



## Pulmonary function test in diabetes mellitus and correlation with duration of diabetes mellitus: A study in Shaheed Ziaur Rahman medical college hospital, Bogura, Bangladesh

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### Abstract

**Introduction:** Although diabetes is a multi-systemic disorder its pulmonary involvement is not extensively studied. Pathoanatomical studies in diabetic patients have represented changes in basal lamina of alveolar epithelium and capillaries. This study was undertaken to find out the correlation between duration of DM and PFTs in patients who attended or admitted to medical OPD of Ziaur Rahman Medical College Hospital, Bogura, Bangladesh.

**Aims and Objectives:** The present study is conducted to find the relation between duration of diabetes and its impairment of pulmonary function tests (PFT) in Type 2 DM patients.

**Study Population:** One hundred diabetic patients previously diagnosed, belonging to either sex attending admitting to OPD of Ziaur Rahman Medical College Hospital, Bogura, Bangladesh during from March to August 2018.

**Methods:** Patients will be classified into three groups A, B, C depending on the duration of diabetes. Group A consists of diabetes with duration of up to 3 years. Group B consists of diabetes with duration of 3 to 5 years. Group C consists of diabetes with duration more than 5 years. Pulmonary function tests were done for all cases and controls.

**Results:** Our results showed that diabetic patients have reduced FEV1, FVC, FEV1/FVC%, PEFR when compared with healthy non diabetic controls. Mean FEV1 in our study is 2.496 litres/min which is reduced significantly than control ( $p < 0.001$ ). Mean FVC in our study is 3.161 which is reduced significantly ( $p < 0.001$ ). There is a restrictive pattern in diabetics when compared with the non-diabetic controls of same age.

**Conclusion:** Type-2 diabetic patients have reduced FEV1, FVC, PEFR when compared with non-diabetics of same age. Type 2 diabetic patients have a restrictive pattern of pulmonary function tests even in the absence of any symptoms. This restrictive pattern is more prominent as the duration of diabetes is increased. Periodic monitoring of lung functions is necessary in diabetics as spirometry is a cost effective, non-invasive tool.

**Keywords:** hypertension, macrovascular, pulmonary function tests

### 1. Introduction

Diabetes is one of the important non-communicable disease of the modern era, which leads to multi system involvement i.e cardiac, nervous, renal, ophthalmic, genito urinal, gastro intestinal, dermatological etc. Although diabetes is a multi-systemic disorder its pulmonary involvement is not extensively studied. Pathological studies in diabetic patients have represented changes in alveolar epithelium and capillaries. The consequence is development of obstructive or restrictive disorders. Despite advancements in understanding the pathogenesis of diabetes and the complications, the pathology of lung involvement is not well established. The PFT might show a restrictive pattern. The probable mechanisms explained are due to the advanced glycation of end products (AGE's). First due to the pro inflammatory effect of AGE's. Second one is functional alteration of lung connection tissue by AGE's. The other proposed mechanisms are micro vascular involvement lead to changes in lung parenchyma. Due to endothelial dysfunction vasodilation does not occur. Insulin resistance may also play role in lung dysfunction. Neuropathy of thoracic nerves leading to respiratory muscle abnormality may have a role. With these proposed mechanisms it is clear that pulmonary involvement is

similar to other micro vascular complications of diabetes and may co-exist with other micro and macro vascular complications. If diabetes is detected early and adequate steps are taken, it may be possible to significantly delay the occurrence of complications and there after their progression." Although a lot of research is going on the effects of Diabetes Mellitus on pulmonary function tests all over the world, the literature supporting to this is not in abundance in India. Therefore this study was undertaken to find out the correlation between duration of type 2 DM and PFTs in diabetic patients who attended or admitted to medical OPD or wards" of Ziaur Rahman Medical College Hospital, Bogura, Bangladesh.

### 2. Aims and Objectives

The present study is conducted to find the relation between duration of diabetes and its impairment of pulmonary function tests (PFT) in Type 2 DM patients.

### 3. Methodology

One hundred (100) diabetic patients previously diagnosed, belonging to either sex attending admitting to OPD of Ziaur Rahman Medical College Hospital, Bogura, Bangladesh, will be studied. Patients will be classified into three groups

A, B, C depending on the duration of diabetes. Group A consists of diabetes with duration of up to 3 years. Group B consists of diabetes with duration of 3 to 5 years. Group C consists of diabetes with duration of 5 to 7 years.

**Source of Data**

100 Patients with diabetes mellitus attending OPD in Department of diabetology and admitted in department of general medicine Of Ziaur Rahman Medical College Hospital, Bogura, Bangladesh during the study period from March to August 2018.

**Inclusion Criteria**

Previously diagnosed Type 2 Diabetic patients for less than 7 years, between age 40-60 years, with regular follow up. One hundred age and sex matched non-diabetic were included as the other group. Diabetes was ruled out in non-diabetic group with fasting and 2-hr post prandial blood glucose measurement.

