

## Effect of body mass index on pulmonary function tests among diabetic patients in Manipur

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### Abstract

**Introduction:** Diabetes mellitus (DM) is an important public health problem, where patients do not present with any pulmonary complaints because of large vascular and ventilatory reserve. As obesity is regarded as one of the risk factors leading to diabetes, the present study will try to determine the effect of body mass index (BMI) on pulmonary system.

**Aim:** The present study is aimed to find out the effect of BMI on pulmonary function tests (PFTs) among diabetic patients.

**Materials and Methods:** The study was undertaken in the departments of Physiology and Medicine to determine the effect of BMI on PFTs. Thirty (30) known diabetic patients were recruited from medicine OPD on the basis of guidelines according to American Diabetes Association (ADA) and they were divided into two groups based on their BMI. PFTs were performed using computerized spirometer. Data were entered and analyzed using independent student's t-test.

**Results:** Patients with higher BMI have reduced values of Forced Vital Capacity (FVC), Forced Expiratory Volume in 1st sec (FEV<sub>1</sub>), FEV<sub>1</sub>/FVC, Forced Expiratory Flow in between 25%-75% (FEF<sub>25-75%</sub>) compared to those with lower BMI, whereas with higher BMI, Peak Expiratory Flow Rate (PEFR) was increased. The differences in FEV<sub>1</sub>, PEFR and FEF<sub>25-75%</sub> values among the two groups were found to be significant (p-values are 0.003, 0.05 and 0.026 respectively).

**Conclusion:** Increased BMI can have detrimental effects on pulmonary functions among diabetics. So, early awareness about body weight and prevention strategy would be important steps towards making a diabetes free nation.

**Keywords:** Body Mass Index (BMI), Diabetes Mellitus, Pulmonary Function Tests (PFTs).

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### Introduction

Diabetes mellitus (DM) is an important public health problem with about 347 million people being diagnosed to have diabetes with a global average prevalence of approximately 10%, according to World Health Organization (WHO). India is referred to as the diabetes capital of the world and estimation says that by 2025, there will be nearly 70 million people with diabetes in India, which means every 5<sup>th</sup> diabetic in the world would be an Indian.<sup>1</sup>

Usually diabetic patients do not present with any pulmonary complaints because of its large vascular and ventilatory reserve, which is the reason behind the poor understanding of pulmonary complications of diabetes. But abnormal phagocytic actions induced by hyperglycaemia and the impact of non-enzymatic glycation of the lung rich in collagen and elastin may lead to stiffening of the thorax and lung parenchyma are some of the reasons given for lung involvement in diabetic process.<sup>2</sup>

Obesity is always regarded as an important risk factor for metabolic syndromes including diabetes. As higher body weight is associated with hypertriglyceridemia, this might play a role in the pathogenesis of decreased lung functions in diabetic patients.<sup>3</sup> Abdominal obesity was strongly associated with lung function impairment, independently of major risk factors.<sup>4</sup> Obesity also causes reduction in pulmonary function parameters like FEV<sub>1</sub>/FVC at all ages while FVC and Maximum Mid Expiratory Flow (MMEF) were negatively associated with body mass index (BMI).<sup>5</sup> So the aim of this study is to find out the effect of BMI on pulmonary function tests (PFT) parameters in diabetic patients.

### Material and Methods

It was a cross-sectional study, which was conducted in the Departments of Physiology and Medicine, RIMS, Imphal during the period of 5 (five) months (July, 2016 to November, 2016). Thirty (30) known diabetic patients were recruited for the study,

who were selected on the basis of guidelines according to American Diabetes Association (ADA). The patients were divided into two groups: group-I with BMI 18- 24.9 and group II where BMI was above 25. The height and weight were measured and BMI calculated. Pulmonary Function Tests (FVC, FEV<sub>1</sub>, FEV<sub>1</sub>/FVC, PEFR and FEF<sub>25-75%</sub>) were recorded using Computerized Spirometer (Helios 702, RMS, Chandigarh). Ethical approval was taken from Research Ethics Board, RIMS, Imphal. Data were collected and entered in SPSS (Statistical Package for the Social Sciences, version 21) and the association of two groups were analyzed using independent student's t-test.

**Results and Discussion**

The study evaluated various pulmonary functions among diabetic patients which are FVC, FEV<sub>1</sub>, FEV<sub>1</sub>/FVC, PEFR and FEF 25-75%.

