Journal of Pharmaceutical and Scientific Innovation

www.jpsionline.com

Research Article

A COMPARATIVE EVALUATION OF PULMONARY PARAMETERS IN DIABETES MELLITUS PATIENTS AND NON DIABETES MELLITUS APPARENTLY HEALTHY VOLUNTEER AS CONTROL

Qazi Rais Ahmed[1]*, Sapna Goyal[2], Narendra Gupta[3], Raj Bhadur Kamal[4], Shikky Garg[5]
[1]Associate Professor, Department of Physiology, Rohilkhand Medical College and Hospital, Bareilly, U.P. India
[2]Assistant Professor, Department of Skin & V.D., Rohilkhand Medical College and Hospital, Bareilly, U.P. India.
[3]Assistant Professor, Department of Physiology, Rohilkhand Medical College and Hospital, Bareilly, U.P. India
[4]Assistant Professor, Department of Physiology, Motilal Nehru Medical College Allahabad U.P. India
[5]Associate Professor, Department of Anatomy, S.N. Medical College Agra U.P. India
*Email: qazihmd@yahoo.com

Received on: 05/08/12 Revised on: 26/09/12 Accepted on: 04/10/12

ABSTRACT
The best early evidence of a description of the symptoms of diabetes in the world's literature is recorded in the Ebers Papyrus that Diabetes Mellitus is characterized by chronic hyperglycemia with disturbances of carbohydrate, fat, and protein metabolism result in from defects in insulin secretion, insulin action, or both which affect the respiratory system also. So we decided to study the effects of diabetes mellitus on pulmonary parameters. In this study a group of 50 apparently healthy control subject of both gender and 50 Diabetic patients of both gender were randomly selected with age ranging from 19-68 years. The Diabetic patients were matched with control group in terms of age, height, weight and BSA and BMI. Spirometry was performed on an electronic spirometer (spiro exel) according to American Thoracic Society and results were compared by a student t-test (2-tailed). Diabetic patients showed a significant decrement in the Forced Vital Capacity (FVC %) and Peak Expiratory Flow Rate (PEFR %) relative to their matched controls. However, there were no significant difference in the Forced Expiratory Volume in one Second (FEV_1%) and Forced Expiratory Ratio (FEV_1 / FVC %) between the groups We conclude that pulmonary parameters in diabetic patients there is decrement in FVC% and PEFR%, as compared to controls. which indicate restrictive pattern of lung function impairment.
Key Words Diabetes Mellitus, hyperglycemia, metabolism, pulmonary parameters, Spirometry

INTRODUCTION

Diabetes mellitus is characterized by chronic hyperglycemia with disturbances of carbohydrate, fat, and protein metabolism resulting from defects in insulin secretion, insulin action, or both. The effects of diabetes mellitus include long-term damage, dysfunction, and failure of various organs, especially the eyes, kidneys, heart, and blood vessels. Diabetes may present with characteristic symptoms such as thirst, polyuria, blurring of vision, weight loss, and polyphagia, and in its most severe forms, with ketoacidosis or nonketotic hyperosmolarity, which, in the absence of effective treatment, leads to stupor, coma, and death. It is found FEV_1 (% of predicted) decreased in diabetics compared to control ($p<0.05$).[1] In a similar study there is also found significant decrease in FEV_1 values ($p<0.05$) as level of blood sugar rises.[2] Many workers have reported either no change or lower pulmonary functions in diabetics than normal subjects ascribing different reasons [1,2,3,4,5]. It has been suggested that pulmonary dysfunction may be one of the earliest measurable non-metabolic alteration in diabetes.[6]The incidence of pulmonary pathology was found to be 50% on autopsy in japan.[7] In an observation there is significant decrease in FEV_1 only in those male who were on oral hypoglycemic.[8.] There is significant reduction ($p<0.001$) in PFER of young diabetic subjects.[9] In a study of diabetic patients had a reduced forced vital capacity (FVC) % of the predicted; ($P < 0.03$) [10]. Matsubara and Hara studied pulmonary function and microscopic changes in the lungs of diabetic patients as compared to those without diabetes and reported that the forced vital capacity, total lung capacity, residual volume, and maximal expiratory flow rate were decreased significantly in the group with diabetes compared to the control group. [11, 12] Makkar P et al. concluded that spirometric evaluation in type 1 diabetes mellitus showed varying derangements in the different parameters of pulmonary function tests, suggestive of dominantly restrictive with some obstructive pattern as indicated by significant decline in forced vital capacity (FVC), peak expiratory flow rate (PEFR) and maximal expiratory flow ($MEF_{75\%}$).[13] McKeever et al. reported that an increase in mean glycosylated hemoglobin (HbA_{1c}) is associated with a decrease in lung function parameters FVC and FEV_1. They hypothesized that impaired glucose autoregulation is associated with impaired lung function.[14] However, Benbassat et al. showed that FVC, FEV_1, and forced expiratory flow ($FEF_{25–75\%}$) were within the predicted values in both type 1 and type 2 diabetes populations.[15] Rosenecker et al. reported that in patients with diabetes, FVC and FEV_1 declined significantly over the 5-year study period.[16] McKeever et al. Davis et al. and reported decreased lung function in diabetic subjects, and convincingly showed that this decrease is associated with inadequate diabetes control.[14,17]

