Association of Lipid Profile, Glycosylated Haemoglobin (HbA1C) and Body Mass Index (BMI) in Patients with Type-2 Diabetes Mellitus.

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Abstract

Methods: In this cross sectional study two hundred-thirty six diabetic patients (126 males and 110 females) participated. Patients included in the study were newly diagnosed as diabetic according to WHO criteria. Dyslipidemia was defined by presence of one or more than one abnormal serum lipid concentration, according to National Cholestrol Education Program Adult Treatment Panel III (NCEP ATP III) guideline. Weight was measured using electronic digital scales. Height was measured using a wall-mounted stadiometer. BMI was subsequently calculated as weight (kg) per height (m2). Fasting plasma glucose and 2h-BG (after 75 g glucose load) were estimated for all studied subjects. Three ml of blood was collected in EDTA bottles for measurement of HBA1c by immunoturbimetry method. Statistical analysis was performed using t-test. Significance was defined as p<0.05.

Results: Of the 236 patients, 126 patients were male and 110 were female ranging from the age group 35-80 years. The mean BMI 24.3, Total Cholesterol 163.9 mg/dl, TGL 126.8mg/dl, HDL 29.9 mg/dl, VLDL 31.6 mg/dl, LDL 108.7 mg/dl was seen in patients having HbA1c of less than 6.5. The mean HbA1c 6.7%, Total Cholesterol 160.3 mg/dl, TGL 146, HDL 27.3 mg/dl, VLDL 37.6 mg/dl, LDL 101 mg/dl was seen in patients having BMI of less than 25.

Conclusion: There is a direct association of high BMI, elevated HbA1c and deranged lipid profiles in patients of diabetes mellitus. HbA1c and BMI showed positive correlation with lipid profile including total Cholesterol, LDL, TGL, VLDL & negative correlation was found with HDL levels.

Key Words: Diabetes mellitus, Glycosylated haemoglobin, Body Mass Index

Introduction

In both developed and developing countries diabetes increasing prevalence of Diabetes Mellitus (DM) is becoming a global endemic. Worldwide DM is one of the leading causes of death. In Pakistan the prevalence of type 2 diabetes mellitus is now reaching about 11.77%. [1,2] Globally the prevalence of DM was about 8% in 2011. Its prevalence is expected to increase to 10% by 2030.[3] Low- and middle-income countries comprise of about 80% of patients with DM. Particularly affected areas are Asia and Pacific.[4] Currently prevalence of DM is 11.7% in Pakistan.[5] Type-2 DM is commonly associated with obesity, ethnicity, sedentary lifestyles, sex,family history, hypertension, smoking and alcohol consumption.[6] However there is now overwhelming evidence from experimental, epidemiological and intervention studies shows that obesity is one of the major risk factor leading to DM among all risk factors.

According to WHO criteria Obesity is defined as a Body Mass Index (BMI) of >30 kg/m2. Being obese is a significant public health problem across the world, affecting almost an estimated of one billion people. This leads to complications like hypertension, DM, cardiovascular disease and death[7]. Worsening of glycemic control deteriorates lipid and lipoprotein abnormalities in DM.[8] American Association of Clinical Endocrinologists recommend glycosylated hemoglobin(HbA1c) level of less than 6.6%. Elevated levels of Triglyceride (TG),Total Cholesterol (TC)&Low Density Lipoproteins (LDL) are documented as risk factors of atherogenesis. [7] In Type-2 DM, lipid abnormalities are almost always present. 70 to 97% of adults with Type-2 DM have one or more lipid abnormalities.[8-9] The pattern of lipid profile in Type-2 DM is called diabetic dyslipidemia or atherogenic dyslipidemia comprising of raised triglycerides, reduced High Density Lipoproteins (HDL), and excess small dense LDL particles. Index of diabetes is provided by glycated haemoglobin (HbA1c).An average of blood glucose levels in a patient during the past 2–3 months is the most objective and reliable measure for long-term metabolic control of glucose.[11]

Patients and Methods

This cross sectional study was conducted in Pathology Department of Pakistan Institute of Medical Sciences, Islamabad, from April to October 2017. Sample size came out to be 236 using Confidence Level 95%, Confidence Interval 5% and reference population 610. Two hundred-thirty six diabetic patients (126 males and 110 females) participated in this study and their ages ranged between 35 and 85 years. Non probability convenient sampling was done. Patients included in the study were diagnosed as diabetic according to WHO criteria which is "An HbA1c of 6.5% is recommended as the cut point for diagnosing diabetes. A value of less than 6.5% does not exclude diabetes diagnosed using glucose tests." All patients were newly diagnosed or known cases of type 2 DM. Patients with abnormal liver function, nephropathy, neuropathy or retinopathy and patients not giving consent were excluded from the study. Dyslipidemia was defined by prescence of one or more than one abnormal serum lipid concentration, according to National Cholestrol Education Program Adult Treatment Panel III (NCEP ATP III) guideline. Diabetes was defined as per World Health Organization (WHO) criteria. Weight was measured using electronic digital scales. Height was measured using a wall-mounted stadiometer. BMI was subsequently calculated as weight (kg) per height (m2). Five ml of venous blood was collected into plain vacutainers after 8 hours of fasting, and then centrifuged so that serum was separated. The sera were used to measure lipid profile using spectrophotometric methods. Fasting plasma glucose and 2h-BG (after 75 g glucose load) were estimated for all studied subjects. 3ml of blood was collected in EDTA bottles for measurement of HBA1c by immunoturbimetry method. Significance was defined as p<0.05.

