



To Study The Relationship Of Pulmonary Function Tests On Type-2 Diabetes

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Type of Publication: Original Research Paper

Conflicts of Interest: Nil

Abstract

Objectives: To study the pulmonary function tests of individuals with type-2 diabetes mellitus and compare them with that of healthy non-diabetic subjects.

Material & Methods: The present study was undertaken in the Postgraduate department of Physiology, Government Medical College and Hospital, Jammu. On 200 subjects aged between 40-60 years. It is prospective observational study.

Results: there was progressive reduction in mean values of FVC, FEV1, PEFR and FEV1/FVC among subjects with increasing duration of type-2 Diabetes .

Conclusion: The mean value of FVC, FEV1, PEFR was significantly reduced, mean value of FEV1/FVC was less in subjects of type-2 diabetes Mellitus than that of healthy non diabetics subjects. Though it is not significant. There was no significant difference in mean fasting blood sugar. Among diabetic subject the duration of diabetes has no relation with alteration of blood glucose levels.

Keywords: Diabetes Mellitus, Pulmonary function test, Blood Glucose.

Introduction

Diabetes Mellitus is a metabolic syndrome characterized by persistent hyperglycemia, abnormal metabolism of carbohydrates, proteins and lipids resulting from impaired insulin secretion⁹. Globally, as of 2010 was estimated that there were 285 million people with Type-2 Diabetes mellitus, making up about 90% cases. Chronic hyperglycemia leads to non-enzymatic glycosylation of proteins, such as collagen and elastin with subsequent thickening of basement membrane and microangiopathy. These changes leads to restrict lung volumes and capacities⁵. Another cause of reduced pulmonary functions in Type-2 Diabetic patients is respiratory muscle weakness, which reduces the inspiratory and expiratory capacity and thus decreases the vital capacity¹⁰. Type-2 Diabetic Mellitus leads to reduction in pulmonary function test often associated

with duration of the disease. HbA1c (glycated haemoglobin) is higher amount indicates poor control of blood glucose levels and it has been associated with microvascular and macrovascular changes. Increased HbA1c value is associated with decrease in FVC and FEV1¹². An increase in 1% mean HbA1c is associated

with decrease of 4% predicted FVC.¹⁹ Selection criteria for diagnosis of Diabetes Mellitus.

Material and methods: The present prospective observational study was undertaken in the postgraduate department of physiology Government medical College and hospital, Jammu after approval on 200 subjects aged between 40-60 years.

Selection procedure of the subjects:-The study was conducted on patients of the Type-2 diabetes

attending Endocrinology OPD of Government Medical College and Hospital, Jammu, with a duration of diabetes of more than 5 years having HbA1c levels >8% or blood sugar control has not been achieved. 200 subjects were selected by random sampling technique. After detailing the purpose and methodology of the study and consent.

The subjects were categorized into two major groups.

1. Group I (Study group) comprised 100 type-2 diabetes; 50 males and 50 females.
2. Group-II (Control group). Comprised 100 healthy non diabetes; 50 males and 50 females.

Inclusion Criteria: Age 30-60 years Patients suffering from Type-2 DM attending OPD or admitted in GMC Hospital. **DM duration >5yrs.**

Exclusion Criteria: Age <30, not >60 years., Duration of DM <5 years, Subject with gross abnormalities of the vertebral column or thoracic cage or respiratory disease or chest wall injuries.. History of smoking or **Technique:** A detailed history was taken and clinical examination conducted on subjects as per performa and BP measured with sphygmomanometer Biochemical Measurement:

- Subjects were advised to take a light dinner and fast overnight before the day of tests. This was done to avoid the influence of diet on lipid profile and blood glucose level. 5ml of venous blood was drawn from antecubital vein under all aseptic precautions for the estimation of biochemical parameters. The sample transferred to department of

Biochemistry, Govt. Medical College, Jammu.

1. **Fasting Blood Sugar:** Method used for estimation of glucose by hexokinase-glucose-6 phosphate dehydrogenase method.
2. Glycosylated haemoglobin (HbA1c): HbA1c test estimates the average from kit procured from Vector Biotech Pvt. Ltd. India.

