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## RESEARCH ARTICLE

# TO STUDY THE RELATIONSHIP OF DURATION OF TYPE 2 DIABETES MELLITUS ON PEAK EXPIRATORY FLOW RATE

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**ABSTRACT**

**Introduction:** The incidence of diabetes mellitus is increasing tremendously throughout the world especially in developing countries. This disease affects various organs like eyes, nerves, kidneys and heart. Pulmonary complications of diabetes mellitus (DM) have been poorly characterized. Moreover, the duration of glycemic control have varied impact on the pulmonary function.

**Aims and objectives:** To study the effect of DM on PEFR and its relationship with duration of the disease.

**Material and method:** The study was carried out in the department of physiology M.G.M Medical College Aurangabad. Total 90 subjects were included in the studies &were grouped in 3 groups of 30 subject in each respectively. Group I consist of 30 age and socio-economically matched apparently healthy non diabetic subject were randomly selected from the OPD mainly the relatives of patients. Group II consist of 30 type 2 DM patients with the duration of 5 to 10 years of disease. Group III consist of 30 type 2 diabetic patients with duration of 10 to 20 years of disease. The PEFR of all the subjects were measured by spirowin, a computerized spirometer. Blood samples were taken for heamatologicl and biochemical parameters. The data were analysed by one way ANOVA, unpaired students "t" and Pearsons correlation coefficient tests.

**Results:** The mean percentage of predicted values of PEFR in non diabetic male was within normal range. But it was significantly ($p < 0.001$) lower in both the groups of type 2 diabetic male compared to those of non diabetic male. PEFR was lower in the patients of longer duration as compared to those of shorter duration.

**Conclusion:** PEFR is lower in type2 diabetic male and is inversely related to the duration of the disease.



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## INTRODUCTION

Diabetes mellitus (DM) is a growing public health problem and becoming an epidemic globally and specially in Asian Indian (Fauci *et al*., 2008). Diabetes is a systemic disease that causes secondary pathophysiological changes in multiple organ systems and the complications affecting these systems are responsible for the majority of morbidity and mortality associated with the disease (Fauci *et al*., 2008). The prevalence of complications such as micro and macro angiopathy involving heart, kidney, eyes, central nervous system (CNS) are also increasing, causing severe economic and social burden. The pathogenesis of diabetic complications are still a matter of debate and are thought to involve both a microangiopathic process and non-enzymatic glycosylation of tissue proteins and peptides of extracellular matrix at elevated circulating glucose level (Fauci *et al*., 2008; Marvisi *et al*., 2001). The prevalence of Type 2 Diabetes in Asian Indians is the highest prevalence in the world (Ahmed AM 2002, Albert RE1995) India is called Diabetic Capital of World as there are going to be 80% of all diabetes from the entire world population, concentrated here. Type 2 Diabetes comprises 90% of people with diabetes all around the world, and is largely the result of excess body weight and physical inactivity. Diabetes mellitus is associated with long term damage, dysfunction and failure of various organs and its complications are mostly due to macro vascular and micro vascular damage; include cardiovascular disease, nephropathy, diabetic retinopathy, neuropathy and lung damage (Prevalence, 1998; Committee report, 2002) WHO projects that diabetes will be the 7th leading cause of death in 2030. Complications of diabetes are both acute and chronic (American Diabetes Association, 2010). Experimental data and histopathological studies support the notion that lung is a target organ for diabetes, both type 1 and type 2 (Fouty, 2008). Considering the large vascular

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network and richness in collagen and elastin of lungs, pulmonary system is prone to undergo micro vascular damage and non-enzymatic glycation in diabetes. Although systemic vascular complications are more common in diabetes, diabetes also affects pulmonary microcirculation (Fouty, 2008; Goldman, 2003). Some epidemiological and clinical studies have found that adults with diabetes have decreased lung function compared with adults without diabetes. The reduced lung function in patients with diabetes appears to be inversely related to blood glucose levels, duration of diabetes and its severity, and is independent of smoking status or obesity (Walter, 2003; Yeh, 2008; Lange *et al*., 2002; Litonjua *et al*., 2005; Davis *et al*., 2000; Lawlor, 2004; Chance *et al*., 2008; Yeh *et al*., 2005; Ford, 2004; Engstrom *et al*., 2003; Eriksson, 1996). There is significant reduction ($p < 0.001$) in PEFR of young diabetic subjects (Makkad *et al*., 2000). The micro vascular complications appear early within 5to10 years and macro vascular complications appear within 15 to 20 years from the onset of diabetes (Benbassat *et al*., 2001). Pulmonary functions are reduced in type 2 DM and duration of diabetes has more influence on pulmonary functions than glycemic control (Davis *et al*., 2000). If diabetes is detected early and blood sugar level is maintained within normal limits with the help of insulin or oral hypoglycemic drugs and proper diet and exercise, it may be possible to prevent or delay the occurrence of complications and there after their progression. So many research studies is being carried out on the after effects of Diabetes Mellitus on pulmonary parameters worldwide, the literature pertaining to this is not in abundance in India. Therefore this study was undertaken to find out the correlation between duration of DM and PEFR in patients who attended or admitted to medical OPD or wards of M.G.M Medical College, Aurangabad.

**Objectives**

To record PEFR in patients of Type 2 – Diabetes mellitus and in normal healthy subjects without diabetes and correlate the effect of duration on DM.

