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Evaluation of Lipid Profile in Type-II Diabetes Mellitus with Obesity

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Abstracts
Diabetes mellitus is a heterogeneous chronic metabolic disorder characterized by hyperglycemia and its lethal complications. Among the various types of diabetes, Type-II diabetes mellitus is the most prevalent variant and it is due to combination of insulin resistance and relative insulin deficiency due to pancreatic β cell failure. In this study we examined the serum lipid profile in obese Type II diabetics and compared with a control group who were obese but not diabetic. The mean TC, TG, HDL-c, LDL-c, VLDL-c, FBS were 243.36±36.72, 201.97±55.44, 42.48 ± 9.2, 164.96 ± 16.8, 40.59±11.09 and 143.55 ± 38.68 respectively. In our study, the levels of TC, TG, LDL-c, VLDL-c were significantly increased while HDL-c levels did not show statistically significant difference in the two group.
Key words: *Obesity, BMI, Lipid Profile &TypeII Diabetes Mellitus.*

Introduction

In the ancient Sanskrit Literature, diabetes mellitus was described as "honey-urine disease," associated with gross emaciation and wasting. Diabetes is a global endemic with rapidly increasing prevalence in both developing and developed countries.[1]

Diabetes mellitus is a heterogeneous chronic metabolic disorder characterized by hyperglycemia and its lethal complications. Among the various types of diabetes, Type-II diabetes mellitus is the most prevalent variant and it is due to combination of insulin resistance and relative insulin deficiency due to pancreatic β cell failure. Type-II DM often have both quantitative and qualitative abnormalities of lipoproteins that are responsible for increased incidence of microvascular and macrovascular complications.[2] Incidence of coronary heart disease is three to four folds higher in patients with Type-II diabetes mellitus compared to non diabetics.

The worldwide prevalence of diabetes mellitus had risen dramatically. Basing on current trends, the International Diabetes Federation projects that 438 million individuals will have diabetes by the year 2030.[3] Although the prevalence of both type I and II DM is increasing worldwide, the prevalence of type II DM is rising much more rapidly, presumably because of increasing obesity, reduced activity levels as countries become more industrialized and the aging of the population. India is considered the diabetes capital of the

world by 2020AD. It is estimated that 35 million in our country already have diabetes and it is expected to reach 70 to 80 million by 2030AD. In India the prevalence is 2-4% in rural and 4.0-11.6% in urban areas.[4] Worldwide estimates project that in 2030 the greatest number of individuals with diabetes will be aged 45–64 years. Dyslipidemia (raised triglycerides, raised cholesterol and low HDL) were common in patients with Type-II DM with other features of insulin resistance like hyperinsulinemia, hypertension with central obesity together known as metabolic syndrome or Reaven's syndrome; and is strongly associated with atherosclerosis. Low HDL-C was a major risk factor had emerged from the Framingham Heart Study. Total cholesterol (TC): HDL-C ratio (>4.5) is considered the most powerful predictor of coronary heart disease. The obese Type-II DM subjects have a very high level of serum triglycerides, a triglyceride level >130mg/dl and /or a triglycerides-to-HDL-C ratio above three is highly predictive of small, dense LDL particles. LDL is the most important proatherogenic lipoprotein. Smaller, denser LDL's were more atherogenic than larger buoyant LDL's; Lp(a) was a genetic variant of LDL-C it had an abnormal protein called apo(a) attached to it and is the most dangerous lipoprotein.[5] Hyperglycemia and dyslipidemia affects the progression of coronary heart disease and increases the mortality rate in diabetic patients. Endothelial dysfunction occurs due to increased LDL-C and decreased HDL-C levels. So, aggressive management of lipid levels along with anti-diabetic treatment, which not only reduces the complications of Type-II diabetes mellitus but also mortality.

Obesity is a disorder of body regulatory system characterized by accumulation of excess body fat.[6] It is an abnormal growth of fat cell size (hypertrophic obesity) or an increase in fat cell number (hyperplastic obesity) or combination of both. Obesity is the most common and most expensive nutritional problem in U.S.A. Obese people are more likely to have high cholesterol levels, this increases the risk of atherosclerosis. Android obesity – high risk abdominal fat distribution (Apple shaped= upper body obesity), [6] this abdominal obesity is important in development of insulin resistance in metabolic syndrome that link with coronary heart disease. Obesity is a major risk factor for diabetes especially central obesity and as many as 80% of patients with Type-II DM (due to insulin resistance) were obese.[3] So, patients with Type-II DM with dyslipidemia and obesity have markedly increased risk of coronary heart disease than dyslipidemic non diabetic obese patients. There are major ethnic and gender differences in the rate of accumulation and the amount of visceral fat. For example, Asian Indians hsave relatively higher truncal and abdominal fat mass as compared to Caucasians and black population despite similar or less average value of waist circumference.[7] In this study we examined the serum lipid profile in obese Type II diabetics and compared with a control group who were obese but not diabetic.