Method: 1.5ml of venous blood was collected after all aseptic conditions in a vial with anticoagulant EDTA from non-fasting subjects (GHb) calculated

Glycohaemoglobin% temperature factor¹⁷

.Pulmonary Function test: by computerize spirometer (Medspiror) and all according to American Thoracic Society/European

Respiratory Society (ATS/ERS) in a quiet room in sitting position¹³.

Statistical Analysis: the data was analysed using computer soft were Microsoft Excel and SPSS version 20.0 for windows. Statistical difference in mean value was tested using unpaired ‘t’ test. ANOVA (analysis of variance) was also performed . A p-value of <0.05 was considered statistically significant.

Results: 200 randomly selected subject with age group of 30 to 60 years. The subjects were divided into two groups Group-I (Study Group) comprised of 100 subjects comprising of 50 males and 50 females with diabetes for more than 5 years, or having HbA1c levels >8% and Group-II (control group) comprised of 100 subjects, who are healthy not divided into 50 males and 50 females Age and Sex distribution of subjects was not significant with p=0.42 not significant.

Table-1: Comparison of mean FVC (L) in Group-I subjects according to duration of T2DM.

Duration of T2DM (in years)	Group-I (n=100) FVC (L) Mean ± SD	Statistical inference (ANOVA)
5 (n=20)	2.12 ± 0.68	F=2.74; p=0.06; Not Significant
6-10 (62)	1.94 ± 0.50	
>10 (n=18)	1.70 ± 0.56	

Table-2: Comparison of mean values of FVC (L) between Group-I and Group-2 Subjects.

Variable	Group-I (n=100) Mean ± SD	Group-II (n=100) Mean ± SD	Statistical inference (Unpaired t test)
FVC (L)	1.93 ± 0.56	2.49 ± 0.61	t=6.76; p< 0.0001;

Table 3: Comparison of mean FEV1 (L) in Group-I subjects according to duration of T2DM.

Duration of T2DM (in years)	Group-I (n=100) FEV1 (L) Mean ± SD	Statistical inference (ANOVA)
5 (n=20)	1.76 ± 0.70	F=1.13; p=0.32; Not Significant
6-10 (62)	1.73 ± 0.51	
>10 (n=18)	1.52 ± 0.52	

Table-4: Comparison of mean PEFr (L/S) in Group-I Subjects according to duration of T2DM.

Duration of T2DM (in years)	Group-I (n=100) PEFr (L/S) Mean ± SD	Statistical inference (ANOVA)
5 (n=20)	6.58 ± 1.67	F=2.17; p=0.11; Not Significant
6-10 (62)	5.77 ± 1.60	
>10 (n=18)	5.65 ± 1.59	

Table-5: Comparison of mean values of PEFr (L/S) between Group-I and Group-II subjects.

Variable	Group-I (n=100) Mean ± SD	Group-II (n=100) Mean ± SD	Statistical inference (Unpaired t test)
PEFr (L/S)	4.92 ± 1.42	5.91 ± 1.63	t=4.57 H.significant

Table-6: Comparison of mean FEV1/FVC (%) in Group-I subjects according to duration of T2DM.

Duration of T2DM (in years)	Group-I (n=100) FEV1/FVC (%) Mean ± SD	Statistical inference (ANOVA)
5 (n=20)	89.48 ± 6.80	t=4.57 p<0.0001; Highly significant
6-10 (62)	88.96 ± 10.30	
>10 (n=18)	82.95 ± 19.49	

Table-7: Comparison of mean values of fasting blood sugar (mg/dL) between Group-I and Group-II Subjects.

