

# Assessment of Forced Vital Capacity and FEV1 as Pulmonary Function Tests in Males with Type-2 Diabetes Mellitus

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## Abstract

**Introduction:** Diabetes mellitus (DM) is a group of metabolic diseases. It is associated with well known complications linked to either microangiopathy, macroangiopathy or a combination of both. Some studies found that there were changes in respiratory system or pulmonary functions in diabetes so this study was planned to see the effect of type 2 DM on pulmonary functions.

**Materials & Method:** The present study was undertaken in two groups. Hundred male individuals were included in the study with each group comprised of 50 individuals. For pulmonary function tests we used computerized Spirometer Statistical difference between the data obtained in various groups was evaluated by z test.

**Observations:** Reduction in FVC-Forced vital capacity reduction is statistically significant. FEV<sub>1</sub>-reduction is statistically significant. FEV<sub>1</sub>/FVC (%) reduction is statistically significant.

**Conclusion:** So it is always better to detect the respiratory damage in diabetes patient at an early stage to prevent the further complications

**Keywords:** FVC, FEV1, Males, Type 2 DM

## Introduction

The earliest mention of diabetes like illness characterized by Polyuria can be traced to Egyptian papyrus dating back to around 1550 BC. <sup>1</sup>

Diabetes was recognized as a disease entity in ancient Indian Ayurveda (the science of life and longevity) Diabetes mellitus (DM) is a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action or both. <sup>2</sup>

The vast majority of cases of diabetes fall into two broad etio pathogenic categories. In one category, type 1 diabetes, the cause in an absolute deficiency of insulin

secretion. In the other, much more prevalent category type 2 diabetes the cause is a combination of resistance to insulin action and an inadequate compensatory insulin secretory response. <sup>3, 4, 5</sup>

The severity of metabolic abnormality can progress, regress or stay the same. Diabetes mellitus has been appropriately labeled a silent killer. It is associated with well known complications linked to either microangiopathy, macroangiopathy or a combination of both, such as diabetic nephropathy, neuropathy, retinopathy, cataracts, coronary artery disease, cerebrovascular disease, diabetic cardiomyopathy, peripheral arterial disease etc. <sup>6, 7</sup>

Some workers found that there were changes in respiratory system or pulmonary functions in diabetes<sup>1-2</sup>. Therefore it was planned to study the effect of type 2 DM on pulmonary functions.

## Materials and Method

The present study was undertaken in two groups. Hundred male individuals were included in the study with each group comprised of 50 individuals.

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Group-I included type 2 DM male patients an oral antidiabetic drugs. Group-II included Nondiabetic male subjects of same age.

Male subjects, aged between 40 to 65 years with and without history of taking oral antidiabetic drug were included in the study.

Male subjects with history of smoking and alcohol, history of any respiratory disorder, high blood sugar levels were excluded from the study. Estimation of blood sugar level was done by GOD-POD Method by Erba Autoanalyser

For pulmonary function tests we used computerized Spirometer–Schiller Cardiovit AT-10 spirometer. All the subjects were made familiar with the instrument and procedure for performing pulmonary function tests. The data of the subject as regards to the name, age height weight, sex etc. was fed to the computerized spirometer. The tests were performed in standing position. The subject was asked to take deep full inspiration which was followed as much rapid and forceful expiration as possible in the mouthpiece of the spirometer.

Three consecutive readings were taken and best among three was selected and noted. One single expiratory effort gives readings about many parameters. Following parameters were selected for the study- Forced vital capacity (FVC) Forced expiratory volume in one second.

Three consecutive readings were taken by allowing the rest for 10 minutes between each effort and best reading was selected and noted. Then the data of observation for all the parameters was statically analyzed by calculating mean and standard deviation.

Statistical difference between the data obtained in various groups was evaluated by z test and P value < 0.05 was considered as statistically significant.

**Observations and Results:** FEC, FEV<sub>1</sub> and FVC (%) in control and study group

	Cases Mean ISD	Control Mean ISD	Z Value	P Value
FVC (Liter)	2.56±0.99	2.99±0.69	2.53	<0.05
FEV <sub>1</sub> (Liter)	1.89±0.56	2.52±0.49	5.99	<0.0001
FEV <sub>1</sub> /FVC (%)	65.45±16.87	79.89±7.37	5.54	<0.0001

Reduction in the following parameters was statistically significant in the study group. FVC-Forced

vital capacity reduction is statistically significant. FEV<sub>1</sub>-reduction is statistically significant. FEV<sub>1</sub> /FVC (%) reduction is statistically significant.

