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Research Article

THE PULMONARY FUNCTION TESTS IN PATIENTS WITH DIABETES MELLITUS AND NON-DIABETES PEOPLE OF AJMER, RAJASTHAN

Yamini Singh[1] and *Sumitra Kumari[2]
[1]Department of Physiology, J.L.N Medical College, Ajmer
[2]Department of Physiology, Pacific Institute of Medical Sciences, Udaipur (Raj.)
**Author for Correspondence*

ABSTRACT
Diabetes is one of the major causes of premature illness and death worldwide. Non communicating diseases including diabetes account for 60% of all deaths worldwide. The present study has been conducted in the Department of physiology and medicine in a group of 50 subjects with carried out on 25 patients suffering from diabetes mellitus and 25 healthy controls. Spirometry values were consistently lower in diabetics than in non-diabetics. The differences were statistically significant among both sexes and that too for the parameters of FVC and PEFR. In our study, an obstructive pattern indicated by an FEV1/FVC ratio less than 70% was seen in 54% males. 31%males had Restrictive pattern. One male had mixed pattern. 67% of women had restrictive pattern. Mixed pattern is seen in 33% women. Thus in total 25 diabetics 48% diabetics had restrictive pattern, 28% had obstructive pattern, 20% had mixed pattern.

Keywords: *Diabetes Mellitus, Spirometry, Forced Vital Capacity (FVC), Forced Expiratory Volume in 1 sec. (fev_1), FEV_1/FVC, Peak Expiratory Flow Rate (PEFR)*

INTRODUCTION
Diabetes is one of the major causes of premature illness and death worldwide. Non communicating diseases including diabetes account for 60% of all deaths worldwide. In most of cases, this disorder is detected by presence of increase level of sugar in blood & urine. It reflects the disturbances in the carbohydrate metabolism, protein metabolism, low serum insulin level and change in lipid profile level. The metabolism of minerals is also affected. The central feature of this disease is hyperglycemia. This produces some secondary effect such as increased glycosylation of proteins particularly that of haemoglobin. The insulin affects the formation or clearance of very low density lipoprotein and low density lipoprotein, since level of these protein and consequently the level of cholesterol are often elevated in poorly controlled diabetics. The atherosclerosis also affects to this metabolic defect.
Diabetes mellitus causes early maturation, abnormal cross linkages and stiffening of the collagen and elastin fibers of connective tissues all over body. Uncontrolled diabetes mellitus with elevated blood glucose levels for Long period causes increased and rapid non-enzymatic glycation of the collagen and elastin fibres and this process also affect the lungs and central tendon of diaphragm (Kohn *et al.,* 1982). During the recent past several studies on lung functions in diabetic subjects have been published in which some of the investigators have found reduced Forced vital capacity (FVC), Forced expiratory volume in one second (FEV1) and other pulmonary functions amongst diabetic subjects compared to normal controls (Lange *et al.,* 1988; Anasuma *et al.,* 1985; Schnapf *et al.,* 1984). Other investigators have been unable to demonstrate any changes in lung functions in diabetic subjects (Schuyler *et al.,* 1976; Schernthener *et al.,* 1977; Sandler *et al.,* 1986; Sandier *et al.,* 1987). Practically system is affected by complication of Diabetes mellitus. Attention is usually paid to angiopathy (micro, macro), retinopathy and neuropathy but one of the system most neglected in Diabetes mellitus is the Respiratory System, except for the recognition of increased in infection prevalence like tuberculosis.

MATERIALS AND METHODS
The study was conducted in patient suffering from diabetes mellitus, patient attending outdoor of MEDICINE Department J.L.N Hospital, Ajmer. The present study was carried out on 25 patient suffering from diabetes mellitus and 25 healthy control.
They are divided into following groups:

Group A → Comprised of 25 healthy subjects of age group40 to 60 yrs.
Group B → Comprised of 25 subjects of age group 40 to 60 yrs suffering from diabetes attending the medical outdoor

Subjects were requested to attend a interview. Nonsmoking diabetic patient who had no history of respiratory disease and who gave informed consent were selected for this study, and underwent pulmonary function testing. Healthy, non smoking, non diabetic who were matched for age and sex were chosen as control also underwent pulmonary function testing. The result were entered on a Microsoft excel spread sheet.