**Exclusion Criteria**

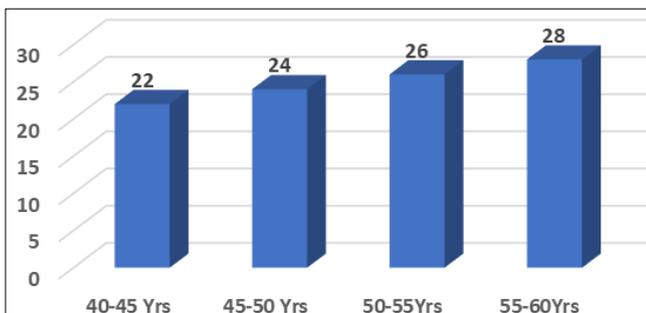
Smokers, patients with previous/present cardio respiratory diseases, h/o occupational exposure, Persons with physical disabilities, Obese (BMI>30), Neuromuscular diseases were excluded from the study

**Method of Collection of Data**

Patients were made to undergo pulmonary function tests using Medspiror, for 3 times at every 15 minutes interval and best of 3 readings was taken. The Forced Vital Capacity (FVC), Forced Expiratory Volume at the end of one second (FEV1), Peak Expiratory Flow Rate (PEFR), FEV1/ FVC ratio were recorded.” Diabetes mellitus was ruled out in non-diabetic group by fasting and post prandial blood glucose was analysed by GOD-PAP (glucose oxidase-phenol 4-aminophenazone peroxidase) method.” Other relevant investigations are done ECG in all leads, Echocardiogram, Fasting and 2 hr blood sugar, Chest X RAY.

**4. Results and Statistical Analysis**

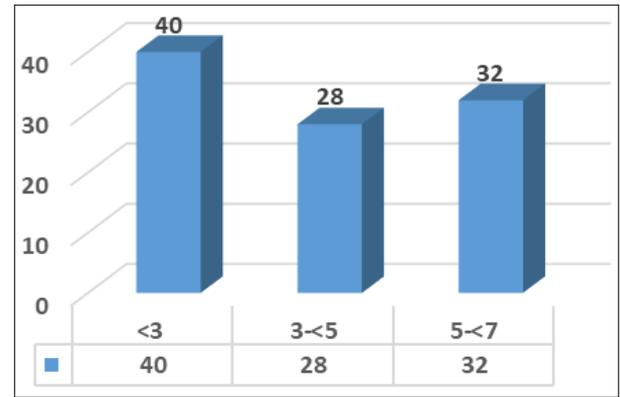
This study was 100 Patients with diabetes mellitus attending OPD in Department of diabetology age variation 40-60 years included [Figure 1]. Statistical analysis was done by using percentages, mean values, standard deviation, chi-square test, t-test and proportion test. A p-value <0.05 level was considered statistically significant and a p-value >0.05 was considered as not statistically significant.



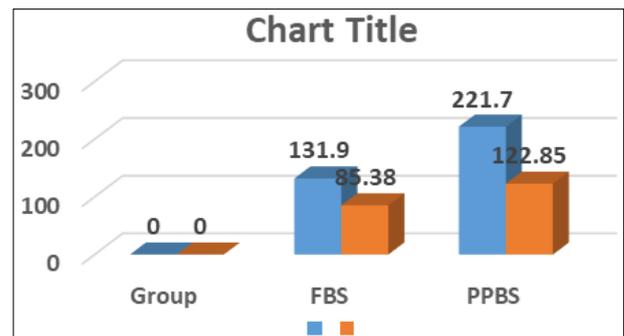
**Fig 1:** Age Distribution of patient’s cases.

**Table 1:** Comparison of Diabetes Mellitus and Correlation with Duration of Diabetes Mellitus Groups (N=100)

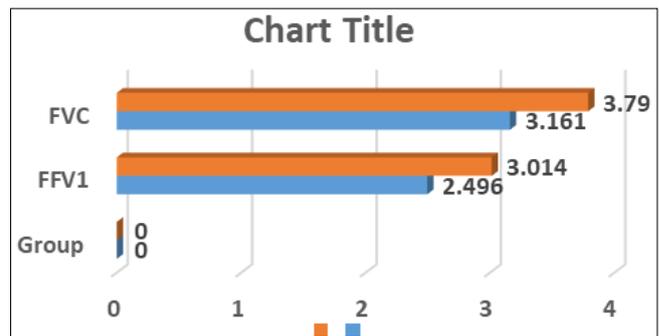
Comparison	Case		Control		P-Value
	Mean	SD	Mean	SD	
FBS	131.95	14.712	85.38	8.098	<0.001
PPBS	212.7	34.735	122.85	15.085	<0.001
FEV1	2.496	0.476	3.014	0.431	<0.001
FVC	3.161	0.568	3.79	0.603	<0.001
FEV1/FVC %	78.901	3.935	79.984	5.43	0.108
PEFR	486.74	73.569	535.0	72.744	<0.001



**Fig 2:** Duration of Diabetes Mellitus.



**Fig 3:** FBS and PPBS Comparison.



**Fig 4:** FEV1 and FVC Comparison.

In this study we found that diabetics had decreased lung volumes compared to normoglycemic subjects. FVC, FEV1, FVC/FEV1 & PEFR were statistically significantly lower in diabetic patients than in normal controls (p<0.05): In the present study, two hundred patients with type 2 diabetes mellitus were taken, of which 100 patients are diabetic and 100 patients non-diabetic. Pulmonary function tests was compared between these two groups, along with comparison

