

COMPARATIVE STUDY OF SERUM LIPID PROFILE IN OBESE TYPE 2 DIABETIC PATIENTS WITH OBESE NON DIABETIC PATIENTSJain Darshna¹, Shaikh M. K. S², Jha R. K³, Mittal Shilpa⁴, Shahi Deepasha⁵**HOW TO CITE THIS ARTICLE:**

Jain Darshna, Shaikh M. K. S, Jha R. K, Mittal Shilpa, Shahi Deepasha. "Comparative Study of Serum Lipid Profile in Obese Type 2 Diabetic Patients with Obese Non Diabetic Patients". Journal of Evolution of Medical and Dental Sciences 2014; Vol. 3, Issue 65, November 27; Page: 14129-14136, DOI: 10.14260/jemds/2014/3891

ABSTRACT: 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, wellbeing and economic welfare of humanity **OBJECTIVE:** To study serum lipid profiles in Obese type 2 diabetics in comparison with Obese non-diabetic subjects. **MATERIALS AND METHODS:** The study was conducted in the Department of Biochemistry in collaboration with Department of Medicine, Sri Aurobindo Medical College & Post Graduate Institute, Indore. In this study a total of 200 subjects included, out of which 100 type 2 diabetic patients with obesity (BMI ≥ 30 kg/m²) taken as cases and 100 obese patients without diabetes mellitus are taken as controls as per the criteria of study design and their serum lipid profile was analyzed & computed. **RESULTS:** Majority of the study population were males in both cases and controls. No significant differences were observed between different age categories between cases and controls. In cases the mean TC levels, TG levels, LDLc levels, VLDLc levels found to be 225.95 ± 24.51 mg%, 175.35 ± 24.45 mg%, 170.77 ± 18.86 mg%, 35.03 ± 4.89 mg% and it was found to be higher than controls. However, the mean HDLc value and the HDLc /LDLc ratio was found to be 37.03 ± 7.84 mg% and 0.44 ± 0.25 which was higher than those reported in the cases. A significant difference ($P < 0.0001$) was found between cases and control population when the serum TC, TG, HDLc values, LDLc values, VLDLc values, HDLc /LDLc ratio were compared between them. **CONCLUSION:** Dyslipidemia is more in obese diabetics than obese non diabetics and it can be prevented with proper monitoring and therapy to avoid associated comorbidity of diabetes mellitus. **KEYWORDS:** Lipid profile, Type-2 diabetes mellitus, Obesity.

INTRODUCTION: Diabetes mellitus (DM) is a group of metabolic disorders that are characterized by hyperglycemia resulting from defects in insulin secretion, insulin action or both while obesity is accumulation of excess body fat. It is well established that obesity is directly or indirectly associated with type 2 diabetes mellitus.¹ Diabetes and obesity currently threaten the health, wellbeing and economic welfare of humanity. DM is a disorder of multiple etiologies characterized by chronic hyperglycemia associated with abnormal carbohydrate, protein and lipid metabolism.² Among the various types of diabetes, Type 2 diabetes mellitus (T2DM) is the most prevalent variant.

The prevalence of diabetes for all age groups worldwide was estimated to be 2.8 % in 2000 and 4.4 % in 2030.³ Basing on current trends, the International Diabetes Federation projects that 438 million individuals will have diabetes by the year 2030.⁴ Calling India the diabetes capital of the world, the International Journal of Diabetes in Developing Countries says that there is alarming rise in prevalence of diabetes, which has gone beyond epidemic form to a pandemic one.⁵ In India the prevalence of diabetes is found to be 2.4% in rural and 4–11.6 % in urban dwellers.⁶ India had 32 million diabetic subjects in the year 2000 and this number would increase to 80 million by the year 2030.⁷

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The most characteristic lipid abnormality in diabetics is hypertriglyceridemia, with or without associated increase in plasma cholesterol.^{8,9} Type 2 diabetes is an independent risk factor for coronary artery disease and risk of coronary disease is three to four fold increase in patients with Type 2 diabetes compared with non-diabetic population.¹⁰

Abnormal serum lipid levels are likely to contribute to the increased risk of coronary artery disease in diabetic patients.¹¹ The measurement of the lipid profile of diabetic patients is needed to investigate how their lipid metabolism is affected by diabetes, as they have different genetic compositions and lifestyles. Hence, the present study was taken up to assess the serum lipid level in obese diabetics and obese non-diabetics to manage early therapy, to prevent complications and to improve the outcome.

OBJECTIVE: To study serum lipid profiles in Obese type 2 diabetics in comparison with Obese non-diabetic subjects.