Inclusion Criteria

Patient with diabetes mellitus at least 6 month duration, able to give informed consent. Diabetics who have never smoked, with any past history of respiratory illness and who did not show at the time of examination, symptoms related to respiratory illness. These include nasal itching, nasal congestion, running nose, dry throat, hoarseness, epistaxis, sneezing, and pain suggestive of sinusitis, cough, expectoration and dyspnoea.

Exclusion Criteria

- Smokers
- Present or past history of respiratory disease that might affect lung function such as asthma, COPD, tuberculosis, bronchiectasis, interstitial lung disease.
- History of occupational exposure to any substance that could affect lung function.
- Individual with current or recent upper respiratory or lower respiratory infection, that could predispose to heightened airway reactivity.
- Individual with unacceptable spirometric technique. An unacceptable spirometry was that in which FEV_1 or FVC could not be correctly measured due to –
  - Cough
  - Obstruction of teeth or tongue

Computerized spirometer - Medispirer was used to measure the FVC and FEV1. Subjects were lightly clothed and any tight clothing removed or loosened and suitably rested. Subjects were given breathing tube of spirometer in one hand and explained that we are measuring "how much air you can get out of your lungs".

After few normal respirations, asked to take as deep breath as he can to completely full the lungs. Now mouthpiece of the tube put into the mouth, lips closed around it to check any leakage. Asked to breathe out as much completely as possible into the tube till maximal expiration reached. The procedure repeated three times and maximum of the three values taken for study.

Statistical Analysis

All value are presented as mean + SD. Comparison of mean value of parameter of Diabetic and control subjects was done by using student's t test.

RESULTS AND DISCUSSION

Results

Pulmonary function test in diabetic mellitus study done in a total number of 50 cases were suitable for analysis.

Spirometric values were consistently lower in diabetics than in non-diabetics. The differences were statistically significant among both sexes and that too for the parameters of FVC and PEFR.

HS : Highly significant
VS : Very significant
S : Significant

Table 1: Spirometric results

Males	**Diabetic (n=13) Mean (SD)**	**Non-diabetic (n=8) Mean (SD)**	**T value**	**P value**
FVC	2.65(.76)	3.18(.51)	7.57	<.001(HS)
FEV1	1.54(.95)	2.94(.40)	5	<.001(HS)
FEV1/FVC	39.45(34.73)	81.19(32.80)	3.3	<.01(VS)
PEFR	4.2(1.89)	5.78(1.12)	2.43	<.05(S)
Females	Diabetic (n=12) Mean (SD)	Non-diabetic (n=17) Mean (SD)	T value	P value
FVC	1.29 (.35)	2.11(.30)	6.83	<.001(HS)
FEV1	.86(.59)	2.01(.37)	6.05	<.001(HS)
FEV1/FVC	66.84(37.51)	95.21(8.49)	2.57	<.05(S)
PEFR	3.07(1.6)	4.84(1.67)	4.78	<.001(HS)

Table 2: Lung function in control and diabetic group
Males

Parameters (all % predicted)	**Diabetic(n=13) Mean(SD)**	**Nondiabetic (n=8) Mean(SD)**	**T value**	**P value**
FVC	79.07(25.33)	92.5(15.70)	1.50	>.05(NS)
FEV1	56.61(34.36)	103.62(15.11)	4.30	<.001(HS)
FEV1/FVC	76.30(43.07)	112.25(6.84)	2.95	<.01(VS)
PEFR	49.84(21.42)	65.25(10.43)	2.20	<.05(S)

