CODEN [USA]: IAJPBB ISSN: 2349-7750

INDO AMERICAN JOURNAL OF
PHARMACEUTICAL SCIENCES

SJIF Impact Factor: 7.187
http://doi.org/10.5281/zenodo.3968007

Available online at: http://www.iajps.com *Research Article*

# PULMONARY FUNCTION TESTS IN PATIENTS WITH TYPE II DIABETES MELLITUS IN ASSOCIATION WITH FASTING BLOOD GLUCOSE

**Dr. Sumaira Mushtaque[3], Dr. Shezana Kosar[2], Dr. Amina Pervaiz[1]**
[1] Medical Officer, Sheikh Zaid bin Nihan hospital (CMH) Rawalakot
[2] Medical Officer, Rahma hospital Khuiratta
[3] Medical Officer, BHU DESA Paghwati District Poonch AJK

**Article Received:** May 2020 **Accepted:** June 2020 **Published:** July 2020

**Abstract:**
***Background & Goals:*** *Diabetes (DM) is an important public health issue worldwide associated with hormonal, metabolic and microvascular disorders. Angiopathic complications affect the eye, kidneys, nerves, cardiovascular and respiratory systems, which mainly depend on biochemical changes in the connective tissue.*
***Place and Duration:*** *In the Pulmonology and Department of Physiology, Sheikh Khalifa bin Zayed Al-Nayhan Combined Military Hospital, Rawalakot for one-year duration from February 2019 to February 2020.*
***Material and Methods:*** *This study includes 100 people aged 30 to 55 years, 50 diabetics (25 men and 25 women) and 50 (25 men and 25 women) healthy individuals. The pulmonary function tests were performed by the computerized spirometer in the Pulmonology and Department of Physiology.*
***Results:*** *The results of our study showed a statistically significant reduction in FEF50%, FEF75% & FEV1 /FVC ratio in diabetic male subjects when compared with control male subjects ($p< 0.0001$) and diabetic female subjects showed a reduction in FEV1/FVC which is not statistically significant ($p = 0.0004$) but we observed a statistically significant reduction in FEF50% & FEF75% in diabetic female subjects when compared with control female subjects ($p< 0.0001$). On spirometry, Diabetic subjects showed a significant reduction in FEV1/ FVC ratio, FEF 50%, FEF 75% relative to non-diabetic controls.*
***Conclusion:*** *From our study, we conclude that people with diabetes showed impaired lung function. We found a decline in FEV1 / FVC, FEF50% and FEF75% in diabetic patients compared to the control group.*
***Keywords:*** *Diabetes, Forced Vital capacity, forced expiratory Volume, Forced Expiratory Flow.*

**Corresponding author:**
**Dr. Sumaira Mushtaque,**
*Medical Officer, Sheikh Zaid bin Nihan hospital (CMH) Rawalakot*

QR code

*Please cite this article in press Sumaira Mushtaque et al,* ***Pulmonary Function Tests In Patients With Type II Diabetes Mellitus In Association With Fasting Blood Glucose.,*** *Indo Am. J. P. Sci, 2020; 07(07).*

