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Original Research Article

Correlation of Pulmonary Function Tests with BMI in Type-2 Diabetes Mellitus

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Abstract

Diabetes mellitus is a public health problem in developing and developed world, according to WHO, India will be world diabetic capital in 2025. Diabetes is a complex medical syndrome comprising of heterogeneous group of disease resulting from diverse aetiologies predominantly of genetic and environmental origin. DM affects almost all the organ systems in the body producing biochemical, morphological and functional abnormalities mainly of collagen and elastine . The alterations in these scleroproteins in turn affect the mechanical behaviour of the lungs manifesting in altered lung volumes measured by pulmonary function tests. The alterations in these scleroproteins in turn affect the mechanical behaviour of the lungs manifesting in altered lung volumes measured by pulmonary function tests. People with a higher BMI are more susceptible to diabetes and its complications .High body fat increases insulin resistance in muscles, liver, adipose tissue which increases body insulin production and causes impaired glucose tolerance. The effect of BMI in reducing lung function has been well documented .The present study has focused on correlation of pulmonary function test with BMI in type 2 diabetics.

Keywords: Diabetes mellitus, BMI, Pulmonary function test.

Introduction

Diabetes mellitus is a public health problem in developing and developed world, according to WHO, India will be world diabetic capital in 2025. Diabetes is a complex medical syndrome comprising of heterogeneous group of disease resulting from diverse aetiologies predominantly of genetic and environmental origin. DM affects almost all the organ systems in the body producing biochemical, morphological and functional abnormalities mainly of collagen and elastine . The alterations in these scleroproteins in turn affect the mechanical behaviour of the lungs manifesting in altered lung volumes measured by pulmonary function tests (Benbassat et al., 2001)[1]. In the context of rising prevalence of DM, Particularly in developing countries and in younger age groups and since these changes can potentially incapacitate the patients, it is of utmost importance to not only define these changes but also find ways of retarding the progression of disease so that they do not become irreversible. DM affects almost all the organ systems in the body producing biochemical, morphological and functional

abnormalities mainly of collagen and elastine . The alterations in these scleroproteins in turn affect the mechanical behaviour of the lungs manifesting in altered lung volumes measured by pulmonary function tests. Obesity is becoming one of the serious public health problems of modern world with rapidly changing lifestyles involving consumption of high calorie foods with decreased physical activities. People with a higher BMI are more susceptible to diabetes and its complications .High body fat increases insulin resistance in muscles, liver , adipose tissue which increases body insulin production and causes impaired glucose tolerance. The effect of BMI in reducing lung function has been well documented. Another more important effect of BMI on lung function is related to the metabolic syndrome in which low grade inflammation plays a central role in the development of diabetes as well as reduced lung function .The aim of this study was to correlate the pulmonary function tests with body mass index in type -2 diabetes mellitus.

Material and Methods

A cross –sectional and retrospective study was conducted in Department of physiology , D.Y Patil medical college & hospital, Kolhapur India . The subjects of the study included forty type-2 diabetics who were between 40-65 years of age and a similar number of age, sex and BMI matched controls. Both were selected on the basis of exclusion criteria. Persons with any conditions that effect lung functions were excluded from the study. subject with BMI >30 Kg/m^2 were excluded from the study. Controls and type 2 diabetics both were assessed by using a proforma and written informed consents were taken from them. The study was approved by the institutional ethical committee. Required measurements such as weight (kg) and height (m) were measured according to anthropometric standards. Three reading of each of the measurement were taken and then their average were calculated to ensure accuracy.

BMI=Weight(kg)/Height(m^2)

Underweight - <18.5kg/m^2

Normal range – 18.5 -22.9kg/m^2

Overweight – 23-24.9kg/m^2

Obese I – 25-29.9kg/m^2

Obese ll - ≥ 30kg/m^2

Pulmonary function tests were assessed by using a computerized spirometer RMS Helios 702 which consists of transducer attached with disposable mouthpiece. The subject were informed about the whole manoeuvre. The subjects were encouraged to practise this manoeuvre before doing PFT. The test was performed with the subject in the sitting position and by using soft nose clip. The values of parameters (FVC, FEV1, FEV1/FVC% and PEFR) of these the best manoeuvre were taken and were analyzed with a software EPI INFO statistical software by using unpaired student t-test.

Observation and results

BMI were matched for type -2 diabetics and control (p=NS*) .The following parameters FVC, FEV1 and PEFR were significantly reduced in type -2 diabetics as compared to those in controls & FEV1/FVC% was significantly increased in type 2 diabetics as compared to control.

Table 1. Spirometric lung function test data of Type 2 diabetics compared with their matched control.

Parameters	Type -2 diabetics (Mean±SD)	Controls (Mean±SD)	P value
BMI	0.010724±0.0006268	0.010464±0.005996	3.074 NS*
FVC (Liters)	7.528±0.3956	11.2376±0.6576	0.0004
FEV1(Liters)	6.0932±0.3056	7.9556±0.3764	0.002
FEV1/FVC%	336.4624±7.5124	289.0644±9.8824	0.002
PEFR (Liters/sec)	14.2376±0.9532	18.08±1.1368	0.0968

Discussion

People with a higher BMI are more susceptible to diabetes and its complications. High body fat increases insulin resistance in muscle , liver , adipose tissue which increases body insulin production and causes impaired glucose tolerance [2,3]. Asians are genetically predisposed to diabetes hence risks for diabetes and its complications are high even for normal BMI [4]. Central obesity can influence respiratory mechanics. WC is a better indicator of a health risk as it measures abdominal fat which correlates to intra-abdominal fat [5]. Excess of abdominal fat may restrict the diaphragmatic movement which leads to a decrease in pulmonary function.

In our study diabetes showed reduced lung function. Mean values in diabetics were less when compared with non-diabetics for FVC, FEV1 and PEFR. Both in the Copenhagen city heart study (Lange et al., 1989) [6] and in the Fremantle diabetes study, lung function among diabetic subjects were diminished when compared among controls. FEV1/FVC% is the volume of air expired in the first second, expressed as percentage of FVC. It is a more sensitive indicator of airway obstruction than FVC or FEV1 alone. Our study showed statistically significant increase FEV1/FVC%. The FEV1/FVC% was increased suggested that the impairment of pulmonary functions in type 2 diabetics was primarily restrictive. The association between PFT and diabetes is also affected by age, sex and BMI. In this study also it is seen.

In our study the effect of BMI in reducing lung function has been well documented. Another more important effect of BMI on lung function is related to the metabolic syndrome in which low grade inflammation plays a central role in the development of diabetes as well as reduced lung function.

Some of the prospective and cross sectional studies have shown low vital capacity or restrictive pattern in type 2 DM. Meta-analysis by Vandenborst et al [7] showed that DM is associated with statistically significant impaired pulmonary function in a restrictive pattern. Moreever these results were irrespective of body mass index (BMI), smoking, diabetes duration and HBA1c levels [8].

A decrease in the mean FVC , FEV1 and PEFR values were seen in type -2 diabetic patients compared to the controls .BMI showed an inverse relationship with FVC , FEV1 and PEFR. FEV1/FVC% was significantly increased in type 2 diabetics as compared to control.

Conclusions

This study concluded that higher BMI will lead to reduction in lung function as well as development of diabetes. Diabetes mellitus will further affect the lung function. Increased BMI were correlated with decreased lung functions in diabetes. So the lung function might be improved by weight loss.

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