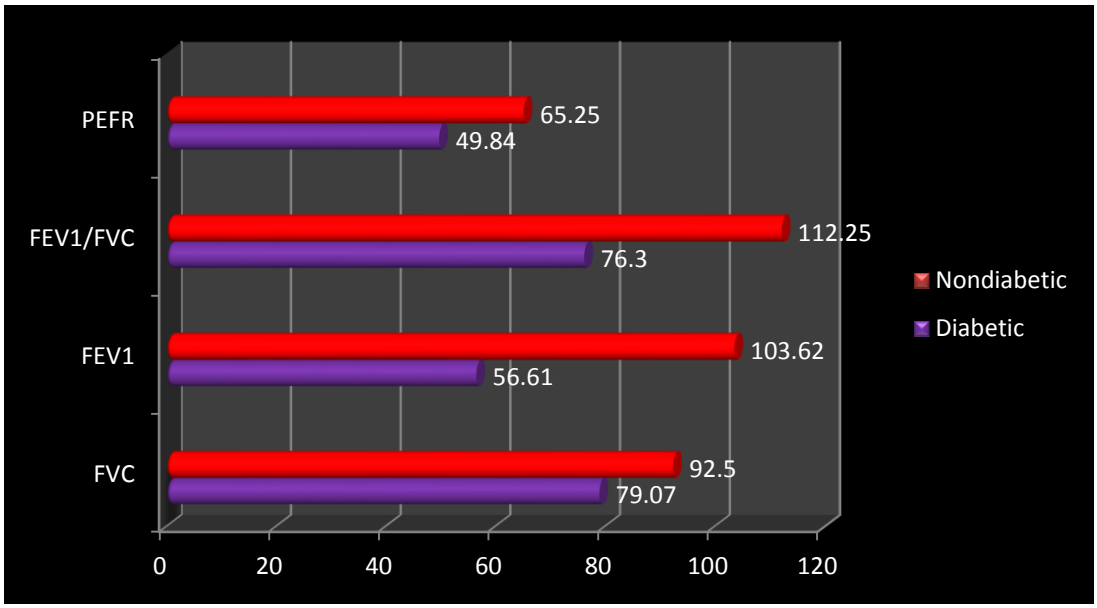

Chart 1: ????

Table 3: Lung function in control and diabetic group
Females

Parameter (all % predicted)	**Diabetic (n=12) Mean(SD)**	**Nondiabetic (n=17) Mean(SD)**	**T value**	**P value**
FVC	53.83(14.37)	87.94(14.39)	6.31	<.001(HS)
FEV1	47.66(32.89)	108.70(21.51)	5.63	<.001(HS)
FEV1/FVC	86.66(48.96)	122.47(10.57)	2.49	<.01(VS)
PEFR	51.66(27.96)	80.76(28.84)	2.72	<.01(VS)

