

## Effects of Diabetes on pulmonary function tests in COPD Patient

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### RESEARCH ARTICLE

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#### ABSTRACT

COPD (chronic obstructive pulmonary disease) is a condition caused by abnormalities in the inflammatory responses of the lungs to irritable particles or gases. This is an irreversible condition that progresses in later years. Diabetes patients have an increased risk of developing abnormal lung functioning and also in conditions of COPD it even worsens the condition, up to 1.6-16% of the COPD population were affected due to diabetes mellitus. Many studies also suggest that the lungs are a target organ in diabetes and glycemic exposure may be a causation factor for reduced lung function. Systemic inflammation, hypoxemia, oxidative stress, altered gas exchange, and changes in lung tissues were the major impacts on the respiratory system which were induced by hypoglycemia. In this study, we aimed to assess the lung functioning in COPD patients with diabetes by performing the pulmonary functions test like spirometry by obtaining the values of FVC, FEV1, FEV1/FVC, and PEF thereby analyzing the level of lung dysfunction that has been done. Patients were included of both genders and were divided into two groups depending on their disease group 1 includes COPD and group 2 includes COPD with DM considering twenty members in each group. Our study results show that diabetes worsens the lung functioning in COPD than it already is, it may also cause respiratory collapse if untreated.

**Keywords:** Diabetes, COPD, Pulmonary Function Tests, Hypoglycemia

### 1. Introduction

COPD (chronic obstructive pulmonary disease) is a condition caused by abnormalities in the inflammatory responses of the lungs to irritable particles or gases. This is an irreversible condition that progresses in later years. (1) Pulmonary function tests are the parameters for assessing the level of lung functioning of a person which is important in prognostic, diagnostic, and clinical values, clear decrease in lung functioning has been reported in patients with diabetes from the past decade. Patients with diabetes were at risk for developing chronic airflow obstruction. (2)

Diabetes patients have an increased risk of developing abnormal lung functioning and also in conditions of COPD it even worsens the condition, up to 1.6-16% of

the COPD population were affected due to diabetes mellitus. The considerable or considered risk factors for the development of decreased lung functioning were systemic inflammation, insulin resistance, and metabolic syndrome which was in healthy and nonsmoking patients. (3)

Many studies also suggest that the lung as a target organ in diabetes and glycemic exposure may be a causation factor for reduced lung function. Systemic inflammation, hypoxemia, oxidative stress, altered gas exchange, and changes in lung tissues were the major impacts on the respiratory system which were induced by hypoglycemia. (4)

Decreased pulmonary function in patients with diabetes mellitus was due to biochemical changes in connective tissue

constituents of lungs, specifically collagen and microangiopathy because of the nonenzymatic glycosylation of proteins and extracellular matrix of lung parenchyma and also elastin. Chronic hypoglycemia induced basal lamina thickening increased susceptibility to infection, and skeletal muscle weakness with subsequent sarcolemma.(5) The alveolar diffusion capacity was altered due to diabetic microangiopathy. Phrenic nerves were affected by autonomic neuropathy which results in the reduction of muscle tone and control of the diaphragm. Inflammations cause scarring in the walls of the lungs eventually make them lose elasticity, which reduces the ability to breathe in and breathe out limiting the oxygen transferred into the bloodstream. In this study, we assessed the pulmonary function in COPD patients and COPD patients with Diabetes. (6)

## 2. Materials and Methods

The study was conducted in Pinnamaneni Siddhartha institute of medical sciences and research foundation; chinaavutupalli. A detailed proforma was filled by the volunteer patients during the recruitment, twenty normoglycemic COPD patients and twenty COPD with diabetes patients were included in the study.

### Inclusion Criteria

Patient already known COPD and also newly diagnosed COPD patients based on post-bronchodilator with or without Diabetes (7), patient with diabetes already on treatment (history of diabetes from past 4 years).

### Exclusion Criteria

Patients above 70 years of age. Any history of tuberculosis, asthma, cardiac diseases, and newly diagnosed diabetes. (8)

### Ethics

Request to conduct the study was applied to the ethical committee of PSIMS&RF and was kindly accepted to perform the study. (9) Participants provided informed consent before being included in the study and were notified that they could quit the study at any time.