## INTRODUCTION:

Diabetes is a systemic disease that causes changes in the structure and function of various tissues. The pathogenesis of diabetic complications includes both the macroangiopathic process and the non-enzymatic glycation of tissue proteins[1-2]. This process results in a decrease in the strength and elasticity of connective tissue, which causes biochemical changes in the components of connective tissue, also due to non-enzymatic glycosylation of proteins. The presence of abundant connective tissue in the lungs and extensive microvascular circulation can be a possible cause of the "target organ") of the lungs in patients with diabetes. Especially in Pakistan, due to the increased intricacies and incidence of DM, it is necessary to study lung function in patients with type DM and study its correlation with microangiopathic complications[3-4]. Several clinical studies have suggested a possible link between pulmonary dysfunction and renal microangiopathy and diabetic retinopathy. Changes in the ability of pulmonary monoxide (DLCO) are reported as a symptom of pulmonary microangiopathy[5]. Defective lung function in asymptomatic diabetic patients is generally more common than it is known to affect 60% of adult cases. Autopsy results in people with diabetes and experiments in diabetic rats include thickening of the alveolar epithelium, pulmonary emphysema and pulmonary microangiopathy[6-7]. These anatomical changes may be due to biochemical changes in connective tissue components caused by non-enzymatic glycosylation of proteins and peptides caused by chronic high circulation[8]. Pulmonary mechanical function tests include lung flexibility measurement, airflow resistance and pulmonary lung function tests. Diabetes is associated with spirometric abnormalities in many inconsistent small cross-sectional retrospective studies, including even less than 50 people[8-9]. Changes such as hyperglycemia, oxidative stress from glucose autooxidation, non-enzymatic protein glycosylation, and changes in nitric oxide (NO) metabolism have been reported to be metabolic markers of diabetes. The source of free radicals in diabetes is not fully understood, but glycation of proteins can lead to oxidative stress through direct O2 and H2O2 release and activation of phagocytes by a specialized receptor for advanced glycation end products. Oxidizing agents include reactive oxygen species (ROS), reactive nitrogen species (RNS), sulfur focused radicals, and others. Phagocytic cells produce large amounts of NO and other ROS. Peroxynitrite (ONOO−) is formed when NO reacts with peroxide (O−). This reaction is rapid and promotes the nitration of biomolecules, including protein tyrosine residues. The peroxynitrite anion and the peroxynitrous acid (ONOOH) can freely pass through lipid membranes and can mediate oxidation, nitration or nitrosation reactions. Peroxynitrite is more than two orders of magnitude more potent than H2O2 at catalyzing lipid oxidation in vivo. The pathophysiological relationship between diabetes mellitus and lung function was explained by a possible proinflammatory stimulus of hyperglycemia resulting in impaired lung function by exacerbation of pulmonary inflammation and apoptosis. Another possible cause of impaired lung function may be increased hardening of the bronchial arteries as a consequence of generalized atherosclerosis in diabetes. Diaphragm elevation with increased occluding volume and decreased FVC in the absence of detectable bronchial obstruction is another possible cause of impaired pulmonary function.

## MATERIALS AND METHODS:

This study was held in the Pulmonology and Department of Physiology, Sheikh Khalifa bin Zayed Al-Nayhan Combined Military Hospital, Rawalakot for one-year duration from February 2019 to February 2020.

We included 100 people, 50 diabetics (25 men and 25 women) and 50 healthy people (25 men and 25 women) aged 30-55 years old, with their consent, in this study. Approval was obtained from the institutional ethics committee. Subjects were classified as having diabetes (according to the criteria adapted from the 1997 American Diabetes Association Criteria criteria) if any of the following were met: Fasting glucose of 7.0 mmol / liter (126 mg / dL) or higher; non-fasting blood glucose of at least 11.1 mmol / liter (200 mg / dl); current use of antidiabetic drugs. Inclusion Criteria: People who have never smoked and have never reported any respiratory complaints or history of respiratory illness. Exclusion criteria: people with heavy smoking, alcohol consumption, anemia, malnutrition, productive cough, exercise dyspnea and cardiovascular diseases, people with chronic lung diseases (such as pulmonary tuberculosis, bronchial asthma, chronic bronchitis, etc.), people who past thoracic surgery, kypho scoliosis, carinatum chest, funnel chest, occupational diseases such as pneumoconiosis.

## RESULTS:

Compared to the control group, diabetic men showed a reduction in the mean FEV1 / FVC ratio by 3.51% (i.e. 2.9), a decrease in the mean FEF50% by 21.05% (i.e. 0.8 L / s) and a reduction in average FEF 75% by 19.04% (i.e. 0.24 l / s). Compared to women in the control group, diabetic women showed a reduction in mean FEV1 / FVC by 3.48% (i.e. 1.8), a mean FEF50% reduction by 31.57% (i.e. 1.2 L / s) and a 25% (ie 0.3 L / s) reduction in the mean FEF 75. In the spirometric test, diabetic patients showed a significant

reduction in FEV1 / FVC, FEF 50%, FEF 75% compared to the control group without diabetes. The results of our study showed a reduction in the FEV1 / FVC ratio in men with diabetes compared to the control group of men, which is statistically significant (p <0.0001), and in women with diabetes, a decrease in FEV1 / FVC was found, which is not statistically significant (p = 0.0004). The results of our study showed a statistically significant reduction in FEF50% in men with diabetes compared to the control group (p <0.0001), and also women with diabetes showed a statistically significant reduction in FEF50% (p value <0.0001). The results of our study showed a statistically significant reduction in FEF75% in men with diabetes compared to the control group (p <0.0001), and women with diabetes also showed a reduction in FEF75% (p <0.0001), which is statistically significant. (Table 1)

