ISSN- O: 2458 - 868X, ISSN –P: 2458 - 8687

International Journal of Medical Science and Innovative Research (IJMSIR)

IJMSIR : A Medical Publication Hub

Available Online at: www.ijmsir.com

Volume – 2, Issue –5, September- October - 2017, Page No. : 142 - 147

Evaluation of Pulmonary Function in NIDDM Patients by Spirometry

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Conflicts of Interest: Nil

Abstract

Diabetes mellitus is a major health care problem not only in the developed countries but also in the developing countries such as India. Amongst the various ethnic groups Asian Indians seem to be particularly at a great risk of developing diabetes.Non insulin dependent diabetes mellitus(NIDDM) is a serious, progressive condition associated with number of chronic complications that are mainly a consequence of macro vascular and micro vascular damage.The present study was conducted to evaluate pulmonary function in Non Insulin dependent diabetic patients by spirometry. This study was conducted in the physiology department. 40 apparently healthy type 2 diabetic patients with a mean age of 47.85± 1.75 years (mean ± SEM), range 5-7 years with duration of disease range 45-50 years, were selected and 80 were excluded. Controls were selected in a similar manner to that of the diabetics.60 interviewed, 40 apparently healthy control subjects were selected with a mean age of 46.95 ± 1.95 years (mean ± SEM), range 45-50 years. Spirometry was performed on an electronic spirometer (Schiller).Pulmonary parameters Force Vital Capacity (FVC), Force Expiratory Volume in First Second (FEV_1),Force Expiratory Ratio (FEV_1/FVC), Force Expiratory Flow ($FEF_{25-75\%}$) and Peak Expiratory Flow Rate (PEFR) were noted. Statistical analysis was conducted using a student t-test for independent group (two-tailed), on initially all matched pairs of subjects.It was observed that in Type 2 Diabetic patients had statistically significant reductions in FVC, $FEV_1$and PEFR .Study shows type 2 diabetes mellitus adversely affect the pulmonary function.

Keywords: NIDDM, IDDM, FVC, FEV1, PEFR.

Introduction:

Diabetes mellitus is a major health care problem not only in the developed countries but also in the developing countries such as India. Amongst the various ethnic groups Asian Indians seem to be particularly at a great risk of developing diabetes. NIDDM is a serious, progressive condition associated with number of chronic complications that are mainly a consequence of macro vascular and micro vascular damage [1]. The most prevalent NIDDM form of the disease is likely to account for over 90 % of the total diabetic cases [2]. It is often asymptomatic in its early stages and can remain un-diagnosed for many years [3]. Diabetes mellitus, although worldwide in distribution, used to be more seen commonly in the developed European countries, US and Middle-East countries [4]. Over the last 20 years there is increase in incidence of diabetes mellitus in India due to the adaptation of western

life style with respect to nutritional habits and physical activity. Diabetes mellitus is associated with long term damage, dysfunction and failure of various organs[5} and its complications are mostly due to of macro vascular and micro vascular damage; include cardiovascular disease, nephropathy, diabetic retinopathy, neuropathy and lung damage [6].The histo-pathologic evidence of the involvement of lungs in subjects with diabetes mellitus showed thickened alveolar walls, alveolar capillary walls and the pulmonary arteriolar walls, these histological changes in the lungs are cause of pulmonary dysfunction [7]. Diabetes mellitus can cause the development of pulmonary complications due to collagen and elastin changes as well as microangiopathy. It has been also demonstrated that both the pulmonary and renal complications of diabetes share a similar microangiopathic background [8] . These complications have a significant impact on the quality of life of affected individuals [9] and impose a heavy burden on health care providers worldwide. The present study was designed to determine the changes of pulmonary functions in normal groups with history of diabetes since 5-7yrs. Many studies were done on insulin dependent diabetes mellitus (IDDM) and very few studies were done in relationship to Non Insulin dependent diabetes mellitus (NIDDM).: Non Insulin dependent diabetes mellitus (NIDDM). It is the predominant form of diabetes worldwide accounting for 90% of cases globally. NIDDM results when there is insufficient insulin action to maintain plasma glucose levels in the normal range.

Material and Methods:

This study was conducted in the physiology department.

