



CODEN [USA]: IAJ PBB

ISSN: 2349-7750

**INDO AMERICAN JOURNAL OF
PHARMACEUTICAL SCIENCES**<http://doi.org/10.5281/zenodo.3596282>Available online at: <http://www.iajps.com>

Research Article

**ASSOCIATION OF PULMONARY FUNCTION TEST WITH
GLYCEMIC CONTROL IN CASES OF TYPE-II DIABETES
MELLITUS**¹Dr. Muhammad Moin, ²Dr. Akbar Ali, ³Dr. Komal Parvez¹Medical Officer, Lahore general hospital, Lahore²Assistant Professor Physiology, Bakhtawar Ameen Medical College Multan³Woman Medical Officer, THQ Hospital, Yazman**Article Received:** October 2019 **Accepted:** November 2019 **Published:** December 2019**Abstract:****Objective:** To assess the pulmonary function test in cases of type-II diabetics and its association with glycemic status.**Material and methods:** This cross sectional study was conducted at Department of Pulmonology, Lahore General Hospital, Lahore from January 2019 to June 2019 over the period of 6 months. Total 100 patients of type-II diabetes mellitus both male and female having age 30-60 years were selected. Pattern of pulmonary function was assessed.**Results:** Total 100 patients of type-II diabetes mellitus were selected and pulmonary function test assessed. Mean age of the patients was 49.3±7.74 years. Out of 100 diabetics, pulmonary function test was found normal in 32 (32%) patients followed by restrictive in 50 (50%) patients and obstructive in 18 (18%) patients. Among the 24 (24%) patients, glycemic status was controlled and normal pulmonary function test was found normal in 14 (58.33%) patients, restrictive in 7 (29.17%) patients and obstructive in 3 (12.5%) patients. Out of 76 (76%) patients with uncontrolled glycaemia, pulmonary function test was found normal, restrictive and obstructive in 18 (23.68%) patients, 43 (56.58%) patients and 15 (19.74%) patients respectively. Statistically significant ($P = 0.006$) association of pulmonary function test with glycemic status was found.**Conclusion:** Results of present study showed that most of the diabetics found with restrictive pattern. Most of the diabetics were male but no association between pulmonary function test and gender was noted. Obese diabetics were significantly associated with pulmonary function test and restrictive pattern was most common obese diabetics. Statistically significant association of pulmonary function test with glycemic status was observed.**Key words:** Diabetes mellitus, restrictive, obstructive, pulmonary**Corresponding author:****Dr. Muhammad Moin,**

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Please cite this article in press Muhammad Moin et al., Association Of Pulmonary Function Test With Glycemic Control In Cases Of Type-II Diabetes Mellitus., Indo Am. J. P. Sci, 2019; 06(12).

INTRODUCTION:

Hyperglycemia and disturbed metabolism of body macros (due to endogenous insulin) can cause Diabetes mellitus (DM).¹ Its growth is becoming rapid on an epidemic level and it carries a crucial economic weight. It can cause noticeably high mortality and morbidity in patients and is a major health concern worldwide.² According to International Diabetes Federation, 387 million people were suffering diabetes mellitus in 2014 and by 2035, 1 in 10 adults will be suffering from diabetes mellitus increasing the number to estimated 600 million.³ Almost every organ system is effected by this metabolic disorder along with widespread biochemical, morphological and functional abnormalities. Morbidity and mortality are caused by diabetes including several organ failures (eyes, kidneys nerves etc). Diseases like peripheral vascular disease, coronary heart disease and stroke are higher in type 2 diabetes patients adding hypertension, dyslipidemia, and obesity as risk factors. Drawbacks such as developing microvascular and macrovascular problems are related to diabetes type 2.⁴

Chronic hyperglycemia in diabetes may lead to systemic inflammation which results in airway and lung damage.⁵ As a proinflammatory stimulus, chronic hyperglycemia leads to increased intrapulmonary inflammation and tissue fibrosis. Structural modifications of the lung parenchyma that result from these changes include the narrowing of the alveolar space, flattening of the alveolar epithelium and expansion of the interstitial.⁶