**Table: 1. Comparison of Mean Values of FEV1/FVC, FEF50% and FEF75% in Male, female subjects**

| PARAMETER | Male | | | Fe male | | |
|---|---|---|---|---|---|---|
| | CONTROL | DIABETIC | P-value | CONTROL | DIABETIC | P-value |
| FEV1/ FVC | 82.4± 1.63 | 79.5± 1.87 | 0.0001 | 80.4 ± 1.35 | 78.9± 1.40 | 0.0004 |
| FEF50% (L/sec) | 3.8± 0.31 | 3.0 ± 0.50 | 0.0001* | 3.8± 1.24 | 2.6±0.33 | 0.0001* |
| FEF75% (L/sec) | 1.26± 0.13 | 1.02± 0.20 | 0.0001* | 1.2± 0.12 | 0.9± 0.11 | 0.0001* |

## DISCUSSION:

Many studies on diabetes lung dysfunction are cross-cutting, including a small number of patients suffering from insulin-dependent diabetes (type I) or type II diabetes. Diabetes affects the mechanical and microvascular function of the lungs and affects ventilated control. Numerous studies on lung function in patients with diabetes have shown a slight decrease in mandatory rates of exhalation and lung volume in both type I diabetes and type II diabetes[9-10]. Lange P Groth S, Kastrup J and others worked to find a link between diabetes, mandatory life ability and mandatory exhalation volume in a second. In all age groups, lung function was impaired in patients with diabetes[11]. The mandatory exhalation volume and the mandatory average exhaust flow in the second (FEV1) are reduced by 8-20% with a moderately restrictive defect without overloading the airways. In other studies, spirometric lung function tests detect a significant difference between patients with diabetes mellitus and normal controls. Diagnosis of DM in the Framingham heart study was associated with a further decrease in CVF than FEV1, suggesting a restrictive pathology. On the other hand, when people with diabetes were excluded from treatment, high fasting blood sugar was associated with a greater reduction in FEV1 than CVF. A gradual decrease in the rate of fev1/vcf residues with increased blood sugar levels suggests that higher hunger is associated with more obstructive blood sugar physiology[12]. A Fremantle diabetes study showed a reduction in spirometric lung function in patients with type 2 diabetes. Goya wannamethee S, Gerald Sharper A, Ann Rumley and others

studied the link between potential lung function, at risk of type 2 diabetes[13-14]. They thought that the cause of these connotations could be inflammation. They concluded that blockage of lung function was associated with type 2 diabetes instead of a restrictive deterioration. Ali M.O, Begum S, Begum N et al. Studies have been conducted to observe the relationship between different parameters of lung function in patients with type 2 diabetes mellitus. They concluded that ventilation function in the lungs can reduce type 2 diabetes, which may be related to the duration of the disease. Mohhamed Irfan, Abdul jabbar, Ahmed Suleiman Haque et al. They observed that lung function worsened regardless of smoking in diabetics. The results of our study were consistent with this study. The reduction in FEV1 and CVC in people with diabetes is similar to that seen in non-diabetes cases in some longitudinal studies. Little has been done to examine the functions of the respiratory muscles in diabetes[15]. DLCO was used to study pulmonary vascular lesions. Although some studies have shown no drawbacks in diabetes, most studies have reported lower diffusion ability in diabetic patients. Carmela Maiolo, Ehab And Mohamed, Angela Andreoli worked to assess the relationship between fat breakdown and reduced lung function in obese adult type 2 diabetics. DLCO and respiratory function was found to explain the relationship between lung dysfunction and body composition. A potential mechanism explaining the finding of reduced lung function may have reduced muscle strength in patients with diabetes due to faulty muscle metabolism or inflammatory origin.

## CONCLUSION:

The cause for the decline in lung function in diabetes remains unclear. Taking into consideration of increased prevalence of lifestyle-related chronic diseases like diabetes, the complications for patients with diabetes, with overt pulmonary diseases claim special attention. To study the possible pathophysiological mechanisms further

research is needed. Our study has several limitations. First, there were a smaller number of subjects. So, we cannot generalize the result in different groups i.e., diabetic and control groups. Secondly, we did not measure DLCO in our subjects. Several studies showed a reduction in DLCO in diabetic subjects, also in subjects with normal spirometric values. Lung function should be monitored regularly to know the degree of impairment in diabetic or pre - diabetic subjects