The results of the two groups were obtained and compared. Out of 30(thirty) diabetic cases, 21(twenty one), belonged to group I and 9(nine), to group II. The mean age of group I and group II patients were 56.85±11.8 yrs and 50.11±8.1yrs respectively as shown in table I.

**Table I: Mean age of the groups**

Group	Number(n)	Age(yrs)
I	21	56.85±11.8
II	9	50.11±8.1

Table II showed that few lung parameters (FVC, FEV<sub>1</sub>, FEV<sub>1</sub>/FVC & FEF 25%-75%) were decreased among group II patients in comparison with group I patients, but PEFR values were increased among group II patients. It was found that only FEV<sub>1</sub>, PEFR and FEF<sub>25%-75%</sub> values were significantly associated with increased BMI.

**Table II: PFT values among the patients**

Parameters	Group I	Group II
FVC(L)	2.7510±0.68	2.6544±0.75
FEV <sub>1</sub> (L)	2.2548±0.18*	1.7044±0.72*
FEV <sub>1</sub> /FVC	69.6610±9.69	66.0722±23.24
PEFR(L/S)	3.4287±0.90*	4.5933±2.38*
FEF <sub>25%-75%</sub>	3.1195±0.72*	2.3611±0.98*

Study by Adeyeye OO et al<sup>2</sup> showed no significant association of BMI with PEFR (3.70±0.98, p=0.00) and FEV<sub>1</sub>(1.61 ±0.62, p=0.00). However a negative association were found between BMI and FVC (2.03 ±0.76, p=0.00). In contrast, the present study showed significant association between BMI with PEFR

and FEV<sub>1</sub>, but no such association between BMI and FVC.

A study done by Klein OL et al<sup>6</sup> have found significant reduction in FEV<sub>1</sub> (75.3 ± 0.7% of predicted) and FVC (71.2 ± 0.7% of predicted) among high BMI diabetics, where the present study have these values as 1.7044±0.72 and 2.6544±0.75 respectively in high BMI group-II, which is quite low when compared to lower BMI group-I (2.2548±0.18 and 2.7510±0.68 respectively)

Again, Özmen B et al<sup>7</sup> found gradual diminution of values of FEV<sub>1</sub> among three groups of BMI in which the values were 105±10.59%, 100.33±7.23% and 96.50±17.09% of the predicted values respectively for BMI groups of <25, 25-26.9 and >27. But in cases of FVC and FEF<sub>25%-75%</sub>, there were variations among the different groups. FVC was maximum (96.67±10.50% of predicted) among patients of BMI 25-26.9 in comparison to FVC values of 92.89±10.43% and 91.39±14.65% of predicted among patients of BMI <25 and >27 groups respectively. Again FEF<sub>25%-75%</sub> value was maximum (110.44±31.16% of predicted) among patients of BMI <25 in comparison to values of 85.67±15.89% and 89.28±39.79% of predicted among BMI groups 25-26.9 and >27 respectively. But these values were within normal limits and showed no significant association, whereas the present study showed decreasing values of these three parameters with increasing BMI and the differences were significant.

According to Rao UR et al<sup>8</sup>, reduced values of FVC were found to be associated with increasing BMI, but higher values of FEV<sub>1</sub> and FEV<sub>1</sub>/FVC were associated with increasing BMI, whereas the present study showed that all the parameters (FVC, FEV<sub>1</sub> and FEV<sub>1</sub>/FVC) were kept on decreasing with increased BMI.

S Karande et al,<sup>9</sup> Panesar P et al,<sup>10</sup> Kaur S et al<sup>11</sup> and Mane SB et al<sup>12</sup> also found significant reduction in values of all PFT parameters with raised BMI. But contrary to these studies, the present study showed similar findings except for PEFR which was found to be increased with increasing BMI. On the other hand, studies by Gajbhiye RN et al,<sup>13</sup> Acharya P et al<sup>1</sup> and Latha S et al<sup>5</sup> did not find any correlation between BMI and PFTs which are against the finding of the present study.

The relevance of decrease in FEV<sub>1</sub> and increase in PEFR with increase in BMI among the diabetic patients need to be examined in the context of normal physiological functions of lungs. So, perhaps increased BMI might have detrimental effects on the pulmonary functions.

## Conclusion

Increased BMI seem to have detrimental effects on pulmonary functions among diabetics. So, the need of the hour will be early awareness about body weight management and prevention strategy which would be the important steps towards making a diabetes free nation.

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