Of other parameters. On analysing results, patients had significant impairment in FEV1 (2.496 in patients when compared with 3.014 with controls) for which the p value was <0.001 which is statistically significant. This concludes have a significant reduction in the FEV1 when compared with the controls. Also FVC was 3.161 among cases when compared with controls 3.79 which also showed a statistically significant reduction. Among the groups A, B, C the pattern of restrictive PFT is more prominent as the duration advances FEV1 (A=2.65 B=2.65 C=2.17), FVC (A=3.33 B=3.33 =3.17) PEFR (A=509 B=480 C=463). So which gives the impression that restriction is more prominent as the disease duration advances. Despite the reduction in FEV1&FVC, FEV1/FVC % (A=79.53 B=79.56 C=77.53) ratio declines but which is more than the predicted value shows [Table 1 & Figure 2, 3, 4].

## 5. Discussion

Diabetes is a multisystem disease. Involvement of cardiac, renal, ocular systems are more extensively studied when compared to lung involvement. The cause of lung function has not been studied. There are no detailed proposed mechanisms for it. Possible mechanisms are microvascular changes in lung tissue will lead to impairment in pulmonary functions. Few studies have shown that T2DM with microangiopathies show reduced diffusion capacity for carbon monoxide (DLCO). The study further suggested that hyperglycaemia and dyslipidaemia might have a contributory role in its pathogenesis. In this study we found that diabetics had decreased lung volumes compared to normoglycemic subjects. FVC, FEV1, FVC/FEV1 & PEFR were statistically significantly lower in diabetic patients than in normal controls ( $p < 0.05$ ): In the present study, two hundred patients with type 2 diabetes mellitus were taken, of which 100 patients are diabetic and 100 patients non-diabetic. Pulmonary function tests was compared between these two groups, along with comparison of other parameters. On analysing results, patients had significant impairment in FEV1 (2.496 in patients when compared with 3.014 with controls) for which the p value was <0.001 which is statistically significant. This concludes have a significant reduction in the FEV1 when compared with the controls. Also FVC was 3.161 among cases when compared with controls 3.79 which also showed a statistically significant reduction. Our results showed a similar results with schanek *et al*, ljubic *et al*. Similar to our study Gregory L. Kinney *et al* have observed a moderate reduction in FVC, FEV1 and diffusing capacity for carbon monoxide of the lung in patients with type 1 and type 2 diabetes. Yeh HC *et al* have suggested that pulmonary function test in middle aged non-diabetic adult showed a restrictive pattern of lung pathology which is predictive of subsequent type 2 diabetes. David *et al* studied 495 diabetic patients and recorded baseline values. A subset of 125 patients were studied after 7 years, who showed a significant reduction in the FEV1, FVC, and PEFR. Irfan *et al* studied 64 diabetic and 64 non diabetic patients and showed that diabetic patients had reductions in FEV1, FVC when compared with non-diabetic controls. This result concurred with our result. The FEV1/FVC % in our study was lower than normal and was found to have restrictive pattern. This is in concordance Boulbou *et al*, Sultan *et al*, Sreeja *et al*, Fimognari *et al*, and Nakagima *et al*, Studies of Klein OL stated diabetics have reduced FVC more consistent than reduced FEV1 and our

study had given similar results. PEFR was also reduced in our study which was similar to Sreeja *et al*. Among the groups A, B, C the pattern of restrictive PFT is more prominent as the duration advances FEV1 (A=2.65 B=2.65 C=2.17), FVC (A=3.33 B=3.33 =3.17) PEFR (A=509 B=480 C=463). So which gives the impression that restriction is more prominent as the disease duration advances. Despite the reduction in FEV1&FVC, FEV1/FVC % (A=79.53 B=79.56 C=77.53) ratio declines but which is more than the predicted value. Davis *et al* had reported that FEV1% declines approximately about 1.5% for each year of diabetes. Kanya Kumari *et al* studied 125 patients and showed that type 2 diabetes patients have a restrictive pattern of PFT. And the restriction is more prominent as the duration of diabetes is prolonged which concurs with our study. Anuradha *et al*, Kapoor *et al* also had similar results in their results. Also patients had higher mean FBS (131), PPBS (212) than healthy controls FBS (85), PPBS (122). Interestingly patients with higher FBS, PPBS had more decrease in PFT values when compared with lower FBS, PPBS which was also statistically significant.

## 6. Conclusions

Type-2 diabetic patients have reduced FEV1, FVC, PEFR when compared with non-diabetics of same age. Type 2 diabetic patients have a restrictive pattern of pulmonary function tests even in the absence of any symptoms. This restrictive pattern is more prominent as the duration of diabetes is increased. Thus spirometry can be used as a simple investigation to study the pulmonary morbidity among the diabetics and to plan for an effective aggressive strategy in management of diabetes. Periodic monitoring of lung functions is necessary in diabetics as spirometry is a cost effective, non-invasive tool.

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