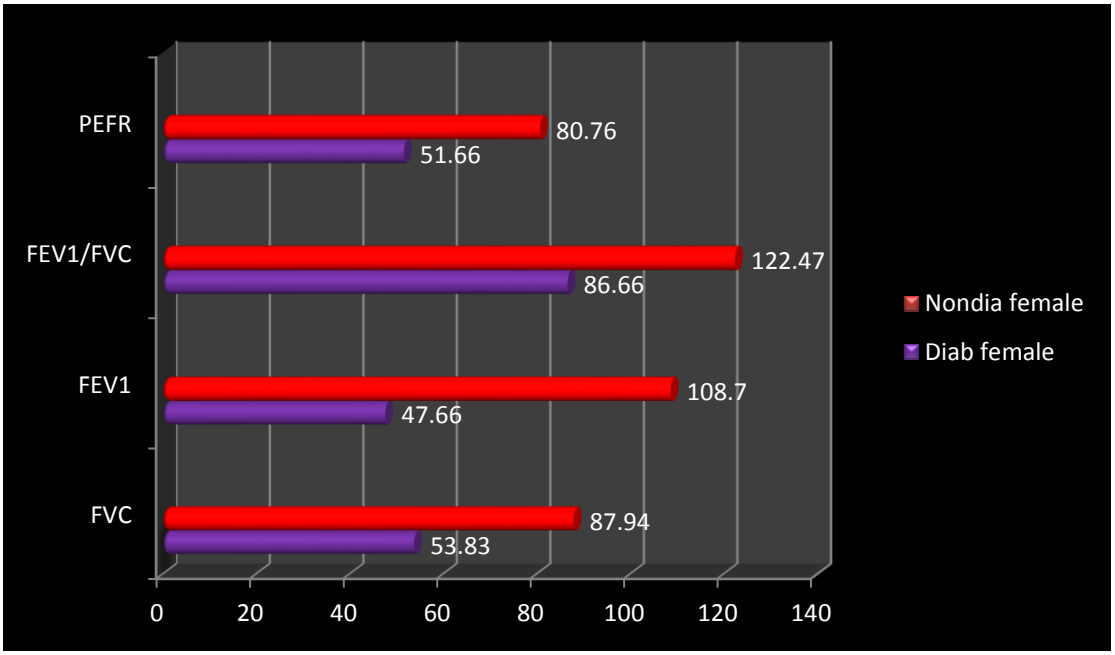

Chart 2: ?????

Discussion

This study was undertaken to assess the pulmonary function test (Ventilatory) of diabetes mellitus patient, and to compare it with those of non-diabetic healthy subjects. Few studies have focused on relationship between pulmonary function and diabetes. Most such studies have been conducted on subjects with type 1 diabetes mellitus.

In this study there were a larger number of females than males (58%vs 42%). The probable cause for this female preponderance was the fact that many males were excluded on account of their smoking history, while the female diabetics were eligible on account of their being non smokers. The different groups i.e. male and females, diabetic and non diabetic were comparable in terms of age, height and weight. These being the major determinants of the spirometric value, the main determinants of ventilatory differences are likely to be the presence or absence of diabetes. The groups were also homogenous in respect of having no known respiratory disease, and all being non smokers. In the study of Hiroshi Mori et al, smokers were included in the analysis, and this was additional confounding factor.

The few studies have mainly focused on alteration in diffusing capacity and their relationship with diabetes mellitus, in insulin dependent diabetes mellitus. They found that there was reduction in lung function that was slightly more pronounced in insulin dependent than in non insulin dependent diabetics. As expected, for all parameters except FEV1/FVC males had higher mean value than females. Among diabetics and non diabetics, non diabetics had higher mean value on all parameters than diabetics. There was a tendency for all parameters to fall with longer duration of diabetes; however a multiple regression analysis showed that this was not significant. Clearly those with a longer duration of diabetes also were older, and the effect of decline in lung function with age was a greater contributing factor.

FEV1fall in values was more pronounced among females than among diabetic males.

Poor diabetic control was associated with poorer lung function.

In our study the number of patients was too small to draw difference in FVC%, FEV1% in patients treated with insulin and OHA (oral hypoglycemic agent). In lange's (2004) study, the diabetic subjects had slightly smaller height adjusted FEV1 and FVC compare values of non-diabetic subjects, their regression analysis also, showed association between raised values of plasma glucose and reduction of lung function was highly significant. Ozmen *et al.,* (2008) reported finding abnormal pulmonary function test in their diabetic patients that were mild and unlikely of clinical significance. The most likely explanation is that

single breath method may not be sensitive enough to detect pulmonary vascular angiopathy. Low pulmonary vascular pressure determines only minor changes in pulmonary capillaries of diabetes mellitus subjects, and so the commonly used method of DLco might not discriminate between diabetes mellitus and normal subjects. In Rajan's (2009) study, spirometric reading of study group patient revealed that 60% showed an obstructive pattern, 30% showed a restrictive pattern &there was a mixed obstructive restrictive pattern in 23%.

In our study, an obstructive pattern indicated by an FEV1/FVC ratio less than 70% was seen in 54% males. 31%males had Restrictive pattern. One male had mixed pattern. 67% of women had restrictive pattern. Mixed pattern is seen in 33% women. Thus in total 25 diabetics 48% diabetics had restrictive pattern, 28% had obstructive pattern, 20% had mixed pattern.

