THE STUDY OF PULMONARY FUNCTIONS IN PATIENT OF TYPE 2 DIABETES MELLITUS

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ABSTRACT

BACKGROUND
Diabetes mellitus and the complications associated with it has become a reason of concern due to health problems related to them.

AIM
To study and compare the pulmonary function parameters like FVC, FEV1, FEV1%, PEFR, FEV 25-75% in patients with type 2 diabetes mellitus and control group.

SETTINGS AND DESIGN
This study was planned to assess pulmonary functions in type 2 diabetic patients.

METHODS AND MATERIALS
We evaluated 60 diabetic male subjects in the age group 41-60 years. For controls, 60 age matched healthy male subjects were taken. PFT was carried out with Computerised Medspiror.

STATISTICAL ANALYSIS
The various data was collected, compiled, statistically analysed by unpaired t-test and conclusion drawn.

RESULTS
The present study results showed a significant decrease in the mean values of FVC, FEV1, PEFR and FEF 25-75% in diabetic subjects as compared to controls. FEV1% was significantly increased in diabetic persons.

CONCLUSION
Chronic hyperglycaemia leads to non-enzymatic glycosylation of extracellular matrix leading decrease in lung compliance, which is responsible for restrictive type of pulmonary impairment of lung functions.

KEYWORDS
Diabetes Mellitus (DM), Medspiror, Pulmonary Function Tests (PFT).

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INTRODUCTION: Diabetes as a metabolic disorder is rising at an alarming rate all over the world. As per WHO, major burden of diabetic patient amongst Asian population is carried by India. There are about 50 million diabetic patients in India, which might be going to increase 79.4 million in 2030.[1] In type 2 DM, there is decreased sensitivity of target tissue to metabolic effect of insulin. Type 2 diabetes is lifestyle disorder. Sedentary lifestyle with change in food habits and increased stressful events in day-to-day life has adversely affected anthropometric parameters of person.

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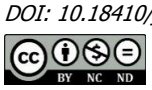

Most people who have type 2 diabetes mellitus are obese have disturbances in lipid metabolism. Epidemiological evidences also indicates that majority of world's population are prone to type 2 diabetes mellitus in wake of increasing obesity.[2] The major morbidities in diabetes mellitus type 2 are due to microangiopathic and macroangiopathic complications, which affects kidney, heart, eyes, nerves and major blood vessels. Lungs also considered as a target organ in diabetes.[3] Hence, present study was undertaken to see the effect of diabetes on pulmonary function tests.

METHODS: The present study was carried out in 60 male patients with type 2 diabetes mellitus and 60 male subjects served as controls belonging to same socioeconomic status between the age group of 41-60 years.

Age Group (in years)	Cases	Controls	Total
41-50	22	25	**47**
51-60	38	35	**73**
	60	**60**	**120**

Table 1: Distribution of Persons According to the Age

Selection Criteria for Cases:

1. Known case of type 2 diabetes mellitus, at least 6 month duration, regularly attending diabetic OPD.
2. Clinically stable diabetic male subjects, non-smoker with no history of cardiorespiratory disease were selected as cases.

Criteria for Diagnosing Diabetes: Fasting plasma glucose >126 mg/dL or postprandial glucose >200 mg/dL.[4] Quantitative estimation of Blood Sugar Level (BSL) was done in Autoanalyzer XL 300 in biochemistry department laboratory as:

1. Fasting BSL collected after overnight fasting.
2. Postprandial BSL collected 2 hours after taking food.

Selection Criteria for Controls: Male subjects between the age group of 41-60 years, non-smoker with no history of cardiorespiratory disease and not suffering from type 2 diabetes mellitus were selected as controls.

Anthropometric parameters like standing height (m), weight (kg) was measured and BMI (Body mass index) was calculated as:

$$\text{BMI} = \frac{\text{Weight in Kg}}{(\text{Height in meter})^2}$$

PFT were carried out by computerised Medspiror by:
FVC manoeuvre: Subjects were asked to take deep breath and execute fast, forceful expiration in the mouthpiece of equipment while closing the nose.[5]

Following Parameters Were Taken in the Consideration:

1. FVC (lit) - Forced vital capacity.
2. FEV1 (lit) - Forced expiratory volume in one second.
3. FEV1% - FEV1/FVC ratio.
4. FEF 25-75% (lit/sec) - Mean forced expiratory flow during the middle of FVC.
5. PEFR (lit/sec)-Peak expiratory flow rate.

Ethics: The study protocol was approved by ethical committee of college. Before enrolment in the study, informed written consent was obtained from subject of cases and control group.