Subjects: A detailed history was taken to determine whether they would be included in the study or not on the basis of the exclusion criteria. They were questioned with regard to smoking cigarettes other tobacco products chewing tobacco or betel nut products. After the initial interviews 40 apparently healthy type 2 diabetic patients with a mean age of 47.85± 1.75 years (mean ± SEM), range 5-7 years with duration of disease range 45-50 years, were selected and 80 were excluded. Controls were selected in a similar manner to that of the diabetics. 40 apparently healthy control subjects were selected with a mean age of 46.95 ± 1.95 years (mean ± SEM), range 45-50 years. Diabetic patients were individually matched for age, height, and weight with controls. It was attempted that the matching between both groups was ± 5 years for age, ± 7 cm for height, ± 8kg for weight; some pairs did not fall within this matching, 5 for age, 7 for height, 8 for weight. Age and height were given more emphasis for matching as these two relate better to lung function than weight.

Controls were of a similar community with socio-economic group relative to diabetics; both were assessed by a questionnaire. All subjects were non-smokers, who had never smoked.

Spirometry: Spirometry was performed on an electronic spirometer (Schiller). All pulmonary function tests were carried out at a fixed time of the day (10.00 – 14.00 hours) to minimize diurnal variation. After taking a detailed history and anthropometric data the subjects were informed about the whole manoeuvre and informed consent was taken. The subjects were encouraged to practice this manoeuvre before doing the pulmonary test. The test was performed with the subject in the sitting position by using a nose clip. The test was repeated three times after adequate rest and results were printed with built in printer available in the spirometer. These parameters were Force Vital Capacity (FVC), Force Expiratory Volume in First Second (FEV_1), Force Expiratory Ratio (FEV_1/FVC), Force Expiratory Flow ($FEF_{25-75\%}$) and Peak Expiratory Flow Rate (PEFR).

Statistical analysis: Statistical analysis was conducted using a student t-test for independent group (two-tailed), on initially all matched pairs of subjects. The level of significance was taken as $p<0.025$. The pulmonary function data was correlated against the duration of exposure.

Results:

Table 1 and Graph A shows Age wise distribution of study participants (diabetic and non diabetic)

Table 1: Age wise distribution of study participants

Age Group	Diabeties (Study Group) n =40	Non Diabeties (Control Group) n =40	Total
40-45	6	14	20
46-60	34	26	60
Total	40	40	80

Graph - A

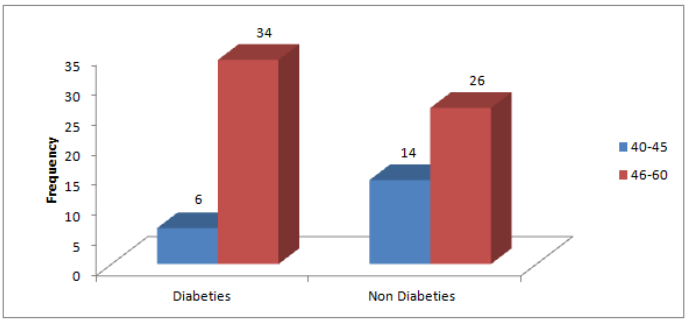

Table 2 and Graph B shows Gender wise distribution of study participants.

Table 2: Gender wise distribution of study participants

Gender	Diabeties (Study Group) n =40	Non Diabeties (Control Group) n =40	Total
Male	22	19	41
Female	18	21	39
Total	40	40	80

Graph B

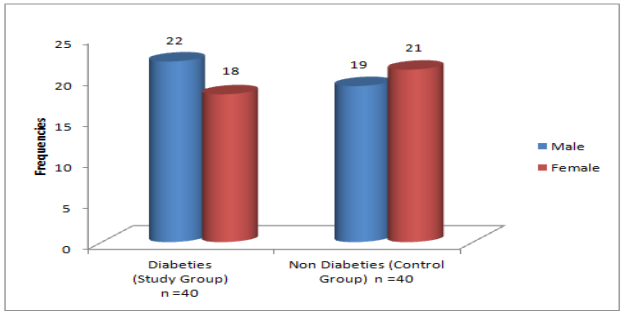

Table 3 shows Lung function data for the total type 2 Diabetic patients compared with their matched controls.