**Table 1: Comparison of forced vital capacity (FVC) in study group and control**

FVC (Lit)	Cases	Control	Z Value	P Value
	Mean±SD (n=50)	Mean±SD (n=50)		
Predicted	3.13±0.39	3.19±0.35	0.78	>0.05
Best	2.56±0.99	2.99±0.69	2.53	<0.05

FVC reduction is statistically significant in the study group

**Table 2: Comparison of forced expiratory volume (FEV<sub>1</sub>)**

FEV1 (Lit)	Cases	Control	Z Value	P Value
	Mean ±SD (n=50)	Mean ±SD (n=50)		
Predicted	2.31 ±0.31	2.34 ±0.27	0.39	>0.05
Best	1.89 ±0.56	2.52±0.49	5.99	<0.0001

FEV<sub>1</sub> reduction is statistically significant in the study group

**Table 3: Comparison of forced expiratory volume (FEV<sub>1</sub>)/forced vital capacity (FVC)**

FEV1/ FVC (%)	Cases	Control	Z Value	P Value
	Mean±SD (n=50)	Mean±SD (n=50)		
Predicted	77.89 ±2.45	77.19 ±2.18	1.51	>0.05
Best	65.45 ± 16.87	79.89 ±7.37	5.54	<0.0001

Table showed decrease in FEV<sub>1</sub> /FVC (%)in the study group

## Discussion

Forced vital capacity (FVC) measures the amount of air one can exhale with force after one inhales as deeply as possible.

The FVCs serve little purpose as an independent measures of pulmonary function, they can be of much value when considered in conjunction with the results of other tests. FVC is an indirect measure of the flow and resistive properties of the lung. In obstructive lung disease-ratio of FEV<sub>1</sub> /FVC is generally reduced with reduced FVC.

In restrictive lung disease–FVC is generally reduced with preservation or an increase in FEV<sub>1</sub> /FVC. In patients with restrictive lung disease the FVC will be smaller because the amount of air that can be forcefully

inhaled or exhaled from the lung is smaller to start with because of the disease.

FVC reduction is statistically significant. Similar results were found by-

Hsin-Chiesh, yeh<sup>8</sup>. Augusto et al.<sup>9</sup> As the FVC reduction is statistically significant restrictive pathology can be considered as possible cause for small vital capacity. Probable causes of reduced lung capacity may result from abnormal collagen formation as well as connective tissue breakdown.

Forced expiratory volume in one second is the amount of air that is forcefully exhaled in the first second of FVC test. In general it is common in healthy individuals to be able to expel 75%-80% of their vital capacity in the first second of the FVC test. FEV<sub>1</sub> manifests overall airway status of the bronchopulmonary tree during expiration. Hence FEV<sub>1</sub> is a pulmonary function value that is highly diagnostic of obstructive diseases that is if an individual's FEV<sub>1</sub> is low compared to the predicted FEV<sub>1</sub> in the normal population, the individual may have an obstructive lung disease. FEV<sub>1</sub> reduction is statistically significant. Similar results were found by Augusto et al.<sup>9</sup> M. Sandler et al.<sup>2</sup>

As FEV<sub>1</sub> reduction is statistically significant we can suspect the presence of obstructive pathology in the study group. Probable cause of reduced FEV<sub>1</sub>. This decrement in lung function after the development of D. M. postulates that mechanisms involved in the insulin resistant state contribute to the diminished lung function in the subjects.

FEV<sub>1</sub> /FVC (%) indicates what percentage of the total FVC was expelled from the lungs during the first second of forced exhalation. This is called FEV<sub>1</sub>% This gives an idea about overall resistance to air movement from the lungs and expiratory power for forceful expiration.

If the individual being tested displays a low FEV<sub>1</sub> and FEV<sub>1</sub> /FVC (%) is low, then the clinician should suspect the presence of obstructive pathologies. In patients with restrictive lung disease the FEV<sub>1</sub> will be lower than predicted normal values and so will the FVC. Since both of these values may equally be affected in restrictive disease, FEV<sub>1</sub> /FVC (%) may well be calculated to be between 85% to 100% normal.

Hence in restrictive disease, one should look closely at FEV<sub>1</sub> /FVC (%) is 85 % or greater then a restrictive

pathology may be suspected. FEV<sub>1</sub> /FVC (%) reduction is statistically significant. Similar results were found by-Sreeja L. K. et. al.<sup>3</sup> We can suspect presence of obstructive pathology in study group. Probable causes of reduced FEV<sub>1</sub> /FVC (%) may be related with poor mechanical properties of the lung viz. lung compliance and elastic recoil of the lungs.

Probable causes of reduced pulmonary functions in this study are as follows decrease in FEV<sub>1</sub> /FVC (%) may be related to poor mechanical properties of the lung viz. lung compliance and elastic recoil of lungs.<sup>3</sup> The reduced lung capacity may result from abnormal collagen formation as well as connective tissue breakdown.<sup>3</sup> The thickening of alveolar wall due to increased amount of collagen elastin basal lamina results in microangiopathy.<sup>10,11,12</sup>

So it is always better to detect the respiratory damage in diabetes patient at an early stage to prevent the further complications.

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This study was approved by Institutional Ethical Committee.

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