The result is a reduction of lung volumes and pulmonary diffusion capacity.⁷ T2DM individuals are known to have reduced exercise capacity and the level of reduction is associated with diabetes control. The pulmonary and other late complications of diabetes share a similar microangiopathy mechanism. Since, they share common mechanisms, there may be associations between lung function and markers of microangiopathy.⁸

This study was planned to measure pulmonary test in cases of type-II diabetes mellitus and its association with glycemic control. The results of this study will help bridge the knowledge gap and provide population relevant data on the pulmonary function and related factors in T2DM.

OPERATIONAL DEFINITION**PULMONARY FUNCTION TEST**

Normal: if FEV1/FVC was greater than 70%.

Obstructive: Obstructive ventilatory defect if FEV1/FVC less than 70%

Restrictive: if the ratio of FEV1/FVC greater than 70% and the ratio of obtained FVC/predicted FVC less than 80%

GLYCEMIC STATUS

Controlled: If HbA1c \leq 6.5 mg/dl

Un-controlled: If HbA1c $>$ 6.5 mg/dl

MATERIAL AND METHODS:

This cross-sectional study was conducted at Department of Pulmonology, Lahore General Hospital, Lahore from January 2019 to June 2019 over the period of 6 months. Total 100 patients of type-II diabetes mellitus both male and female having age 30-60 years were selected. Patients with history of smoking, present or past history of respiratory illness 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, individuals with current or recent upper respiratory or lower respiratory infection, that could predispose to heightened airway reactivity, individuals with unacceptable spirometric technique. An unacceptable spirometry was that in which FEV1 or FVC could not be correctly measured due to cough, lack of understanding of the procedure, recent thoracic and abdominal surgery were excluded.

Approval was taken from ethical committee and written informed consent was taken from every patient.

Weight of all the patients was noted by using weighing machine, height of all the patients was measured by using measuring tape to calculate the BMI of the patients. Five ml blood sample was drawn and send to laboratory for HbA1c levels to assess the glycemic control of the patients. Duration of diabetes mellitus was asked and noted on pre-designed proforma. Demographic profile of the all the patients was also taken.

Pulmonary function test of the patients were performed with turbine flow sensor-based 702 Helios - Spirometer (name) between 11 am and 12 pm. All the tests were conducted according to American Thoracic Society/European Respiratory Society (ATS/ERS guidelines) in a quiet room in sitting position by the trained personnel.⁹ Findings of pulmonary function test in term of normal/restrictive/obstructive was noted on proforma.

All the collected data entered in SPSS version 20 and analyzed. Mean and SD was calculated for age, duration of diabetes mellitus, height, weight and BMI. Frequencies and percentages were calculated for

pulmonary function test (Normal/Restrictive/Obstructive), gender, duration of diabetes mellitus, obesity (Obese/Non-obese), Glycemic status (controlled/un-controlled). Stratification was done for age, gender, duration of diabetes mellitus, obesity, Glycemic status. Post stratification, chi-square test was applied to see the effect of these on outcome variable i.e. pulmonary function. P value ≤ 0.05 was considered statistically significant.

RESULTS:

Total 100 patients of type-II diabetes mellitus were selected and pulmonary function test assessed. Mean age of the patients was 49.3 ± 7.74 years. Out of 100 diabetics, pulmonary function test was found normal in 32 (32%) patients followed by restrictive in 50 (50%) patients and obstructive in 18 (18%) patients. (Fig. 1) Selected patients were divided into two age groups i.e. age group 30-45 years and age group 46-60 years. Total 33 (33%) patients belonged to age group 30-45 years and 67 (67%) patients belonged to age group 46-60 years. In age group 30-45 years, pulmonary function test was found normal, restrictive and obstructive in 9 (27.27%) patients, 15 (45.45%) patients and 9 (27.27%) patients respectively. Pulmonary function test was found normal in 23 (34.33%) patients, restrictive in 35 (52.24%) patients and obstructive in 9 (13.43%) patients in age group 46-60 years. Statistically insignificant association of pulmonary function test with age groups was noted with p value 0.2346. (Table 1) Male patients were 67 (67%) and female patients were 33 (33%). Pulmonary test was found normal in 25 (37.31%) male patients, restrictive in 31 (46.27%) male patients and obstructive in 11 (16.42%) male patients. Total 7 (21.21%) female patients found with normal