Statistics: Statistical analysis was done by unpaired t-test.

RESULTS:

Parameter	Cases (Mean±S.D)	Controls (Mean±S.D)	P value	Significance
Fasting BSL (mg/dL)	135.47±13.62	83.14±5.45	<0.001	HS
Post-prandial BSL(mg/dL)	237.80±35.47	129.58±4.82	<0.001	HS

Table 2: Blood Sugar Level in Cases and Controls

Parameter	Cases (Mean±S.D)	Controls (Mean±S.D)	P value	Significance
Height (m)	1.60±0.056	1.61±0.049	0.0812	NS
Weight (kg)	68.08±8.05	59.43±5.37	<0.001	HS
BMI (kg/m^2)	26.49±2.60	22.65±1.56	<0.001	HS

Table 3: BMI in Cases and Controls

Parameters	Cases (Mean±S.D)	Controls (Mean±S.D)	P value	Significance
FVC (lit)	2.01±0.45	2.58±0.37	<0.001	HS
FEV1 (lit)	1.53±0.45	1.89±0.34	<0.001	HS
FEV1%	77.34±11.98	72.97±4.02	<0.0202	S
PEFR (lit/sec)	5.08±1.34	6.32±1.07	<0.001	HS
FEF 25-75% (lit/sec)	1.94±0.75	2.55±0.54	<0.001	HS

Table 4: PFT Parameters in Cases and Controls

Abbreviations used: S. D. - Standard Deviation, NS – Non-Significant, HS - Highly Significant, S - Significant.

Table No. 2: Shows that fasting and postprandial BSL was significantly higher in cases as compared to controls.

Table No. 3: Shows that BMI was significantly higher in diabetic persons as compared to controls.

By Table No. 4: FVC, FEV1, PEFR, FEF 25-75% showed highly significant decline in cases as compared to controls. FEV1% was significantly increased in diabetic persons.

DISCUSSION: In the present study, our finding showed highly significant decline in FVC, FEV1, PEFR, FEF25-75% in cases as compared to controls. FEV1% shows significant increase in diabetic persons. Our findings are consistent with the finding observed by Meo S et al (2006),[6] Verma S et al (2009),[7] Jamatia et al (2014),[8] Gajbhiye et al (2014),[9] Panpalia et al (2014),[10] Sinha et al (2004).[11] Agarwal et al (2010)[12] are against our finding and showed no statistical difference in FVC, FEV1, PEFR in diabetic subject.

Probable cause of reduction in FVC and FEV1 in diabetic subjects are due to decreased compliance of lungs. By chronic hyperglycaemia non-enzymatic glycosylation of connective tissue particularly the collagen and elastin leads to irreversible collagen cross linking and ultimately accumulation of collagen in chest wall and bronchial tree and forms fibrosis by decreasing proteolysis. Cross linking of collagen decreases elastic force of lung tissue affecting elastic recoil of lungs; thus, decreases compliance of lungs.[13] Depending on BMI, majority of type 2 diabetic subjects were overweight. Accumulation of fat may mechanically affect the expansion of diaphragm probably by encroachment of fat into chest wall or diaphragm. Thick layer of subcutaneous fat over the chest wall compress the thoracic cage. It may lead to change in balance of elastic recoil between chest wall and lung parenchyma. Fat deposit between muscles and ribs may also decrease chest wall compliance. This leads to reduction in chest wall, lung and so total respiratory system compliance. This will result in lower FVC and FEV1 measurements.[14,15] Increase FEV1% in diabetic subject maybe due to decrease in FVC value more than decrease in FEV1 value as observed in restrictive lung pathology. In diabetic subject, there is poor skeletal muscle strength due to increased protein catabolism. As PEFR depends on voluntary effort and muscular strength of subject, increased protein catabolism in diabetic person resulted in decreased PEFR. Also, due to non-enzymatic glycosylation of collagen, it accumulates in the chest wall and affects the strength of muscles of chest wall leading to decreased PEFR.[13] FEF 25-75% determines flow in smaller airway and it is reduced in small airway diseases. In diabetic persons, loss of elastic recoil leads to dynamic collapse of small airways during expiration, hence collapse of small airways resulted in decrease in FEF 25-75%.[13]

CONCLUSION: Type 2 DM affects pulmonary function with manifestation of restrictive ventilator defect. This is characterised by lower value of FVC with increased FEV1%. Reduced compliance of lungs by non-enzymatic glycosylation of extracellular matrix affects the muscle strength leading to low value of PEFR.

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