In India the prevalence of disease in adults was found to be 2.4% in rural & 4.0 to 11.6% in urban dwellers. (Park 18th 2007). IDDM is most severe form and seen below 30 year of age. Incidence is highest among 10-14 year of age. But NIDDM is most common type. Diabetes is an iceberg disease. Although increase in both the prevalence and incidence of type 2 diabetes have occurred globally. In some country (UK) male and female ratio is equal. But in south East Asia male diabetics is more common.[18]

MATERIALS AND METHODS

Present study was conducted in the department of physiology at M.L.N. Medical College, Allahabad from 2009 to 2011 after approval of ethical committee. About 100 individuals out of which 50 Diabetics and 50 controls of both gender of age ranging from 19-68 years were included in this study.

The known case of non smokers, diabetes mellitus patient for more the 5 year of duration was selected through medicine OPD (S.R.N. Hospital) Allahabad.

All patients selected for study underwent through clinical examination (general and systemic). History including relevant past history was taken especially regarding of diabetes duration, any evidence of complication of diabetes. Special attention was given to any variable which may affect spirometric test results (e.g. any respiratory disease, congestive cardiac failure, volume overload, cerebrovascular disease etc.)

Plasma Glucose Estimation Criteria for diagnosis of Diabetes Mellitus Symptoms of diabetes plus random plasma glucose concentration ≥ 11.1 mmol/L (200 mg/dl) OR Fasting plasma glucose ≥ 7.0 mmol/L(126 mg/dl) OR Two hour plasma glucose ≥ 11.1 mmol/L (200 mg/dl) during an oral glucose tolerance test Adapted from American Diabetes Association 2000 and patient are exclude suffering from any systemic diseases and diabetes complications. In the selected subjects the plasma glucose level was determined by using glucose oxidase method.

Principle Glucose present in the plasma is oxidized by the enzyme glucose oxidase (GOD) to gluconic acid with the liberation of hydrogen peroxide, which is converted to water and oxygen by the enzyme peroxidase (POD) 4 aminophenazone, an oxygen acceptor, takes up the oxygen and together with phenol forms a pink coloured chromogen which can be measured at 515mm.

Spirometry Tests were performed with the help of computerized Spirometer (spiro exel) with patient in sitting posture wearing a nose clip and breathing through mouth piece. Spirometry perform according to recommendation of American Thoracic Society.[19] After recording age (yrs), height (cm), weight (kg) following % predicted values of FVC, FEV_1, FEV_1/FVC , PEFR parameters were assessed. The subjects were made to sit comfortably on a chair and will be asked to take 3-4 normal breathe through the mouthpiece of Spirometer. Then the will be asked to take slow & deep inspiration & then will be instructed to blowout forcefully & rapidly through the mouthpiece of Spirometer followed by deep & rapid inspiration. The test will be performed with nose clip in position. After one or two practice trails, the highest of the three test readings will be taken as final reading.

Statistical Analysis The all data were analyzed with the help of a software package on 'SPSS' (Version 17.0). The mean and standard deviation was calculated for all data. The't'-test and 'p' values among different groups of parameters had also been made.

RESULTS

The % predicted values of pulmonary parameters are Forced Vital Capacity (FVC %), Forced Expired Volume-1st sec. ($FEV_{1\%}$), Timed Vital Capacity (FEV_1/FVC %) and Peak Expiratory Flow Rate (PEFR %), with the blood sugar level which were taken from the control groups and the patient of Diabetes mellitus group are presented in the Table -2. The result indicates that there is significant difference ($p<0.05$) between control groups and Diabetic group in FVC % and PEFR% of all subjects. There was also significant difference in male subject FVC% ($p<0.05$) and PEFR % ($p<0.05$) between the control group and Diabetic groups but in female there mean value of Diabetics group is decrease then control but not significantly. There is no any significant difference in FEV_1% ($p>0.05$) and FEV_1/FVC % ($p>0.05$) of all subject of control group and Diabetic group. This indicates that in diabetes mellitus patient pulmonary parameters are decrease as compared to controls.