**REFERENCES:**


1. Bajaj, Sarita, Sparsh Anil, and Rajpal Prajapati. "Pulmonary function tests in type 2 diabetes mellitus and their association with glycemic status and insulin resistance." *International Journal of Diabetes in Developing Countries* (2020): 1-4.
2. Prentice, Bernadette J., Avinesh Chelliah, Chee Y. Ooi, Shihab Hameed, Charles F. Verge, Leanne Plush, and John Widger. "Peak OGTT glucose is associated with lower lung function in young children with cystic fibrosis." *Journal of Cystic Fibrosis* 19, no. 2 (2020): 305-309.
3. Choi, Hoon Sung, Sung Woo Lee, Jin Taek Kim, and Hong Kyu Lee. "The Association between Pulmonary Functions and Incident Diabetes: Longitudinal Analysis from the Ansung Cohort in Korea." *Diabetes & Metabolism Journal* 44 (2020).
4. Priyadharshini, N., R. C. Renusha, S. Reshma, Marella Sindhuri Sai, Raja M. Koushik Muthu, and M. G. Rajanandh. "Prevalence of metabolic syndrome in patients with chronic obstructive pulmonary disease: An observational study in South Indians." *Diabetes & Metabolic Syndrome: Clinical Research & Reviews* (2020).
5. Zhu, Lihua, Zhi-Gang She, Xu Cheng, Juan-Juan Qin, Xiao-Jing Zhang, Jingjing Cai, Fang Lei et al. "Association of blood glucose control and outcomes in patients with COVID-19 and pre-existing type 2 diabetes." *Cell metabolism* (2020).
6. Yesufu, JolaOluwa Oluwatosin, Olaoluwa David Oluwasile, Olufemi Idowu Oluranti, Adesoji Adesipe Fasanmade, and Ayodele O. Soladoye. "Cardiopulmonary health indices and diabetes risk scores in undergraduate students of a private university in Nigeria." *Beni-Suef University Journal of Basic and Applied Sciences* 9, no. 1 (2020): 1-7.
7. Aweto, Happiness Anulika, Esther Onyinyechi Obikeh, and Bosede Abidemi Tella. "Effects of incentive spirometry on cardiopulmonary parameters, functional capacity and glycemic control in patients with Type 2 diabetes." *Hong Kong Physiotherapy Journal* (2020): 1-12.
8. Lee, Yi-Yen, Yu-Chung Tsao, Chih-Kai Yang, Chung-Hsun Chuang, Wei Yu, Jih-Chang Chen, and Wen-Cheng Li. "Association between risk factors of metabolic syndrome with lung function." *European Journal of Clinical Nutrition* 74, no. 5 (2020): 811-817.
9. Lee, Do-Youn, and Seung-min Nam. "The Association Between Lung Function and Type 2 Diabetes in Koreans." *Osong Public Health and Research Perspectives* 11, no. 1 (2020): 27.
10. Sánchez, Enric, Chadia Mizab, Ariadna Sauret, Ferran Barbé, Raquel Martí, Carolina López-Cano, Marta Hernández et al. "Effect of Subcutaneous Insulin on Spirometric Maneuvers in Patients with Type 1 Diabetes: A Case-Control Study." *Journal of Clinical Medicine* 9, no. 5 (2020): 1249.
11. Melo, Karla Cinara Bezerra, Flávio de Souza Araújo, Claudionor Cícero Mascêna Cordeiro Júnior, Karoline Teixeira Passos de Andrade, and Sérgio Rodrigues Moreira. "Pilates Method Training: Functional and Blood Glucose Responses of Older Women With Type 2 Diabetes." *The Journal of Strength & Conditioning Research* 34, no. 4 (2020): 1001-1007.
12. Guo, Qingyu, Pu Zang, Shaoying Xu, Wenjing Song, Zhen Zhang, Chunyan Liu, Zhanhong Guo et al. "Time in Range, as a Novel Metric of Glycemic Control, Is Reversely Associated with Presence of Diabetic Cardiovascular Autonomic Neuropathy Independent of HbA1c in Chinese Type 2 Diabetes." *Journal of Diabetes Research* 2020 (2020).
13. Lewis, Douglas, Melissa C. Norton, and Lyndsey N. Buzzard. "CF Related Diabetes." In *Cystic Fibrosis in Primary Care*, pp. 117-125. Springer, Cham, 2020.
14. Palella, Eleonora, Rossella Cimino, Salvatore A. Pullano, Antonino S. Fiorillo, Elio Gulletta, Antonio Brunetti, Daniela P. Foti, and Marta Greco. "Laboratory parameters of hemostasis, adhesion molecules, and inflammation in type 2 diabetes mellitus: Correlation with glycemic control." *International Journal of Environmental Research and Public Health* 17, no. 1 (2020): 300.
15. Lindley, Virginia M., Kamal Bhusal, Laura Huning, Steven N. Levine, and Sushil K. Jain. "Reduced 25 (OH) Vitamin D Association with Lower Alpha-1-Antitrypsin Blood Levels in Type 2 Diabetic Patients." *Journal of the American College of Nutrition* (2020): 1-6.