Results

Of the 236 patients, 126 patients were male and 110 were female ranging from the age group 35-80 years. Hypercholesterolemia is defined as TC >200 mg/dl, High LDL when value is >100 mg/dl, Hypertriglyceridemia as TAG >150mg/dl, & low HDL when value <40 mg/dl. The mean BMI 24.3, Total Cholesterol 163.9 mg/dl, TGL 126.8, HDL 29.9 mg/dl, VLDL 31.6 mg/dl, LDL 108.7 mg/dl was seen in patients having HbA1c of less than 6.5 (Table 1).Patients with good glycemic controls had HDL values lower than the normal.The mean BMI 28, Total

Cholesterol 219.0 mg/dl, TGL232.5 mg/dl, HDL 37.3 mg/dl, VLDL 39 mg/dl, LDL 134 mg/dl was seen in patients having Hba1c of more than 6.5. By comparing both the groups it was found that though the lipid parameters were elevated in patients having uncontrolled glycemic status(HbA1c >6.5), all these parameters were positively and significantly elevated except HDL which was found to be decreased in patients having uncontrolled glycaemic status(HbA1c>6.5). The mean HbA1c 6.7%, Total Cholesterol 160.3 mg/dl, TGL 146, HDL 27.3 mg/dl, VLDL 37.6 mg/dl, LDL 101 mg/dl was seen in patients having BMI of less than 25. The HDL levels were also lower in the normal BMI range.

Table 1: Mean levels of lipid profile and BMI based on HbA1c in type 2 diabetic patients

HbA1c	BMI	Lipid profile (mg/dl)				
		Total Cholesterol	Triglyc erides	HDL	VLDL	LDL
<6.5	24.3	163.9	126.8	29.9	31.6	108.7
>6.5	28	219	232.5	37.3	39	134
	0.001	0.002	0.013	0.192	0.018	0.030
SIG	HS	HS	HS	NS	HS	HS

Table 2: Mean levels of lipid profile and HbA1c based on BMI in type 2 diabetic patients

BMI	HbA1c	Lipid Profile (mg/dl)				
		Total Cholesterol	TGL	HDL	VLDL	LDL
<25	6.7	160.3	146	27.3	37.6	101
>25	8.7	220.9	240	35.1	38.8	146.3
	0.003	0.001	0.009	0.220	0.020	0.001
SIG	HS	HS	HS	NS	HS	HS

The mean HbA1c 8.7 %, total cholesterol 220.9 mg/dl, TGL240 mg/dl, HDL35.1 mg/dl, VLDL 38.8 mg/dl, LDL 146.3mg/dl was seen in patients having BMI of more than 25.By comparing both the groups it is found that though the HbA1c and all the other lipid parameters were elevated in patients having BMI of more than 25, all these parameters were positively and significantly elevated except HDL which was found to be decreased in patients having BMI of more than 25 (Table 2)

Discussion

The present study associates lipid profile parameters, HbA1c and BMI parameters in Diabetic patients and their correlation. The levels of HbA1c amd lipid profile parameters didn't differ significantly between male and female. The present study has shown dyslipidemia with significant rise in total cholesterol, TGL, LDL in patients who had BMI >25. Both Lipid profile and BMI have been shown to be the important

predictors for metabolic disturbances. Obesity predisposes the individuals to DM. While dyslipidemia has association with both Obesity and Diabetes Mellitus.[12-13] It was also found that though the lipid parameters were elevated in patients having uncontrolled glycaemic status(Hba1c >6.5) , all these parameters were positively and significantly elevated except HDL which was found to be decreased in patients having uncontrolled glycaemic status(HbA1c >6.5).

HDL levels are deranged in good glycaemic control group (HbA1c <6.5%) as well as in normal BMI range (< 25Kg/m²). As evident from other studies HDL levels are lower in South Asian population.[14] Similar findings have been observed in our study.

A positive association was seen between HbA1c and dyslipidaemia, it has been reported that severity of a increases among patients at higher levels of HbA1c.[15] High BMI, elevated Hba1c and Dyslipidemia have direct association with diabetes mellitus.[16-17] So when managing the patients of diabetes it is important to consider all three of these parameters. Dietary modifications, lifestyle changes, regular exercise and proper medication are necessary along with proper work up of lipid profile, BMI and HbA1c in patients to prevent complications of type 2 DM.

Conclusion

1. There is direct association of High BMI, elevated HbA1c and dyslipidemia among the patients of type 2 diabetes mellitus. No significant difference between genders in glycemic status or lipid profile was found. HbA1c and BMI showed positive correlation with lipid profile including Total Cholesterol, LDL, TGL, VLDL and negative correlation was found with HDL levels.

2. HDL levels were lower at HbA1c < 6.5% and BMI < 25%. These findings suggest that for proper management for the patients of Type-2 DM all three of these parameters should be given importance and treated accordingly to prevent complications of type 2 diabetes mellitus.

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