pulmonary function test followed by restrictive in 19 (57.58%) female patients and obstructive in 7 (21.21%) female patients. Association between pulmonary function test and gender was not statistically significant with p value 0.2671. (Table 2) Out of 74 (74%) obese patients, pulmonary function test was normal in 13 (17.57%) patients, restrictive was in 47 (63.51%) patients and obstructive was in 14 (18.92%) patients. Non-obese patients were 26 (26%) and pulmonary function test was found normal in 19 (73.08%) patients, restrictive in 3 (11.54%) patients and obstructive in 4 (15.38%) patients. Association of pulmonary function test with obesity was found statistically significant with p value 0.001. (Table 3) Among the 24 (24%) patients, glycemic status was controlled and normal pulmonary function test was found normal in 14 (58.33%) patients, restrictive in 7 (29.17%) patients and obstructive in 3 (12.5%) patients. Out of 76 (76%) patients with un-controlled glycaemia, pulmonary function test was found normal, restrictive and obstructive in 18 (23.68%) patients, 43 (56.58%) patients and 15 (19.74%) patients respectively. Statistically significant ($P = 0.006$) association of pulmonary function test with glycemic status was found. (Table 4) Total 41 (41%) patients found with duration of diabetes ≤ 10 Years and pulmonary function test was found normal in 15 (36.59%) patients, restrictive in 21 (51.22%) patients and obstructive in 5 (12.19%) patients. Among the 59 (59%) patients duration of diabetes mellitus was >10 Years and pulmonary function test was found normal in 17 (28.81%) patients, restrictive in 29 (49.15%) patients and obstructive in 13 (22.03%) patients. Insignificant association between pulmonary function test and duration of diabetes mellitus was noted with p value 0.410. (Table 5)

Fig. 1: Pulmonary function test status

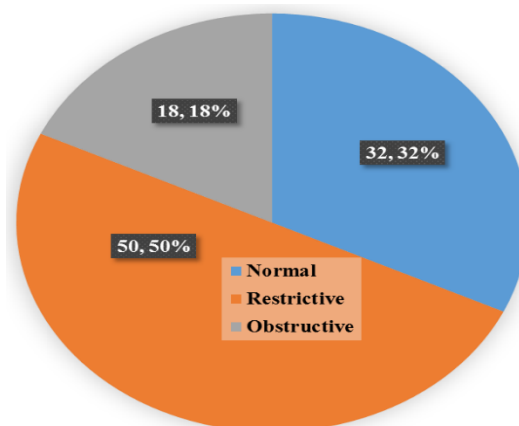


Table 1: Association of pulmonary function test with age

Age Group	Pulmonary function test			Total	P value
	Normal	Restrictive	Obstructive		
30-45	9 (27.27%)	15 (45.45%)	9 (27.27%)	33 (33%)	0.2346
46-60	23 (34.33%)	35 (52.24%)	9 (13.43%)	67 (67%)	
Total	32 (32%)	50 (50%)	18 (18%)	100	

Table 2: Association of pulmonary function test with gender

Gender	Pulmonary function test			Total	P value
	Normal	Restrictive	Obstructive		
Male	25 (37.31%)	31 (46.27%)	11 (16.42%)	67 (67%)	0.2671
Female	7 (21.21%)	19 (57.58%)	7 (21.21%)	33 (33%)	
Total	32 (32%)	50 (50%)	18 (18%)	100	

Table 3: Association of pulmonary function test with gender

Obesity	Pulmonary function test			Total	P value
	Normal	Restrictive	Obstructive		
Obese	13 (17.57%)	47 (63.51%)	14 (18.92%)	74 (74%)	0001
Non obese	19 (73.08%)	3 (11.54%)	4 (15.38%)	26 (26%)	
Total	32 (32%)	50 (50%)	18 (18%)	100	

