Research Article

A study of serum lipid profile among obese and non-obese individuals with or without Type-II Diabetes Mellitus

Mamatha V.[1*], H. V. Shetty[2], Usha S. M. R.[3], Priyadarshini K. S.[4], Deepa. M.[5]

[1,5]Post Graduate III, [2]HOD and Professor, [3,4]Professor, Department of Biochemistry, RRMCH, Bangalore, Karnataka, INDIA.
Email: vmamathan@yahoo.co.in

Abstract

Introduction: Diabetes is a group of metabolic diseases characterized by high blood glucose levels while obesity is accumulation of excess body fat. Diabetes and obesity currently threaten the health, well being and economic welfare of humanity. Today, 90% of over 150 million people suffering from Diabetes worldwide have Type-II Diabetes Mellitus while over 300 million are obese. Thus, up to 1.7 billion of the world's population is at an increased risk of heart attack and stroke. **Objectives:** To study and compare the lipid profile among obese and non-obese individuals with or without Type-II Diabetes Mellitus. **Methodology:** The Body Mass Index (BMI), Fasting Blood Glucose (FBG) and Lipid profile were studied using standard bio-chemical methods. Both obese and non-obese male and female individuals in the age group of 30-70 yrs with or without Type-II Diabetes Mellitus were included. **Results and Discussion:** The FBG was significant with a mean of (166.66±69.51) in obese and non-obese Diabetics and (108.63±42.44, P<0.0001) in controls. Total cholesterol (TC) mean (183.7±42.58) in cases and (185.71±40.66, P=0.7919) in controls, Triglycerides (TG) mean (180.18±116.87) in Diabetics compared to (185.75±219.39, P=0.8625) in controls, HDL-C mean (43.83±8.74) in Diabetics, compared to (45.58±8.41, P=0.7656) in controls and LDL-C (109.39±28.01) in Diabetics and (110.92±28.08, P=0.7656) in controls. The BMI mean was (28.415±3.822) in Diabetics, compared to (27.103±4.34, P=0.0815) in controls. Male obese patients had significant mean of FBG with (124.77±32) than females (199.25±78.56, P=0.0112) and there was no significant changes in lipid parameters between male and females, TC (P=0.9011), TG (P=0.0812). These findings indicate that lipid parameters can be used for Diabetic patients in the early diagnosis of dyslipidemia and timely intervention with lipid lowering drugs.

Keywords: Lipid profile, obese, BMI, Type-II Diabetes Mellitus.

[*]**Address for Correspondence:**
Dr Mamatha V., Post Graduate III, Department of Biochemistry, RRMCH, Bangalore, Karnataka, INDIA.
Email: vmamathan@yahoo.co.in
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INTRODUCTION

Diabetes is a group of metabolic diseases characterized by high blood glucose levels while obesity is accumulation of excess body fat. Diabetes and obesity currently threaten the health, well being and economic welfare of humanity. Today, 90% of over 150 million people suffering from Diabetes worldwide have Type-II Diabetes Mellitus while over 300 million are obese. Thus, up to 1.7 billion of the world's population is at an increased risk of heart attack and stroke.[1] Diabetic patients have an increased risk of lipid abnormalities leading to cardiovascular diseases. The term hyperlipidaemia refers to an increase in concentration of one or more plasma or serum lipids, usually cholesterol and triglycerides and the term dyslipidaemia is used for either an increase or decrease in concentration of one or more plasma or serum lipids. Type 2 diabetic patients have markedly increased risk of coronary heart disease than similarly dyslipidaemic non diabetic subjects. Low HDL and HDL_2 cholesterol, high VLDL cholesterol, and high total and VLDL triglycerides are powerful risk indicators for coronary heart disease events in patients with type 2 diabetes mellitus.[2]

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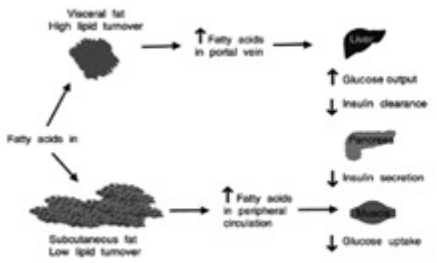

Figure1:

