

RESEARCH ARTICLE

Comparative study of forced expiratory flow and peak expiratory flow in males with and without type-2 diabetes mellitus

Neelima Nerkar¹, Pranita Ashok², Purandare V R³

¹Department of Physiology, Dr. Vasant Rao Pawar Medical College, Nashik, Maharashtra, India, ²Department of Physiology, Bharati Vidyapeeth Medical College, Pune, Maharashtra, India, ³Department of Physiology, D Y Patil Medical College, Pune, Maharashtra, India

Correspondence to: Pranita Ashok, E-mail: pranita76@gmail.com

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ABSTRACT

Background: 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 the respiratory system or pulmonary functions in diabetes. **Aims and Objectives:** This study was planned to see the effect forced expiratory flow (FEF) and peak expiratory flow (PEF) in type 2 DM as pulmonary function tests. **Materials and Methods:** The present study was undertaken in two groups. Hundred male individuals were included in the study with each group comprised 50 individuals. For pulmonary function tests, we used computerized spirometer statistical difference between the data obtained in various groups was evaluated by z-test. **Results:** PEF rate reduction and FEF_(25-75%) reduction were statistically significant. **Conclusion:** Hence, it is always better to detect the respiratory damage in diabetes patient at an early stage to prevent further complications.

KEY WORDS: Forced Expiratory Flow; Peak Expiratory Flow; Males; Type 2 Diabetes Mellitus

INTRODUCTION

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.^[1,2]

The vast majority of cases of diabetes fall into two broad ratio pathogenic categories. In one category, type 1 diabetes, the cause is 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.^[3-5]

DM 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, and peripheral arterial disease.^[6,7]

Some workers found that there were changes in the respiratory system or pulmonary functions in diabetes.^[1,2] Therefore, it was planned to study the effect of type 2 DM on pulmonary functions.

MATERIALS AND METHODS

The present study was undertaken in two groups after approval of the Institutional Ethical Committee. Hundred

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male individuals were included in the study with each group comprised 50 individuals.

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

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

Male subjects with a 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 glucose oxidase-peroxidase method by Erba Autoanalyzer.

For pulmonary function tests, we used computerized Spirometer – Schiller Cardiovit AT – 10 spirometers. All the subjects were made familiar with the instrument and procedure for performing pulmonary function tests. The data of the subject as regard to the name, age height weight, sex, etc., were fed to the computerized spirometer.^[8,9] The tests were performed in a 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 expiratory flow (FEF) rate during 25–75% that is middle half of forced vital capacity in L/s and peak expiratory flow rate (PEFR) in L/s three consecutive readings were taken by allowing the rest for 10 min between each effort and best reading was selected and noted. Then, the data of observation for all the parameters were statically analyzed by calculating the 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.

RESULTS

Table 1 shows that FEF and peak expiratory flow (PEF) were significantly decreased in study groups. Table 2 shows that FEF between 25% and 75% FEF_(25–75%) was significantly decreased in study groups. Table 3 shows that PEF was significantly decreased in study groups.

DISCUSSION

The present study was aimed at finding out the statistically significant correlation between type 2 DM and pulmonary functions. Statistically significant decrease in the pulmonary functions was found in the study group. The study group consisted of 50, type 2 DM male patients in the age group of 40–65 years, with the duration of DM 2–8 years.

Pulmonary function test of the study group and the control group were conducted and comparison was made. PEFR reduction and FEF_(25–75%) reduction were statistically significant in the study group. Therefore, we can suspect the presence of obstructive pathology in the study group.

FEF_(25–75%) reduction is statistically significant. Similar results were found by- Pherwani *et al.*,^[8] Sreeja *et al.*,^[3] and Yang and Zhangguangzhen.^[10] As FEF_(25–75%) reduction is statistically significant, we can suspect the presence of obstructive pathology in the study group. Cause of reduced FEF_(25–75%) is lower airway caliber and higher airway resistance. It denotes the reduced force-generating capacity of expiratory muscles and higher airway resistance.

PEFR, i.e., PEFR depends on expiratory efforts exerted during forceful expiration as well as the status of airways and it is mainly influenced by changes in the intrathoracic pressure.^[11,12] It is measured in liters of air expired per second. Since it is a measure of the peak or maximum flow of expired air, it becomes a sensitive test for the presence of obstructive disease.

PEFR reduction is statistically significant. Therefore, we can suspect the presence of obstructive pathology in the study group. Probable causes of reduced pulmonary functions in this study are as follows: The reduced lung capacity may result from abnormal collagen formation as well as connective tissue breakdown.^[13] The thickening of the alveolar wall due to an increased amount of collagen elastin basal lamina results in microangiopathy.^[2]

Significant reduction in FEF_(25–75%) among type 2 diabetics compared to normal control group shows a lower airway caliber and higher airway resistance and hence, obstructive disease cannot be ruled out. It denotes the reduced force-generating capacity of expiratory muscles and higher airway resistance.^[3]

Table 1: FEF, PEF in both groups

Test	Cases mean ISD	Control mean ISD	Z-value	P-value
FEF _(25–75%) (L/s)	1.92±1.10	3.07±1.15	5.12	<0.0001
PEF (L/s)	4.94±1.72	6.80±1.87	5.19	<0.0001

FEF: Forced expiratory flow, PEF: Peak expiratory flow

Table 2: Comparison of FEF between 25% and 75% (FEF 25–75%) in the study group and control

FEF _(25–75%) (L/s)	Cases	Control	Z-value	P-value
	Mean±SD (n=50)	Mean±SD (n=50)		
Predicted	2.38±0.37	2.33±0.29	0.62	>0.05
Best	1.92±1.10	3.07±1.15	5.12	<0.0001

FEF: Forced expiratory flow

Table 3: Comparison of PEF in the study group and control

PEF (L/s)	Cases	Control	Z-value	P-value
	Mean±SD (n=50)	Mean±SD (n=50)		
Predicted	6.83±0.58	6.93±0.53	0.89	>0.05
Best	4.94±1.72	6.80±1.87	5.19	<0.0001

PEF: Peak expiratory flow

Limitations

This study was conducted in less number of subjects and only in males. Hence, further extension will be on large numbers and both in male and female.

Strength

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

CONCLUSION

Hence, it was concluded that its always better to detect the respiratory damage in diabetes patient at an early stage to prevent further complications.

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