DISCUSSION

Table 1 and Table 2 show the mean and standard deviations of the physical characteristics and different pulmonary function capacities of Control and Diabetics. From the result presented in table-1 it has been revealed that the age , height, weight , BSA[20] and BMI are almost same in Control and Diabetics as there is no more difference in their mean . Table 2 gives an idea about various respiratory parameters in diabetes and non diabetes controls. It shows that respiratory function in Diabetics is comparatively lower than in controls. In our study there is Significant decrement is observed in FVC%, and PEFR % ($p<0.05$) all subject as Yoshihide Asanuma et al (1985) observed a highly significant fall ($p<0.005$) in FVC and FEV_1 in Diabetic subjects.[1] Singh et al (1995) also found a significant reduction in FVC ($p<0.001$), MVV ($p<0.01$) but no significant fall in FEV_1 and PEFR in twenty diabetic subjects.[3]Litonjua AA et al (2005) observed that cases have lower FEV_1, FVC than control but he observed no difference in FEV_1/FVC ratio in cases and control.[21] Vis Niranjan et al (1997) found a significant decrease in FVC values ($p<0.05$) as level of blood sugar increased[2] same as our study. Our study showed significant difference in some parameter which is not coinciding with other study it may be due to greater number of cases in our study or some ethnic and regional variation. Primhak et al on the basis of their longitudinal study of 27 children with IDDM offered two possible causes of this reduction in younger individuals. One is that there may be a single acute episode of non-progressive damage to lung growth occurs during early months. Second is that it could be the result of some genetic factor possibly involving an abnormality in the collagen structure which is linked to genetic predisposition to IDDM. It is the second hypothesis that may be the cause of our present findings.[22]

CONCLUSION

Our study confirms the findings of others study, Now it is being recognized that, Diabetes both type 1 & 2 also effects the respiratory system. So there is need for prevention of lung by controlling the diabetes. From the study we found decreased FVC, which indicate restrictive pattern of lung function impairment. Diabetes is a progressive disease which affects the lung function and so the pulmonary parameters to study its progress should be easily repeatable.

Table 1: Physical Parameters of the Control and Diabetics

Physical Parameters	Control (n=50) Mean±SD	Diabetics (n=50) Mean±SD	Male		Female	
			Control (n=34) Mean±SD	Diabetics (n=32) Mean±SD	Control (n=16) Mean±SD	Diabetics (n=18) Mean±SD
Age (yrs)	44.86±6.43	48.86±11.54	44.00±6.85	49.28±10.06	46.69±5.16	48.11±14.07
Height (cm)	162.64±6.88	159.54±8.01	165.97±5.57	162.94±7.92	155.56±2.83	153.50±3.15
Weight (Kg)	65.14±7.59	63.14±11.41	66.76±7.61	64.06±10.13	61.69±6.50	61.50±13.56
BSA (sq/mt)	1.71±0.13	1.67±0.17	1.75±0.12	1.70±0.15	1.63±0.10	1.61±0.19
BMI (kg/m^2)	24.61±2.35	24.88±4.80	24.22±2.27	24.24±4.41	25.46±2.35	26.01±5.37

Table-2:-: Comparison of pulmonary parameters of control and Diabetes.

	Group	FVC % Mean±SD	FEV_1 % Mean±SD	FEV_1/FVC % Mean±SD	PEFR % Mean±SD	Sugar (mg %) Mean±SD
Male & Female	Control (n=50)	91.54±14.33	90.44±13.52	99.18±8.19	88.66±13.91	98.80±8.56
	Diabetics (n=50)	84.16±17.59*	84.50±19.06	100.44±8.72	82.42±15.00^	218.66±54.83#
Male	Control (n=34)	91.47±11.69	91.41±12.76	100.06±7.05	90.47±13.22	97.53±8.63
	Diabetics (n=32)	83.06±17.18*	84.19±19.52	101.25±8.47	82.94±15.31^	212.09±47.32#
Female	Control (n=16)	91.69±19.25	88.38±15.24	97.31±10.23	84.81±14.97	101.50±8.01
	Diabetics (n=18)	86.11±18.64	85.06±18.76	99.00±9.21	81.50±14.83	230.33±66.01#
	p=level	*p<0.05	p>0.05	p>0.05	^p<0.05	#p<0.001