Variable	Group-I (n=100) Mean \pm SD	Group-II (n=100) Mean \pm SD	Statistical inference (Unpaired t test)
Fasting blood sugar (mg/dL)	4.92 \pm 1.42	5.91 \pm 1.63	t=9.65 p<0.0001;

Diabetes Mellitus is associated with various micro vascular appearing with in 5-10 years of disease and macro vascular complications appearing with in 15-20 years of disease which damage multiple organs of our body.⁶ The hypothesis study was designed assuming that with adverting disease many body functions and parameters show derangements. Diabetes mellitus and its duration, both have some correlation on lung function tests (PFT) and other body parameters. This study was conducted to find out exact correlation, keeping in view the emerging evidences from current literature having both positive and negative co-relation between T2DM and lung

function test. This study was done. Relationship of T2DM with physical parameters. In present study the mean age group-I was 48.38 \pm 8 years and group-II was 49.23 \pm 7.09 years the difference is not statistically significant (p=0.42). The mean height of Group-I was 159.33 \pm 9.75 cm and that of Group-II was 160.57 \pm 9.82 cm, the difference is not statistically significant. The mean weight of group-I was 69.75 \pm 12.38 kg and that of Group-II; 66.38 \pm 12.21 kg again not statistically significant. The mean BMI between two groups has also not statistically significant (p=0.75). This study is in accordance with study by Asanuma.,³ who reported that there was no significant difference in the profile (age, sex, height) between diabetics and control.²⁰

Glycosylated haemoglobin relation with Diabetes Mellitus: The results showed that there was progressive increase in the mean value of HbA1c among subjects, with increasing duration of T2DM. The difference is highly significant (p=0.002) similar results are shown by Parmar al.,¹⁵ reported that along with HbA1c, Cholesterol, Triglycerides levels were significant increased with duration of diabetes.¹⁴

Relationship of Pulmonary function test and duration of diabetes: From the result observed that there was progressive decline PFTs among subjects with increasing duration of Type-2 D.M. However the Difference in mean values of FVC, FEV1, PEFR and FEV/FVC was not statistically significant. Results similar to the present observation were reported by Bell D et al.,⁴ stated that impairment of Lung functions was related to the duration of diabetes and restrictive abnormality might be possible with the progression of diabetes even though not so significant our observations are in agreement to study of^{11, 7, 14} Pulmonary Function test in Type-2 DM and comparison with healthy control. The difference in FVC readings in two groups was statistically high significant p<0.0001 observation in accordance with^{3, 16} FEV1- The difference in two groups was statistically significant. It is in accordance with^{4, 11} PEFR- The difference between the two groups was statistically highly significant p<0.0001 study in agreement with Abid E et al,¹⁴ FEV1/FVC ratio-highly significant.⁸

Conclusion & Summary:- The present study was conducted in the postgraduate Departments of Physiology in collaboration with Department of Endocrinology (Medicine), Government Medical College and Hospital, Jammu. 200 subjects were selected by randomly and then divided into two groups 100 Group-I diabetic and 100 Group-II non diabetics. After approval from ethical committee. The present research work was aimed to study. The pulmonary function test in subjects with Type-2 Diabetes Mellitus and compare them with healthy non diabetics subjects. The following results were drawn:- There was no significant difference between mean weight of Type-2 diabetes and that of healthy non diabetes inference drawn is that weight is less effected by T2DM.

- There was significant difference seen between the mean height, Age, BMI and gender of T2DM.
- There was progressive reduction in mean value of PFTs among subjects with increasing duration of T2DM. But the was not significant.
- Mean FVC, FEV1, PEFR was significant reduced in T2DM. Also ratio FEV1/FVC was less in T2DM group as compare Group-II.
- Mean fasting blood sugar was significantly more in subject of T2DM as compare to healthy non diabetics.
- HbA1c was progressively significant increase among subjects with increasing duration of T2DM.

Conclusion: - The finding of this study revealed that there is a positive relationship between T2DM and PFT Mean values of FVC, FEV1, and PEFR were significantly reduced in T2DM showing a restrictive pattern of airway disease. Though FEV/FVC was also reduced but not significant. The aforesaid observations establish that persistent hyperglycemia seen in T2DM, which can be assessed by HbA1c, might damage various organs like lungs, showing a restrictive pattern of pulmonary function tests as evidenced by reduction in FVC, FEV1,