Material and methods

The present study was conducted in Department of Physiology, Government Medical College Azamgarh dring the period from November, 2014 to September, 2015. Randomly selected, 60 subjects out of them 30 were obese Type II DM patients and 30 were obese non diabetic control were studied for following parameters:

1. blood Glucose by GOD-POD methods.[8]
1. Total Cholesterol (TC) by enzymatic end point CHOD-POD methods.[9]
2. Triglyceride (TG) by enzymatic glycerol phosphate oxidase/peroxidase methods.[10]
3. HDL-Cholesterol by direct enzymatic end point method.[11,12]
4. LDL-Cholesterol by Friedewald's formula.[13]
5. VLDL-Cholesterol by Friedewald's eqution.
6. *LDL-c = Tc-HDL-c(TG/5)*

Anthropometric parameters

Weight and Height:

Weight was recorded in kilograms with the subject standing on the weighing machine without shoes and minimum clothing. Weight of the patients and controls were recorded in the same weighing machine. Height was recorded with the subject barefooted, feet together, back and heels against the upright bar of the height scale; head upright in Frankfort horizontal plane – look straight ahead. The height measuring equipment consisted of a vertical bar with a horizontal bar of wood which was brought down snugly on examinee's head.[14]

Body Mass Index (BMI):

Body Mass index was calculated from the formula:

BMI = weight in kilograms / (height in meters)^2

Patients were taken as obese if their body mass index was 27.8 and 27.3 for males and females respectively.[15]

We used student t-test and pearson's correlation coefficient to find the statistical significance. A P-value <0.05 was to be considered statistically significant.

Results and Discussion

We studied the evaluation of lipid profile in type-II diabetes mellitus with obesity. Table 1 shows the age and anthropometric characters of the study population. Table 2 shows the estimated levels of lipid profile in obese typeII diabetes and obese non diabetic cases along with fasting blood sugars of obese typeII DM.

The mean TC, TG, HDL-c, LDL-c, VLDL-c, FBS were 243.36±36.72, 201.97±55.44, 42.48 ± 9.2, 164.96 ± 16.8, 40.59±11.09 and 143.55 ± 38.68 respectively (Table-2). In our study, the levels of TC, TG, LDL-c, VLDL-c were significantly increased while HDL-c levels did not show statistically significant difference in the two group.

Accelerated Coronary and peripheral vascular atherosclerosis is one of the most common and serious chronic complications of long term diabetes mellitus. Along with other risk factors such as hypertension, smoking, obesity etc., increasing importance has been given to secondary hyperlipidaemias in the causation of accelerated atherosclerosis.[16] Hyperlipidaemia as a metabolic abnormality is frequently associated with diabetes mellitus. Its prevalence is variable, depending on the type and severity of diabetes, glycaemic control, nutritional status, age and other factors.

Table 1: Age and anthropometric characters of the study population:

Parameters	Obese typeII DM(n=30)		Obese Control (n=30)	
	Range	Mean±SD	Range	Mean±SD
Age	30-67	47.8±7.7	30-69	49.06±10.16
Weight in Kg	64-92	77.85 ± 6.88	65-100	78.03 ± 6.90
Height in cm	60-98	79.44±8.94	60-96	79.66±9.31
BMI	30-39	32.06±2.01	30-42	31.65±2.62
Waist circumference in cm	80-116	101.96±9.14	80-120	98.86±8.66

Table 2: Comparison of lipid profile Between Obese typeII DM & Obese Control:

Parameters	Obese typeII DM(n=30)	Obese Control (n=30)	P-Value
TC	243.36±36.72	156.06±20.69	<0.0001
TG	201.97±55.44	116.56±23.39	<0.0001
HDL-c	42.48 ± 9.2	47.25 ± 6.63	>0.06*
LDL-c	164.96 ± 16.8	135.32 ± 35.99	<0.001
VLDL-c	40.59±11.09	23.41±4.55	<0.001
FBS	143.55 ± 38.68	108.20 ± 22.26	<0.001