## MATERIALS AND METHODS

Study was conducted in the department of Physiology MGM'S Medical College. Written informed consent of all the subjects those participated in the study was taken after obtaining ethical clearance from the Institutional ethical clearance committee. Total 90 subjects were included in the studies &were grouped in 3 groups of 30 subject in each respectively. Group I consist of 30 age and socio-economically matched apparently healthy non diabetic subject were randomly selected from the OPD mainly the relatives of patients. Group II consist of 30 type 2 DM patients with the duration of 5 to 10 years of disease. Group III consist of 30 type 2 diabetic patients with duration of 10 to 20 years of disease. Subjects with respiratory diseases, cardiovascular diseases, renal diseases, structural chest deformity were excluded and subjects having obesity where excluded from the study.

**Peak Expiratory Flow Rate**

It is the maximum rate of airflow observed during a sudden forced expiration, from the position of full inspiration. It is measured in liters per second. The PEFR of all the subjects were measured by Spirowin, a computerized spirometer. Blood samples were taken for hematological and biochemical parameters. The data were analyzed by one way ANOVA, unpaired students "t" and Pearson's correlation coefficient tests.

## RESULTS

The mean percentage of predicted values of PEFR in non-diabetic male was within normal range. But it was significantly ($p < 0.001$) lower in both the groups of type 2 diabetic male compared to those of non-diabetic male. PEFR was lower in the patients of longer duration as compared to those of shorter duration.

| Group N= 30 | PEFR (%) | Groups | P value |
|---|---|---|---|
| A | 86.33 ± 14.52 | A vs $B_1$ vs $B_2$ | 0.000*** 0.000*** |
| $B_1$ | 70.36 ± 13.57 | A vs $B_1$ | 0.000*** 0.000*** |
| $B_2$ | 64.03 ± 16.59 | A vs $B_2$ | 0.000*** 0.000*** |
| | | $B_1$ vs $B_2$ | $0.111^{ns}$ $0.888^{ns}$ |

*** = p <0.001. ns = nonsignificant, N = Number of subjects.
Data are expressed as Mean ± SD. For comparison among the groups one way ANOVA and between the groups Independent sample 't' test were done.
Group A = Apparently healthy non diabetic male for control.
Group B1 = Diabetic male with duration 5-10 years.
Group B2 = Diabetic male with duration 10-20 years.

## DISCUSSION

Diabetes mellitus describes a metabolic disorder characterized by chronic hyperglycemia with disturbances of carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, insulin action, or both (Alberti *et al*., 2011). Diabetes mellitus is a leading public health problem with increasing incidence and long term complications such as diabetic nephropathy, diabetic neuropathy, diabetic retinopathy etc. These complications are mainly a consequence of macro vascular and micro vascular damages of the target organs (Ali *et al*., 2009). The presence of an extensive microvascular circulation and abundant connective tissue in the lungs raises the possibility that lung tissue may be affected by microangiopathy process and non-enzymatic glycosylation of tissue proteins, induced by chronic hyperglycemia, thereby rendering the lung a ''target organ'' in diabetic patients. Since normal lung mechanics and gas exchange are influenced by the integrity of pulmonary connective tissue and microvasculature, abnormalities in either of these two structural components of the lung may lead to the development of measurable abnormalities of pulmonary function (Sandler, 1990). There is a progressive decline in PEFR. As the duration of diabetes increases and alterations such as hyperglycaemia, oxidative stress from auto-oxidation of glucose, non-enzymatic protein glycosylation, and alterations of nitric oxide (NO) metabolism have been reported as metabolic markers of the diabetic state (Marvisi *et al*., 1996; Ardigo, 2004; Wolff *et al*., 1987). Nitric oxide is produced by nitric oxide synthase (NOS). There are three different NOS isoforms expressed in normal lung tissue: neuronal (nNOS), endothelial (eNOS), and inducible (iNOS) (Oztay *et al*., 2007). Recently, eNOS expression has been established as a good marker of hyperglycaemia-induced endothelial dysfunction for streptozotocin-induced diabetic rats (Oztay *et al*., 2007). In addition, iNOS has been implicated in acute lung injury (Mehta, 2005). Therefore, excessive NO, particularly produced by iNOS and its potent oxidative derivative peroxynitrite via oxidation, hydroxylation, and nitration, is involved in acute lung injury (Speyer *et al*., 2003). For these reasons, a recent study presents dexamethasone as a potential treatment, alone or in combination with insulin, for

the improvement of the pathological alterations of the lung caused by diabetes (Oztay *et al*., 2007). Hyperglycemia causes thickening of basal lamina in pulmonary capillaries leading to decreased diffusion capacity. The alteration in scleroproteins in turn affects mechanical properties of lungs. In this chronic disease susceptibility and severity of systemic inflammation increases which may cause peripheral airway obstruction (Boulbou *et al*., 2003; Ali *et al*., 2009). A research study done by Nandhini *et al*. (2012) the PEFR values were reduced in diabetics, with a significant p value of 0.01. The findings of this study were in agreement with those of the study of Wendy A. Davis *et al* (Davis, 2004) and Vinay Agarwal *et al*, which showed decreased PEFR values. The possible explanation for this reduction is the reduced force generating capacity of the expiratory muscle and the reduced recoiling of the lungs (Davis, 2004; Agarwal, 2009). Whereas study conducted by Sanjeev Verma *et al*. (2009) showed no significant change in PEFR in diabetic patients.

**Conclusion**

Diabetes mellitus being a systemic disease, also affects lungs causing restrictive type of ventilator changes probably because of glycosylation of connective tissues, reduced pulmonary elastic recoil, and inflammatory changes in lungs. In our study we found that the mean percentage of predicted values of PEFR in non-diabetic male was within normal range. But it was significantly ($p < 0.001$) lower in both the groups of type 2 diabetic male compared to those of non-diabetic male. PEFR was lower in the patients of longer duration as compared to those of shorter duration. PEFR is lower in type2 diabetic male and is inversely related to the duration of the disease.

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