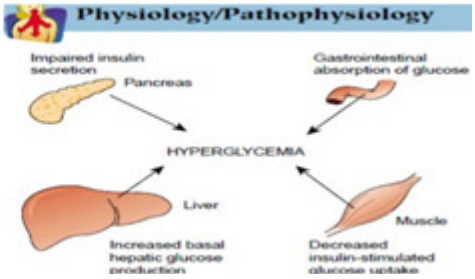

Figure 2: Pathogenesis of type 2 diabetes

- **Obesity** is a medical condition in which excess body fat has accumulated to the extent that it may have an adverse effect on health, leading to reduced life expectancy and/or increased health problems[1,2]
- People are considered obese when their body mass index (BMI), a measurement obtained by dividing a person's weight in kilograms by the square of the person's height in metres, exceeds 30 kg/m^2.[3]

Table 1: Body mass index (BMI)

	BMI	NIH Classification
	<18.5	Underweight
	18.5-24.9	Normal Weight
BMI= Weight (kg)	25-29.9	Overweight
Height^2(m)	30-34.9	Obesity I
	35-39.9	Obesity II
	>40	Extreme Obesity

For serum lipid reference level, National Cholesterol Education Programme (NCEP) Adult Treatment Panel III (ATP III) guideline was referred. According to NCEP ATP III guideline hypercholesterolemia defined as TC > 200 mg/dl, high LDL-C when value > 100 mg/dl, hypertriglyceridemia > 150 mg/dl and low HDL-C when value < 40 mg/dl. Dyslipidemia defined by presence of one or more than one abnormal serum lipid concentration. Values of HbA1c were given as % of total hemoglobin and values of all other parameters were given in mg/dl[4] Obesity is a leading preventable cause of death worldwide, with increasing prevalence in adults and children, and authorities view it as one of the most serious public health problems of the 21st century.[8] Obesity is stigmatized in much of the modern world (particularly in the Western world), though it was widely perceived as a symbol of wealth and fertility at other times in history, and still is in some parts of the world.[2,9] In 2013, the American Medical Association classified obesity as a disease.[10,11]

- Obesity is a medical condition in which excess body fat has accumulated to the extent that it may have an adverse effect on health.[1] It is defined by body mass index (BMI) and further evaluated in terms of fat distribution via the waist–hip ratio and total cardiovascular risk factors.[12,13] BMI is closely related to both percentage body fat and total body fat.[14]
- **Obesity** can be leading to reduced life expectancy and/or increased health problems.[1,2] People are considered obese when their body mass index (BMI), a measurement obtained by dividing a person's weight in kilograms by the square of the person's height in metres, exceeds 30 kg/m^2.[3]
- Obesity increases the likelihood of various diseases, particularly heart disease, type 2 diabetes, obstructive sleep apnea, certain types of cancer, and osteoarthritis.[2] Obesity is most commonly caused by a combination of excessive food energy intake, lack of physical activity, and genetic susceptibility, although a few cases are caused primarily by genes, endocrine disorders, medications or ps ychiatric illness. Evidence to support the view that some obese people eat little yet gain weight due to a slow metabolism is limited; on average obese people have a greater energy expenditure than their thin counterparts due to the energy required to maintain an increased body mass.[4,5]
- Dieting and physical exercise are the mainstays of treatment for obesity. Diet quality can be improved by reducing the consumption of energy-dense foods such as those high in fat and sugars, and by increasing the intake of dietary fiber. Anti-obesity drugs may be taken to reduce appetite or inhibit fat absorption together with a suitable diet. If diet, exercise and medication are not effective, a gastric balloon may assist with weight loss, or surgery may be performed to reduce stomach volume and/or bowel length, leading to earlier satiation and reduced ability to absorb nutrients from food.[5,6,7]

OBJECTIVES OF THE STUDY

The present study was conducted to

- Study and compare the lipid profile among obese and non-obese individuals with or without Type II Diabetes Mellitus.
- Their association with age, gender, Fasting Blood Glucose, and duration of the disease.

METHODOLOGY

Source of the Data

- The Body Mass Index (BMI), Fasting Blood Glucose (FBG), and Lipid profile of obese and non- obese, Diabetic and Non-Diabetic males and females attending the medicine OPD at RRMCH in the age group of 30 to 70 yrs were studied from September 2012 to July 2013.
- Informed written consent taken from the voluntary subjects prior to the investigation.
- Ethical clearance obtained from the ethical clearance committee of RRMCH, Bangalore.

