

**ORIGINAL RESEARCH**

**A PROSPECTIVE STUDY OF EFFECT OF GLYCAEMIC STATUS ON PULMONARY FUNCTION TEST IN TYPE 2 DIABETES MELLITUS**

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**Abstract**

**Introduction:** Diabetes mellitus as we all know is a systemic disorder which affects many organs by causing pathological changes in them. It is considered as a leading cause of increasing morbidity and deaths in today's world. Many studies suggested that lung is a target organ in DM and that glycaemic exposure is a strong determinant of reduced pulmonary function in DM patients theoretically morbidity, several pathological changes may affect the lungs in patients with DM.

**Materials and methods:** This prospective study was conducted over a period of one year from January 2021 to December 2021 (1 year). 100 type-2 diabetic patients who were not on insulin visiting Shaheed Nirmal Mahato Medical College (SNMMCH), Dhanbad as in-patients & out-patients were included. The sample size was taken based on the convenience of the study. 100 healthy controls who's fasting blood sugar (FBS) and postprandial blood sugar (PPBS) were in normal limits from administrative office of Shaheed Nirmal Mahato Medical College (SNMMCH), Dhanbad, and other volunteers constituted the control group. The informed consent of the patient / guardian was obtained.

**Results:** FBS among cases and controls were compared which shows a mean FBS value of 207.8 mg / dl in diabetic group as compared to a mean value of 97.42 mg/dl in controls with P value of 0.001 which is highly significant. Post prandial blood sugars showed highly significant difference among both groups with mean of 254.41 among diabetic group and 126.65 among controls.

**Conclusion:** Type 2 diabetes mellitus is associated with restrictive pattern of respiratory abnormality. As the duration of diabetes increases the restrictive profile was more prominent. There was inverse relation between glycaemic status and spirometric indices FEV1 and FVC. Thus, an intensive glycaemic management may reduce the risk of death through an improved ventilator function which is independent of the other beneficial effects.

**Key Words:** Diabetes mellitus, fasting blood sugar, postprandial blood sugar.

## INTRODUCTION

Diabetes mellitus as we all know is a systemic disorder which affects many organs by causing pathological changes in them. It is considered as a leading cause of increasing morbidity and deaths in today's world.<sup>1</sup>

Many studies suggested that lung is a target organ in DM and that glycaemic exposure is a strong determinant of reduced pulmonary function in DM patients theoretically, several pathological changes may affect the lungs in patients with DM. Many studies show that diabetes could lead to the development of pulmonary complications due to the collagen & elastin changes.<sup>2</sup> Another theory suggested that micro angiopathy due to increase in enzymatic glycation of proteins and peptides of the extracellular matrix at chronic high circulating glucose levels may also have important role in the pathological changes of lungs in DM patients. The above pathophysiological mechanisms suggest that lung is also involved in diabetic subjects as target organ.<sup>3</sup>

Pulmonary function tests in type 2 diabetes have demonstrated varied, and frequently conflicting results with some studies indicating a reduction in lung volumes, whereas others have demonstrated no change compared with healthy controls. Despite the unclear nature, the relationship between diabetes and lung function remains important because of potential epidemiological and clinical implications.<sup>4</sup>

In Type 1 diabetes, lung function has been investigated in several clinical studies and evidenced reduced elastic recoil, reduced lung volumes, diminished respiratory muscle performance, decreased in pulmonary diffusion capacity for carbon monoxide.<sup>5</sup> But there are few data concerning pulmonary function abnormalities in patients with type 2 diabetes mellitus. The purpose of the present study was to highlight the spirometric lung function changes in the patients of type 2 diabetes mellitus and to find out its association with the glycemic status.

## MATERIALS AND METHODS

### **Study design: A prospective study.**

**Study location:** Department of Medicine, Shaheed Nirmal Mahato Medical College (SNMMCH), Dhanbad.

**Study duration:** January 2021 to December 2021 (1 year).

**Sample size:** 100 type 2 diabetes, 100 healthy controls.

**Inclusion criteria:** All patients presenting to medical outpatient department (OPD) and patients from inpatient department (IPD) at Shaheed Nirmal Mahato Medical College (SNMMCH), Dhanbad who were proved cases of type 2 diabetes mellitus and not on insulin.

### **Exclusion criteria:**

- Smokers.
- Previous history of lung disease.
- Signs and symptoms of respiratory infections at the time of test.
- History of being admitted during past six months with respiratory symptoms.
- History of significant cardiovascular illness.
- History of occupational exposure to any substances that could affect lung function.

This prospective study was conducted over a period of one year from January 2021 to December 2021 (1 year). 100 type-2 diabetic patients who were not on insulin visiting Shaheed Nirmal Mahato Medical College (SNMMCH), Dhanbad as in-patients & out-patients were included. The sample size was taken based on the convenience of the study. 100 healthy controls who's fasting blood sugar (FBS) and postprandial blood sugar (PPBS) were in normal limits from administrative office of Shaheed Nirmal Mahato Medical College (SNMMCH), Dhanbad, and other volunteers constituted the control group. The informed consent of the patient / guardian was obtained.