BIBLIOGRAPHY

1. **Abd E Azeem A, Haimdy G, Amin M, Rashad A.** Pulmonary function changes in diabetic Lung. Egypt. *J Chest Dis tuberc* 2013 62(3): 513-7.
2. **Ali MO, Begum S, Ali T, Ferdousi S.** FVC, FEV1 and FEV1/FVC % in type-2 diabetes and their relationship with duration of the disease. *J Bangladesh Soc Physiol* 2009;4(2):81-7.
3. **Asanuma Y, Fujiya S, Ide H, Agishi Y.** Characteristics of pulmonary function in patients with diabetes mellitus. *Diabetes Res Clin Pract* 1985;1(2): 95-101.
4. **Bell D, Coller A, Mathews DM, Cooksey EJ, McHandy GJ Clarke BF.** Are reduced lung volumes in IDDM due to defect in connective tissue? *Diabetes* 1988; 37(6): 829-31.
5. **Chance WW, Rhee C, Yilmaz C.** Diminished alveolar microvascular reserves in Type-2 diabetes reflect systemic microangiopathy. *Diabetes Care* 2008; 31(8): 1596-601.
6. **Francisco CO, Catai AM, Moura-Tonello SCG, Lopes SLB, Benze BG, Leal AMO et al.** Cardio-respiratory fitness, pulmonary function and C-reactive protein levels in non-smoking individuals with diabetes. *Braz J Med Biol Res* 2014; 47(5): 426-31.
7. **Kanya Kumari DH, Nataraj SM, Devaraj HS.** Correlation of duration of diabetes and pulmonary function tests in type-2 diabetes mellitus patients. *Int J Biol Med Res.* 2011; 2(4): 1168-70.
8. **Kaur S, Agarwal N.** Pulmonary function tests in Type-2 diabetes Mellitus. *Arch Med Health Sci.* 2016; 4(1): 35-9.
9. **Keerthi G, Sharan B, Suresh M, Krishan BH.** Deterioration of pulmonary functions in type-2 diabetes mellitus. *J Pharm. Biol. Sci.* 2012; 1(1): 39-43.
10. **Litonjua AA, Lazarus D, Sparrow D, DeMolles D, Weiss ST.** Lung function in type-2 diabetes: the normative aging study. *Respire Med.* 2005; 99(2): 1583-90.
11. **Masmoudi K, Choyakh F, Zouari N.** Ventilatory mechanics and alveolocapillary diffusion in diabetes. *Tunis Med* 2002; 80(9): 524-30.
12. **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; 161(6): 546-56.
13. **Miller MR, Hankinson J, Brusasco V, Burgos F, Casaburi R, Coates A et al.** Standardisation of Spirometry. *Eur Respir J* 2005; 26(2): 319-38.
14. **Niazi S, Hassan SH, Ahmed I, Ashfaq A.** Effects of type-2 Diabetes Mellitus on Lung

- Function Parameters. *Sch J App Med Sci* 2013; 1(5) 482-7.
15. **Parmar D, Vidja K, Ghugare B.** Impact of duration of diabetes and age on lipid profile and glycaemic control in Type-2 Diabetic patients. *Int J Res Med.* 2013; 2(1): 69-72.
 16. **Primhak RA, Whincup G, Tsankas JN, Milner RD.** Reduced vital capacity in insulin dependent diabetes. *Diabetes* 1987; 36(3): 324-6.
 17. **Reynolds TM, Smellie WS, Twomey PJ.** Glycated haemoglobin (HbA1c) monitoring. *Brit Med J* 2006; 333(7568): 586-8.
 18. **Sandler M.** Is a lung 'target organ' in diabetes mellitus? *Arch Int Med.* 1990; 150(7): 1385-8.
 19. **Sinha S, Guleria R, Misra A, Pandey RM, Yadav R, Tiwari S.** Pulmonary functions in patients with type-2 diabetes mellitus and correlation with anthropometry and microvascular complications. *Indian J Med Res* 2004; 119(2): 66-71.
 20. **Wanke T, Formanek D, Auinger M, Popp W, Zwick H, Irsigler K.** Inspiratory muscle performance and pulmonary function changes in insulin dependent diabetes mellitus. *Am Rev Respir Dis* 1991