### Statistical analysis:

The data obtained were analyzed by unpaired t-test and ANOVA using the statistical software SPSS. (10)

## 3. Results and Discussion

The study included 40 volunteered patients categorized into 2 groups.

1. Group A - COPD patients (20)
2. Group B -COPD with DM (20)

Most of the patients recruited were between the ages of 50-60 years which clearly shows that older people were most affected by COPD. As for group 1(COPD) the values of the test clearly indicate the values that represent the general COPD patients which were said to be normal for their condition and according to the results only a few patients can be said to be in severe COPD.(11) Whereas group 2(COPD with DM) the results shows that decline in the values of FEV1, FVC, PEF t indicate the clear effect of diabetes on lung functioning which untreated might cause severe organ damage, and also conditions of severe and extreme severe COPD was found often in this group which shows that diabetes shows its impact on the lungs.

**Table 1.**Glycemic results in 2 groups

Tests	COPD (Mean±SD)	COPD with DM (Mean±SD)	P-value
RBS (mg/dl)	-	237.5±2214	0.014
FBS (mg/dl)	-	129.1±11	0.037
HbA1C	5.4±0.53	8.0±1.93	0.001

**Table 2.** Spirometric results comparison in 2 groups

Tests	Males		Females	P-value
	COPD (Mean±SD)	COPD WITH DM (Mean±SD)	COPD WITH DM (Mean±SD)	
FVC pre	1.79±0.30	1.33±0.25	1.15±0.29	0.001
FVC post	1.89±0.39	1.44±0.30	1.30±0.42	0.001
FEV1 pre	1.10±0.25	0.73±0.19	0.73±0.27	0.001
FEV1 post	1.24±0.30	0.86±0.20	0.83±0.39	0.001
FEV1/FVC pre	0.60±0.07	0.51±0.08	0.67±0.08	0.001
FEV1/FVC post	0.62±0.09	0.50±0.12	0.64±0.05	0.001
PEF pre (L/min)	244.06±57.22	175.56±67.77	129±24.55	0.001
PEF post (L/min)	259.88±70.22	182.8±55.76	150.66±22.66	0.001

We tried to correlate the lung functioning in COPD patients with diabetes the results of our study show that lung functioning decline further greater in diabetes association. Irfan et.al studied PFT in diabetics and showed that there was a significant reduction in FVC, FEV1 and also pointed that lung function impairment is independent of smoking and likely to be a complication of DM itself. Davis et.al showed that reduced lung volumes are the result of chronic complications of DM and are related to glycaemic exposure. (12)

Detailed pathophysiology of how diabetes affects the lungs were still unknown and also a matter of interest for a research topic. Four causes that were said to cause these outcomes were lung elasticity reduction which was caused by disrupted glycemic control which also causes nonenzymatic glycosylation end products. Reduction in diffusing capacity and pulmonary capillary blood volume due to thickened alveolar epithelial basal lamina and micro vascular changes in pulmonary capillary beds. Phrenic nerves were affected by autonomic neuropathy which results in reduced muscle tone and control over the diaphragm. Hyperglycemia increases glucose in airway surface liquid serving as a fuel for bacteria and subsequent increase in the frequency of bacterial pathogens isolated in sputum.

This study showed that FEV1, FVC, FEV1/FVC were decreased in group 2

(COPD with DM) even more than compared to group 1 (COPD). But the study was bounded by certain limitations due to its sample size and also due to not considering a group of only diabetes patients and also patients were not retested for PFT because some alterations can be found due to lifestyle changes. This study result shows the decline of lung function in DM patients in a long term condition including spirometric tests in patients with DM is much advisable which helps the patients in the long term run of health.

#### 4. Conclusion

We conclude that COPD with DM patients (group 2) indicates a decline in the PFT values than the COPD patients (group 1). This finding suggests that the lung is the target organ in diabetes conditions which is independent of smoking so patients with DM were suggested to undergo PFT with other tests as well. So long-term diabetes patients should undergo periodic PFT measurements to evaluate their lung functioning and their severity of damage and thereby could undergo early treatment to avoid respiratory collapse which reduces morbidity and mortality rates of the patients.

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### Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this article.

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