Subjects were selected as per the inclusion and exclusion criteria. Their written consent was recorded. Their detailed history was taken. Age, height, weight, and BMI were recorded, and detailed general physical examination was done. Each patient was instructed to visit hospital with 8 hrs. of fasting, and the blood samples were drawn for estimation of FBS and glycated hemoglobina.

**Statistical Analysis:** Microsoft Excel and SPSS version 11 and Syst at 8.0 were used for the analysis of the data.

## RESULTS

FBS among cases and controls were compared which shows a mean FBS value of 207.8 mg / dl in diabetic group as compared to a mean value of 97.42 mg/dl in controls with P value of 0.001 which is highly significant.

Variables	Groups	N	Mean	SD	P Value
FBS (mg/dl)	Cases	100	207.8	49.27	0.001
	Controls	100	97.42	5.15	
PPBS (mg/dl)	Cases	100	254.41	48.76	0.001
	Controls	100	126.65	6.13	

**Table 1: Comparison of Cases and Controls with FBS and PPBS**

Post prandial blood sugars showed highly significant difference among both groups with mean of 254.41 among diabetic group and 126.65 among controls.

Variables	Groups	N	Mean	SD	P Value
FVC (in litres)	Cases	100	2.48	0.43	0.001
	Controls	100	2.98	0.43	
EV1 (in litres)	Cases	100	2.07	0.40	0.001
	Controls	100	2.43	0.39	
FEV1 / FVC	Cases	100	0.83	0.10	0.001
	Controls	100	0.81	0.06	

**Table 2: Comparison of Cases and Controls with Regard to FVC, FEV and FEV1/FVC**

Variables	Groups	N	Mean	SD	P Value
FVC (litres)	≤1 year	36	2.73	0.35	0.004
	>1 year	64	2.35	0.41	
	≤1 year	36	2.25	0.39	0.008
	>1 year	64	1.96	0.37	

FEV1/FVC	≤1 year	36	0.80	0.08	0.025
	>1 year	64	0.85	0.11	

**Table 3: Comparison of Duration (5 yrs. and > 5 yrs.) with FVC, FEy1 and FEV1 / FVC**

PFT	Summary	90-110	110-220	200-300	P Value
FVC (in litres)	Mean	2.81	2.51	2.4	0.41
	SD	0.2	0.45	0.43	
FEV1 (in litres)	Mean	2.2	2.09	2.02	0.956
	SD	0.18	0.42	0.42	
FEV1 / FVC	Mean	0.75	0.82	0.87	0.14
	SD	0.01	0.1	0.09	

**Table 4: Comparison of FBS Subgroups on Pulmonary Function Test**

PFT % Predict	Cases	Control	P Value
FVC	68.37±20.34	92.74±25.36	0.001
FEV1	81.38±22.25	85.08±20.17	0.008
FEV1 / FVC	79.83±10.56	85.47±10.12	0.428

**Table 5: Effects of Diabetes on % Predicted FVC, FEy1, FEV1 FVC**

The mean % of predicted FVC among the cases was 68.37 and 92.74 among the control group with P-value of 0.001, which is statically significant. And % predicted FEV1 among the cases was 81.39 and 85.08 among the control group with significant P-value of 0.008.

## DISCUSSION

Present study was undertaken to assess ventilatory function of subjects with diabetes mellitus in comparison to subjects without diabetes. Larger population-based studies have been more consistent, demonstrating reduced pulmonary functions in patients with an elevated plasma glucose level and diagnosis of DM.<sup>6</sup>

Out of the total 200 cases studied 100 were diabetic subjects and 100 were non-diabetics. The number of male subjects (60) was same in both diabetic and non-diabetic groups. The number of females in study was 40, equal in both the groups. Hence, there was no significant difference among diabetics and controls with reference to the gender of subjects.

The age wise distribution of subjects was matched in both case and controls. Age group of 50 - 59 years was the largest. Study by Ortiz Aguirre et al. has proved that as age increases the pulmonary function test values decrease. In the present study, age has been ruled out as a confounding factor by considering age matched subjects in both diabetic and nondiabetic groups.<sup>6</sup>

Comparison of subjects with reference to body mass index showed no significant difference in diabetic and non-diabetic group of patients. Mean value of FVC was low in both case and control groups in subjects with low BMI compared to those with higher BMI values. The mean FEV1 and FEV1 / FVC showed no significant difference in diabetic and non-diabetics with reference to BMI.<sup>7,8</sup>

In the study by Crapo et al. BMI in diabetic patients with target organ damage was high compared to those subjects without target organ damage. These subjects with target organ damage and high BMI had reduced mean pulmonary function parameters. The present study

shows no significant difference in BMI values among diabetic and non-diabetics nullifying BMI as one of the confounding factors.<sup>9,10</sup>

## CONCLUSION

Type 2 diabetes mellitus is associated with restrictive pattern of respiratory abnormality. As the duration of diabetes increases the restrictive profile was more prominent. There was inverse relation between glycaemic status and spirometric indices FEV1 and FVC. Thus, an intensive glycaemic management may reduce the risk of death through an improved ventilator function which is independent of the other beneficial effects.

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