The study group

Inclusion Criteria

- Both obese and non-obese, Diabetic/Non-Diabetic individuals attending general medicine OPD, RRMCH, Bangalore.
- About 60 subjects, both male and female with or without Hypertension in the age group of 30-70 years.

Exclusion Criteria

- Diabetic patients with any other concurrent chronic disease such as cardiac disease, thrombotic stroke etc.
- Pregnancy, anaemia and history of any other medical or surgical illness.

Control Group

- Normal, physically healthy volunteers, with no history of Diabetes Mellitus or any other chronic diseases in 60 subjects in both male and females in the age group of 30-70yrs.
- Control group will be screened for the same parameters which are done for the cases and if the values fall within the range, they will be included as control.

Method of data collection

- Under all aseptic precautions, 6ml of blood sample from the volunteer study and control group was collected.
- 2 samples, 8 hours fasting collected in a fluoride EDTA vacuum evacuated tube.
- Blood glucose by glucose oxidase-peroxidase enzymatic method.
- Serum from the remaining sample is used for the estimation of lipid profile and done in the Erba-360 fully auto-analyzer.
- Estimation of serum total cholesterol by cholesterol oxidase / phenol amino antipyrine method (CHOD-PAP).
- Estimation of serum HDL cholesterol by immuno-inhibition method.
- Estimation of serum LDL cholesterol by immuno-inhibition method.

Friedewald formula: LDL=TC-(HDL+TG/5)

- Estimation of serum triglyceride by glycerol phosphate oxidase (GPO) method.
- Statistical analysis of the data was performed by using Microsoft Excel software.
- Results were expressed as mean ± standard deviation.
- Statistical significance was defined by P<0.0001. Two tailed P value calculated by using Graph Pad: Scientific software.

RESULTS

In our study out of 60 cases, 29 (48.33%) were obese Diabetic and 31 (51.66%) were non-obese Diabetic patients. Age was between 52.56 ± 8.559 in cases and 45.25 ± 11.349, P (<0.0001) in controls.

Table 2: Age distribution in obese and non-obese diabetic males and females

Years	Male (30)	Female(30)
31-40	2(6.66%)	2(6.66%)
41-50	7(23.33%)	12(40%)
51-60	14(46.66%)	11(36.66%)
61-70	7(23.33%)	5(16.66%)

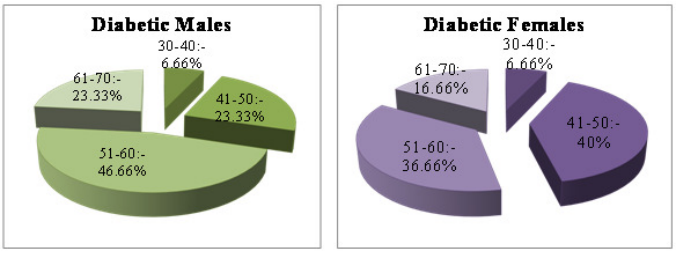

Figure 3: Age distribution in obese and non-obese diabetic males and females

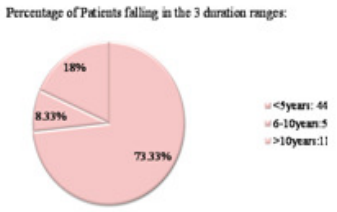

Figure 4: Duration of diabetics

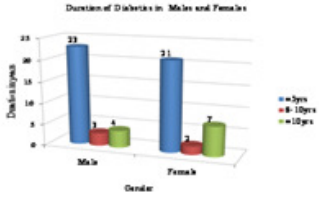

Figure 5: Duration of diabetics in male and female

Table 3: BMI, FBG and Lipid profile parameters in cases and controls :(Total n=120)

Para Pmeters	Cases: 60 Mean±Stddev	Controls:60 Mean±Stddev	P-Value
BMI	28.415 ± 3.822	27.103 ± 4.342	0.0815
FBG	166.66±69.51	108.63±42.44	<0.0001
TC	183.7±42.58	185.71±40.66	=0.7919
TG	180.18±116.87	185.75±219.39	=0.8625
HDL-C	43.83±8.74	45.58±8.41	=0.2660
LDL-C	109.39±28.01	110.92±28.08	=0.7656

Table 4: Characteristics of obese Diabetic male and Female (Total n=29)