Conclusion

In summary, the literature reviewed suggests that diabetes mellitus is associated with:

a. Decreased pulmonary function as FVC, FEV1, FEV1/FVC, PEFR
b. Decreased lung function may predict the development of diabetes mellitus
c. Poor diabetic control is associated with an accelerated pulmonopathy
d. Altered lung function correspond to duration of disease
e. The cause of respiratory abnormalities include:-

i.Advanced glycosylation end products that affect collagen and elastin as well as other tissues.
ii.Microangiopathy.

f. FVC, FEV1, FEV1/FVE, PEFR showed a difference between the diabetic and nondiabetics.
g. In our study, 100% of females having FVC less than 80% of predicted values , while only 48% of males had FVC less than 80% of predicted. 33% women had FEV1/FVC less than 70%. In 61% males the FEV1/FVC is less than 70%.

An obstructive pattern indicated by an FEV1/FVC ratio less than 70% was seen in 54% males. 31%males had Restrictive pattern. One male had mixed pattern. 67% of women had restrictive pattern. Mixed pattern is seen in 33%women.

Thus in total 25 diabetics 48% diabetics had restrictive pattern, 28%had obstructive pattern, 20% had mixed pattern

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Conflict of Interest

Primary interest refer to the principal goals of profession or activity such as the health of patient, integrity of Research and duty office.

Secondary interest includes not for financial purpose but motivate as the desire for professional advancement.

REFERENCES

Anasuma Y, Shunidil F, Ide H and Agishi Y (1985). Characteristics of pulmonary function in patients with DM. *Diabetes Research and Clinical Practice* **I** 95-101.

Davis TME, Knuiman M, Kendall P, Vu H and Davis WA (2000). The Fremantle Diabetes study Davis TME reduced pulmonary function and its association with type 2 DM diabetes. *Diabetes Research and Clinical Practice* **50**(2) 153-159.

Kohn RR *et al.*, (1982). Glycosylation of human collagen. *Diabetes* **31** 47-51.

Lange P *et al.*, (1988). Pulmonary function is influenced by heavy alcohol consumption. *American Review of Respiratory Disease* **137** 1119-1123.

Lange P, Groth S, Kastrup J, Appleyard M, Jansen J and Schnohr P (2004). Diabetes Mellitus, Plasma glucose and lung function in a cross sectional population study. *European Respiratory Journal* **2** 14-19.

Nadeau KJ and Zeitler PS *et al.,* (2009). Found Insulin resistance in adolescents with type 2 diabetes is associated with impaired exercise capacity. *Journal of Clinical Endocrinology & Metabolism* **94**(10) 3687-95, doi: 10.1210/jc.2008-2844, Epub 2013 Jul 7).

Ozmen B *et al.,* (2008). Pulmonary function parameters in patient with diabetes mellitus. *Diabetes Research and Clinical Practice* **57** 209-211.

Rajan SK, Rajesh Prabhu P and Madhu Sasidharan (2009). Spirometric evaluation of type 1 diabetes mellitus, Abstract of paper presented at Apicon. *JAPI* **50** 1529.

Sandler M (1990). Is the lung a 'target organ' in diabetes mellitus. *Archives of Internal Medicine* **150**(7) 1385-8.

Sandler Metal *et al.,* (1987). Cross Section study of pulmonary function in patients with IDDM. *American Review of Respiratory Disease* **135** 223.

Schernthaner G *et al.,* (1987). Lung elasticity in Juvenile onset DM. *American Review of Respiratory Disease* **113** 37-41.

Schnapf BM *et al.,* (1984). Pulmonary function in IDDM with limited joint mobility. *American Review of Respiratory Disease* **130** 930.

Schuyler MR, Niewochner DE, Jnkey SR and Kohn R (1976). Abnormal lung elasticity in juvenile. Diabetes mellitus. *American Review of Respiratory Disease* **113** 37-41.