The results are presented as an overall group and stratified according to the disease in the type 2 diabetic patients (5-7 years).

Type 2 Diabetic patients had statistically significant reductions in FVC, $FEV_1$and PEFR ,and $FEF_{25-75\%}$ and it is statistically significant $p<0.025$. FEV1/FVC% was not decreased in diabetic patients and it is statistically insignificant $p>0.025$.

Table 3.Lung function data for the total type 2 Diabetic patients compared with their matched controls.

Parameter	Diabetic patients (mean ± SEM) (n=20).	Control Subjects (mean ± SEM) (n=20).	Percentage Change (%)	p value
Age (years)	47.85±1.72	46.95±1.95	1.88	.101 NS
Height (cm)	160.06±8.13	155.95 ±6.81	1.29	.036 S
Weight (kg)	64.45± 4.23	60.20± 9.02	2.56	.044 s
BMI(w/cm)	24.5±1.51	21.89±4.74	10.6	0.022 s
FVC (litres)	3.14 ± 0.188	3.7± 0.400	17.83	0.000 s
FEV_1 (litres)	2.68± 0.286	3.06± 0.496	14.17	0.007 s
FEV_1/FVC%	85.50± 5.14	83.40 ± 3.73	2.45	0.078 NS
$FEF_{25-75\%}$ (litres/s)	3.22± 0.367	3.71± 0.49	15.21	0.000 s
PEFR (litres/sec)	5.76± 0.39	6.91 ± 0.711	19.96	0.000 s

NS=non significa

Discussion

Diabetes mellitus is incurable life-long disease, it involve the multiple systems with wide ranging and devastating complications which end up in severe disability and death [10] (Khan *et al.*, 1999). In spite of effective interventions centered for the complication of diabetes mellitus includes cardiovascular disease, nephropathy, diabetic retinopathy, neuropathy, however, the pulmonary complications of diabetes mellitus have been poorly characterized.

In addition many studies were conducted in IDDM on factors such as age, height, weight, smoking and socioeconomic status. Therefore, the present study was designed to determine the effect of pulmonary function in diabetes by considering the potential factors such as age, height, weight, smoking or economic status. The present study shows a strong association, with the effects of disease in years and decreased pulmonary function; impairment in diabetic patients.

This association is explained by age, height, weight and smoking. Type 2 Diabetics with longer years showed a significant reduction in FVC, FEV_1, $FEF_{25-75\%}$ and PEFR, relative to controls. [11]Asanuma (1985), [12] Lange *et al.*, (1989),[8] Boulbou*et al.*, (2003) reported that FVC and FEV1 were reduced in diabetic subjects compared to control subjects. Similarly, Cazzato*et al.*, (2004) [13]conducted a cross-sectional study to assess the pulmonary function in children with insulin-dependent diabetes mellitus (IDDM) and reported that the FVC, FEV_1 were found to be significantly lower in diabetics than controls. Our results for FVC and FEV1confirms the

results observed by Asanuma (1985); Lange *et al.,* (1989); Boulbou*et al.,* (2003) and Cazzato*et al.,* (2004). The other pathological changes in diabetes mellitus causing changes in pulmonary functions were describedat the level of respiratory muscle,thickening of the pulmonary capillary basal laminae and alveolar epithelium , micro angiopathy and collagen.

Collagen forms the important component of the frame work of the air ways.Resistance to collagen digestion by collagenase was shown in NIDDM patients so there was only a limited amount of collagen available for glycosylation by the diseased as these collagen containing sites were already saturated. This could probably be another reason for the restrictive type of defect found in NIDDM

Conclusion: This study confirms the findings of others, which strongly suggest that type 2 diabetes mellitus adversely affect the pulmonary function. The findings are of importance in that they demonstrate the need for prevention of lung. In the present study, we primarily found a restrictive pattern of lung function impairment shown by decreased FVC, FEV_1, and PEF, in type 2 diabetic patients as compared to their matched controls.

It is advisable, therefore, that diabetic patients must undergo periodic Spirometry tests to assess the severity of lung function impairment. Tests will identify more susceptible diabetic patients so they can take additional preventive measures to prevent the lung damage in initial stage .

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