Parameter	Male(n=9)	Female(n=20)	P-Value
BMI	31.35 ± 2.08	31.94 ± 1.64	0.4166
FBG	124.77 ± 32.00	199.25 ± 78.56	0.0112
TC	188.33 ± 47.62	190.75 ± 48.23	0.9011
TG	114.55 ± 65.58	214.85 ± 158.82	0.0812
HDL-C	43.11 ± 6.90	44.5 ± 10.96	0.7300
LDL-C	108.11 ± 28.71	117.06 ± 31.55	0.4744

Table 5: Characteristics of non-obese Diabetic male and Female (Total n=31)

Parameter	Male(n=21)	Female(n=10)	P-Value
BMI	25.53 ± 2.25	24.76 ± 2.08	0.3695
FBG	152.571 ± 66.64	168.8 ± 57.35	0.5138
TC	174.90 ± 33.62	183.9 ± 46.20	0.5421
TG	177.76 ± 94.65	175 ± 74.40	0.9361
HDL-C	42.06 ± 7.709	46.9 ± 7.29	0.1071
LDL-C	102.58 ± 18.77	109.5 ± 35.88	0.4830

Table 6: Characteristics of obese non- Diabetic male and Female (Total n=17)

Parameter	Male(n=9)	Female(n=8)	P-Value
BMI	32.17 ± 1.64	33.58 ± 2.31	0.1636
FBG	123.44 ± 84.66	119.625 ± 35.79	0.9074
TC	195.22 ± 45.38	185 ± 23.15	0.5753
TG	154.66 ± 77.85	159.75 ± 60.62	0.8836
HDL-C	44.88 ± 10.69	45 ± 8.01	0..9797
LDL-C	115.66 ± 27.36	112.87 ± 12.46	0.7951

Table 7: Characteristics of non-obese non- Diabetic male and Female (Total n=43)

Parameter	Male(n=21)	Female(n=22)	P-Value
BMI	25.22 ± 2.50	24.46 ± 2.51	0.3259
FBG	103.80 ± 29.22	103.172 ± 29.94	0.9447
TC	178.23 ± 27.65	189.22 ± 53.34	0.4046
TG	171.38 ± 139.16	155.09 ± 112.43	0.6744
HDL-C	43.38 ± 7.40	48.19± 8.33	0.0523
LDL-C	103.57 ± 19.88	115.29 ± 37.65	0.2122

DISCUSSION

In the present study it was observed that FBG level is higher in Diabetics compared to controls and obese male and female Diabetics and is statistically highly significant. However the difference between cases and controls is minimal and statistically not significant in the lipid parameters. There was no significant difference in BMI when cases are compared with control subjects. There is no significant difference in the lipid levels between the obese and non-obese male and female Diabetics and an increased TG and TC in obese females. The age, gender, blood sugar level, and duration of disease have no significant effect on the lipid parameters in the obese and non-obese diabetic patients. There is no significant difference in the BMI and lipid parameters between the obese and non-obese male and female non-Diabetics. The age, gender, blood sugar level, and duration of disease have no significant effect on the lipid parameters in obese and non-obese non- diabetic patients.

REVIEW OF LITERATURE

- 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.
- 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.
- 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.
- Bijlani *et al* (1984) found HDL - cholesterol to be significantly lower in obese diabetics as compared to normal weight diabetics.

CONCLUSION

Hyperglycemia causes increased activity of hepatic lipase that leads to increased clearance of HDL while impaired catabolism of VLDL causes decreased formation of HDL. Thus the HDL levels decrease in type 2 diabetes. **Dieting** and **physical exercise** are the mainstays of treatment for obesity. Diet quality can be improved by reducing the consumption of energy-dense foods such as those high in fat and sugars, and by increasing the intake of **dietary fibres. Anti-obesity drugs** may be taken to reduce appetite or inhibit fat absorption together with a suitable diet. Severity of dyslipidemia increases in patients with higher HbA1c value. As elevated HbA1c and dyslipidemia are independent risk factors of cardiovascular disorders (CVD), diabetic patients with elevated HbA1c and dyslipidemia can be considered as very high risk group for CVD. Improving glycaemic control can substantially reduce the risk of cardiovascular events in diabetics. It has been estimated that reducing the

HbA1c level by 0.2% could lower the mortality by 10%. These findings indicate that lipid parameters can be used for Diabetic patients in the early diagnosis of dyslipidemia and timely intervention with lipid lowering drugs.

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