Table 4: Association of pulmonary function test with glycemic status

Glycemic status	Pulmonary function test			Total	P value
	Normal	Restrictive	Obstructive		
Controlled	14 (58.33%)	7 (29.17%)	3 (12.5%)	24 (24%)	0.006
Un-controlled	18 (23.68%)	43 (56.58%)	15 (19.74%)	76 (76%)	
Total	32 (32%)	50 (50%)	18 (18%)	100	

Table 5: Association of pulmonary function test with duration of DM

Duration of DM	Pulmonary function test			Total	P value
	Normal	Restrictive	Obstructive		
≤10 Years	15 (36.59%)	21 (51.22%)	5 (12.19%)	41 (41%)	0.410
>10 Years	17 (28.81%)	29 (49.15%)	13 (22.03%)	59 (59%)	
Total	32 (32%)	50 (50%)	18 (18%)	100	

DISCUSSION:

Diabetes is a disease with profound multi-organ damage and several studies locally and internationally had attempted to evaluate relationship between diabetes and lung functions.¹⁰

Several reasons has been given for the development of restrictive diseases in DM, some of which included the fact that there exist the potential for microvascular damage and non-enzymatic glycation in persons with diabetes due to the existence of a large vascular network in the lung and its richness in collagen and elastin thus making the lung, a potential organ for damage in DM.¹¹ This position is further strenghted by the post mortem histologic study which showed thickening of both the alveolar epithelial and pulmonary basal laminae in patients with diabetes. This was thought to be suggestive of microangiopathy which is believed leads to restrictive defects.¹²⁻¹³

In present study out of 100 diabetics, pulmonary function test was found normal in 32 (32%) patients followed by restrictive in 50 (50%) patients and obstructive in 18 (18%) patients.

Panpalia et al¹⁴ selected 50 type-II diabetics and pulmonary function test was performed in selected patients. Out of 50 diabetic patients 14% were normal, 12% were having an obstructive involvement, 22% were having restrictive pattern of involvement. In a study by Adeyeye et al,¹⁵ ventilatory pattern of participating patients with DM was normal in 43.0% patients, restrictive in 38% patients and obstructive in 11% patients. In our study 63.51% obese diabetics had restrictive pattern and 18.92% obese diabetics had obstructive pattern. In one study by Vracko et al¹⁶ total 17% obese diabetics were found with restrictive pattern.

In one study by Karande et al,¹⁷ total 200 diabetics were selected and pulmonary function test was performed. Total 68% patients had normal PFT, mild obstruction 10.0% (20), mild restriction 10% (20) moderate obstruction 2% (4), moderate restriction 4% (8) and mixed 6% (12) were noted.

Hyperglycemia causes pulmonary microangiopathy and glycosylation of proteins such as collagen in the lungs and chest wall.¹⁸ Impaired collagen and elastin crosslinkage increases lung stiffness and results in decreased elastic recoil, decreased chest wall compliance and muscular weakness.¹⁹ Post-mortem studies on diabetic patients have shown the thickening of alveolar epithelial and pulmonary capillary basal laminae, centrilobular emphysema and pulmonary angiopathy.²⁰

Increase in age and longer duration of diabetes has a potential for longer exposure of the lung in diabetics to longer inflammatory processes and end glycation products which are part of the diabetes process and their consequences. In this scenario, possible acceleration of the physiological decline effect of ageing on the pulmonary functions may occur.²¹ However in our study the age of the patient did not appear to predict lung damage and this finding may require further evaluation with a larger study.

CONCLUSION:

Results of present study showed that most of the diabetics found with restrictive pattern. Most of the diabetics were male but no association between pulmonary function test and gender was noted. Obese diabetics were significantly associated with pulmonary function test and restrictive pattern was most common obese diabetics. Statistically significant association of pulmonary function test with glycemic status was observed.

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