*statistically not significant

The most characteristic lipid abnormality in diabetics is hypertriglyceridaemia, with or without associated increase in plasma cholesterol.[17,18] In our study, obese type II diabetics when compared to obese control subjects showed the levels of TC, TG, LDL-c, VLDL-c were significantly increased while HDL-c levels did not show statistically significant difference in the two group. Cohen et al (1979) showed significant increase in the level of serum cholesterol and LDL cholesterol in obese diabetics when compared with obese controls. In their study, serum HDL -cholesterol levels did not differ significantly in the two groups.[19] Sharma (1970) and Jain (1980) observed increase in the levels of serum total lipids, total cholesterol, serum triglycerides and serum phospholipids in diabetic subjects as compared to normal controls.[20,21] The studies of Santen et al (1972) and Peret et al (1974) observed mean serum triglyceride levels higher in obese diabetics in comparison to obese control subject.[22,23] Bijlani et al (1984) found HDL - cholesterol to be significantly lower in obese diabetics as compared to normal weight diabetics.[24]

In preliminary studies, no defect in LDL receptor binding was found in the skin fibroblast from diabetics.[25] However, when the interaction of fibroblast from normal individuals with the LDL isolated from diabetics was studied, a significant impairment was observed in diabetic LDL internalization and degradation.[26] It has been suggested that chemical modification of the LDL particle itself (like non-enzymatic glycosylation of LDL)[26] might result in its increased incorporation in the arterial wall via a receptor independent pathway.[27] The critical range of glycaemia sufficient to induce LDL glycosylation in vivo remains to be determined and would obviously be of great interest. Most of the diabetic patients are found to have variable combination of triglyceride overproduction or under utilization. In severe insulin deficiency, lipoprotein lipase (LPL) activity is markedly impaired.[28,29] However, in mild to moderately severe non-insulin requiring diabetics LPL activity is relatively intact.[29] In such diabetics, endogenous triglyceride synthesis is enhanced[30], particularly in the presence of obesity and adequate amounts of insulin.

Many studies have strongly suggested an inverse correlation of HDL-cholesterol level with the development of ischaemic heart disease.[31-33] Most of the studies have revealed the inverse relationship of HDL- cholesterol with atherosclerosis to be independent of other lipid abnormalities. In a study of 165 diabetic out patients at the Joslin clinic, HDLcholesterol was lower in non-insulin-dependent diabetics and normal in insulin-dependent diabetics of both sexes, while total cholesterol was similar in the two groups.[34] These observations can be at least partly explained by the known inverse correlation of HDL-cholesterol with adiposity and triglyceride levels.[35-36] In some studies, HDL-cholesterol or LDL/HDL-cholesterol ratios have been shown to be inversely correlated with prevailing blood glucose levels[37,38] or with glycosylated haemoglobin levels, as an index of

blood glucose control.[39,40] However , this has not been confirmed by other.[41,42]

This study has clearly shown that all lipid fractions (except HDL) are abnormally elevated in obese type II diabetics when compared with obese controls. There are studies which seem to suggest that the lipoprotein distribution in Type II diabetes mellitus is not significantly altered by the degree of metabolic control.[43-45]

Realizing that most of the diabetics have a high probability of developing cardiovascular and cerebrovascular disease[46], is essential that in an individual who is obese and diabetic (two strong risk factors for coronary artery disease) their lipid abnormalities be properly taken care of, if morbidity and mortality in a diabetic is to be significantly altered. Several studies have shown a salutary effect of physical activity on HDL-cholesterol[47,48] although the degree and frequency of activity needed, remains to be established. Smoking has been shown to adversely effect HDL-cholesterol.[49] Some studies with high fibre diets have suggested significant improvement in plasma triglyceride levels and in HDL/LDL cholesterol ratio.[50,51] Dietary rape seed oil, margarine rich in sitostanol ester was effective for lowering VLDL and LDL cholesterol and increasing HDL–cholesterol in hypercholester-olaemic non-insulin-dependent diabetic subjects.[52]

Conclusion

These finding suggests that all lipid fractions (except HDL) are abnormally elevated in obese type II diabetics when compared with obese controls. There are studies which seem to suggest that the lipoprotein distribution in Type II diabetes mellitus is not significantly altered by the degree of metabolic control. As diabetes is a disease of self management, appropriate nutrition (low calories, low carbohydrates, and low fat with high fiber diet) regular physical activity and proper medication to achieve good glycaemic control have to be followed. Patients of diabetes with obesity- weight management are a key factor.

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