REFERENCES

1. Asanuma Y, Fujiya S, Ide H, Agishi Y. Characteristics of pulmonary functions in diabetes mellitus. *Diab Res Clin Pract* 1985; 1: 95–101.
2. Niranjan V, McBrayer DG, Ramirez LC. Glycemic control and cardiopulmonary function in patients with diabetes mellitus. *Am J Med* 1997; 103: 504– 513.
3. Singh S, Sircar SS, Singh KP. Are ventilatory impairments related to early onset and long history of diabetes? *J Ind Med Assoc* 1995; 93(12): 458-59.
4. Sreeja CK, SamualE, Keshavachandran, Shashidhar S. Pulmonary functions in patients with diabetes mellitus. *Ind J Physiol Pharmacol* 2003; 47(1): 87–93.
5. Schnack C, Fest A, Schwarz AA, Haber P, Scherthaner G. Pulmonary dysfunction in type Idiabetes in relation to long term control and to incipient diabetic nephropathy. *Nephron* 1996; 74: 395–400.
6. Sandler M. Is the lung a 'target organ' in diabetes mellitus ? *Arch Int Med* 1990; 1385–1388.
7. Goto Y, Sato S, Masuda M. Cause of death in 3151 diabetic autopsy cases. *Tohuku J Expt Med* 1974; 112: 339–353.
8. Sanjeev Verma, Mumtaz Goni, Rattan P Kudyar. Assessment of Pulmonary Functions in Patients with Diabetes Mellitus. 2009; 11 No. 2
9. Makkar P, Gandhi M, Agrawal RP, Sabir M, Kothari RP. Ventilatory pulmonary function tests in type 1 diabetes mellitus: *J Assoc Physicians India*. 2000 Oct; 48(10): 962-6.
10. Innocenti F, Fabbri A, Anichini R, Tuci S, Rettina G, Vannucci F, De Gidrgio LA, Seghieri G: Indications of reduced pulmonary functions in type 1 (insulin dependent) diabetes mellitus. *Diabetes Res. Clin. Pract* 1994; 25:161-168.
11. Matsubara T, Hara F. The pulmonary function and histopathological studies of the lung in diabetes mellitus. *Nippon Ika Daigaku Zasshi*. 1991 Oct; 58(5): 528-36.
12. Matsurbara T, Hara F: The pulmonary function and histopathological studies of the lung in diabetes mellitus. PMID: 1744225 (Pub Med indexed for Medline).
13. Makkar P, Gandhi M, Agrawal RP, Sabir M, Kothari RP. Ventilatory pulmonary function tests in type 1 diabetes mellitus: *J Assoc Physicians India*. 2000 Oct; 48(10): 962-6.
14. McKeever TM, Weston PJ, Hubbard R, Fogarty A. Lung function and glucose metabolism: an analysis of data from the Third National Health and Nutrition Examination Survey. *Am J Epidemiol*. 2005 Mar 15; 161(6): 546-56.
15. Benbassat CA, Stern E, Kramer M, Lebzelter J, Blum I, Fink G. Pulmonary function in patients with diabetes mellitus. *Am J Med Sci*. 2001 Sep; 322(3): 127-32.
16. Rosenecker J, Höfler R, Steinkamp G, Eichler I, Smaczny C, Ballmann M et al. Diabetes mellitus in patients with cystic fibrosis: the impact of diabetes mellitus on pulmonary function and clinical outcome. *Eur J Med Res*. 2001 Aug 27; 6(8): 345-50.
17. Davis WA, Knuiman M, Kendall P, Grange V, Davis TME. Glycemic exposure is associated with reduced pulmonary function in type 2 diabetes. *Diabetes Care* 2004; 27: 752-757.
18. Park. K. Park's textbook of Preventive and social medicine Diabetes mellitus. 20th Edition, Jabalpur, Banarsi Das Bhanot 2009:329.
19. American Thoracic Society, Standardization of spirometry: 1994 update. *J Respir Crit Care Med* 1995; 152: 1107–1136.
20. Mosteller RD: Simplified Calculation of Body Surface Area. *N Engl J Med* 1987 Oct22;317(17):1098
21. Litonjua AA, lazarus R, Sparrow D, Demolles D, Weiss ST. Lung function in type 2 diabetes: The Normative Aging Study. Respir Med. 2005 Dec; 99(12):1583-90.
22. Primhak RA., Whincup G., Tsanakas JN., Milner RD.: Reduced vital capacity in insulin-dependent diabetes. Diabetes. 36:324–326, 1987.

QUICK RESPONSE CODE	ISSN (Online) : 2277 –4572
	Website http://www.jpsionline.com

How to cite this article:
Qazi Rais Ahmed, Sapna Goyal, Narendra Gupta, Raj Bhadur Kamal, Shikky Garg. A comparative evaluation of pulmonary parameters in Diabetes mellitus patients and non diabetes mellitus apparently healthy volunteer as control. *J Pharm Sci Innov*. 2012; 1(5): 17-19.