameters	Male(n=24)	Female(n=27)	P value
Age (Years)	49.71±10.96	46.07±8.88	0.20 (NS)
Weight (Kgs)	65±10.40	68.22±13.26	0.34(NS)
Height( m)	163.33±8.12	151.07±8.08	0.0001(HS)
BMI (Kg/m <sup>2</sup> )	24.78±3.90	28.93±5.14	0.002(HS)
WHR	0.91±0.04	0.84±0.06	0.0002(HS)

NS= Not significant

HS= Highly significant

Based on H/O duration of DM, patients were categorised into 3 groups: Group 1= less than 5years, Group 2=5 to 15years, Group 3= more than 15years. Table 3 depicts measured PEFR values and we found significant reduction in its values in females of Group I and II but not in Group III as they were probably lesser in number.

**Table 2: Random blood sugar and Peak expiratory flow rates of the study population**

Parameters	Male(n=24)	Female(n=27)	P value
RBS(mgs%)	216±96.10	206.11±61.06	0.66 (NS)
PEFR (L/sec)	5.97±1.92	3.82±1.38	0.0001 (HS)

NS= Not significant  
 HS= Highly significant  
 RBS- Random blood sugar

**Table 3: Gender effect on the Peak Expiratory flow rate among the three Groups**

Groups	Males	Females	P value
I	6.13±2.07(n=11)	3.44±1.39(n=11)	0.0019(HS)
II	5.75±1.96(n=11)	4.00±1.38(n=14)	0.0153(HS)
III	6.29±0.94(n=2)	4.49±0.89(n=2)	0.1881(NS)

Duration of DM: Group 1= less than 5years, Group 2=5 to 15years, Group 3= more than 15years.  
 NS= Not significant  
 HS= Highly significant

### DISCUSSION

The diabetic population is expected to peak to 366 million by 2030 from the estimated 171 million in 2000 [2]. Estimation of plasma glucose levels still remains the best biological marker to diagnose Diabetes mellitus. The WHO and International Diabetes Federation Technical Advisory Group met in Geneva in 2005 [1] and updated the guidelines for the diagnosis and definitions of diabetes mellitus as follows as depicted in Table 4.

**Table 4: WHO / International Diabetes Federation Recommendations**

Parameter	Fasting Plasma glucose / blood glucose
Fasting plasma glucose	>7.0 mmol/l (126mgs/dl)
Impaired glucose tolerance and 2 hour glucose	< 7.0 mmol/l (126mg/dl) and > 7.8 and < 11.1mmol/l
Impaired fasting glucose	6.1 to 6.9 mmol/l

In 1942, PEFR was introduced by Hadron and it was accepted as an index of spirometry later in 1949[3]. PEFR values depend on the strength of the abdominal muscles, intra-alveolar pressures and the ability of the lung to undergo elastic recoil. Known diabetics on treatment are included in our study Hence we are not able to eliminate bias due to treatment- induced effects on pathophysiology of the pulmonary organs. The option might be to exclude DM on treatment but it would change the characteristics of the study population.

Systemic inflammation secondary to DM is well established causative factor for various metabolic complications. Various international and national studies have postulated microangiopathy and collagen and elastin changes with increased non-enzymatic glycation of proteins and peptides due to hyperglycemia as causes of development of secondary pulmonary inflammation [4-6]. Thickening of alveolar epithelium, pulmonary capillary membranes and development of enlargement of the alveoli are some of the common autopsy findings in DM patients [7]. Pulmonary complications are closely related to other complications in DM patients.

In order to prevent these ill-effects it might be necessary to control the sugar levels in these patients. In our study, there was no correlation between blood sugar and PEFR probably because we had not estimated glycosylated haemoglobin and hence the random blood sugar levels alone were not sufficient. Also, the tendency of patients to follow diabetic diet strictly and to go for regular walking just before a week of their probable appointment with the dialectologist is a well-known fact in this part of the country.

Our earlier study in 2013 has also shown greatly reduced PEFr in geriatric females than males with strong negative correlation ( $r = -0.613$ ) between stress and PEFr [8]. Also the influence of steroid hormones on the lungs in females is less clearly understood and studies relating to puberty, pregnancy, ageing and menopause with PFT need to be undertaken in large scale. Despite advances on the hormonal influences on the various body systems, huge knowledge gaps on the role of gender and Pulmonary functions do remain.

#### LIMITATIONS

PEFR is also reduced in other settings like psychosocial factors, physical exercise, smoking and environmental pollution. Detailed questionnaire on these factors have to be enquired and analysed and correlated with PEFr in the future studies.

#### CONCLUSIONS

Decreased PEFr in females could be due to hormonal influences, sedentary lifestyle, and poor respiratory muscle strength. Periodic assessment of lung functions including PEFr is mandatory to reduce morbidity and mortality of pulmonary complications.

#### Future plans:

Complications of type II DM affects multiple organs and the most important target organ is the lungs. Periodic blood glucose measurement is essential for optimal maintenance of blood glucose levels. Similarly, periodic screening of the lung functions using simple, non-invasive and reproducible parameters is to be stressed. The need of the hour is to promote preclinical research to eliminate bias.

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