MATERIALS AND METHODS: The present study was conducted in the Department of Biochemistry in collaboration with Department of Medicine, Sri Aurobindo Medical College & Post Graduate Institute, Indore. Ethical approval for the study was taken from the institutional research ethical committee. Written informed consent was taken from the patients in local language. In this study a total of 200 subjects included, out of which 100 type 2 diabetic patients with obesity (BMI ≥ 30 kg/m²) taken as cases and 100 obese patients without diabetes mellitus are taken as controls.

INCLUSION CRITERIA: the patients having confirmed diabetes mellitus with BMI more than 30 kg/m² were included in this study as cases while Obese non-diabetic were included as control.

EXCLUSION CRITERIA:

1. Diabetic patients with overt complications like neuropathy, nephropathy, retinopathy, and ischemic heart disease.
2. Patients with acute complications like diabetic keto-acidosis, non-ketosis hyperosmolar coma and hypoglycemia.
3. Patients with any concurrent illness like chronic liver disease, hypothyroidism.
4. Patients on drugs like diuretics, steroids, oral contraceptives and beta blockers etc.

Proforma was filled up for each patient and a detailed history was also taken from them. The basic anthropometric measures, height (mts), and weight (kg) were obtained in all subjects. Blood samples were collected after an overnight fasting of 10 to 12 hours, about 5 ml. of venous blood was drawn under aseptic precaution using sterile disposable syringe. Then blood was collected in sterile plain bulb and serum was separated by centrifugation and was used for analysis.

Different Lipid fractions were estimated along with fasting plasma glucose. Glucose was detected by enzymatic reaction glucose oxidase and peroxidase (GOD-POD).¹² Serum total cholesterol was determined by an enzymatic (CHOD-PAP) colorimetric method.¹³ Triglycerides were determined by an enzymatic (GPO-PAP) method.¹⁴ HDL-Cholesterol was estimated by a precipitant method.¹⁵ LDL-Cholesterol was estimated by using Friedewald formula¹⁶ LDL-Cholesterol = Total Cholesterol – (HDL cholesterol + Triglycerides/5).

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Serum Total cholesterol, HDLc, LDLc, VLDLc and Triglyceride levels were estimated with commercially available kits and run on HITACHI 902 analyzer.

All statistical analysis was done using SPSS v 20. Chi square test and independent sample t test were performed. P value < 0.05 was taken as statistically significant.

RESULTS: In present study, age of the patients (both cases and controls) ranged from 30-65 years with the mean age of the study population was to be 45.75 ± 8.39 years. The mean age of cases was found to be 44.83 ± 8.81 years, whereas the mean age of the controls was found to be 46.63 ± 7.87 years. No significant differences were observed between the two categories. Majority of the study population were males in both cases and controls.

The mean BMI value for the cases was found to be 31.60 ± 1.57 kg/m² whereas the mean BMI value for the controls was found to be 31.10 ± 1.28 kg/m². Majority (97-100%) of the study population in both cases and controls suffered from moderate obesity. No significant differences were found between cases and controls with the severity of obesity [P value 0.246]. The mean fasting and postprandial blood sugar level for cases were found to be 173.11 ± 35.16 mg/dl and 278.16 ± 49.36 mg/dl respectively which was higher than the mean fasting and postprandial blood sugar levels reported in controls.

In cases, majority (94%) of the people had the fasting blood sugar level greater than 125mg/dl and postprandial blood sugar level greater than 200 mg/dl which was found to be significantly higher [P value ≤ 0.0001] than controls. In cases the mean TC levels, TG levels, LDLc levels, VLDLc levels found to be 225.95 ± 24.51 mg%, 175.35 ± 24.45 mg%, 170.77 ± 18.86 mg%, 35.03 ± 4.89 mg % and it was found to be higher than controls. However, the mean HDLc value and the HDLc /LDLc ratio was found to be 37.03 ± 7.84 mg % and 0.44 ± 0.25 which was higher than those reported in the cases. A significant difference (P<0.0001) was found between cases and control population when the serum TC, TG, HDLc values, LDLc values, VLDLc values, HDLc /LDLc ratio were compared between them.

DISCUSSION: This present study is a further step towards understanding the biochemical changes in serum lipid profile in obese type 2 diabetic individuals compared to obese non-diabetic individuals. Dyslipidemia is very common in type 2 diabetes and it is characterized by hypertriglyceridemia and low levels of HDL-C¹⁷ similarly in our study, obese diabetics when compared to obese control subjects showed statistically significant increase in the levels of serum total cholesterol (P <0.001), serum triglycerides (P <0.001), serum LDL-cholesterol (P<0.001) and serum VLDL -cholesterol (P<0.001). Serum HDL-cholesterol levels was significantly decreased (P <0.001) in obese diabetic compared to obese controls.

A significant difference (P<0.0001) was found between cases and controls when the TC, TG, HDLc values, LDLc values, VLDLc values, HDLc /LDLc ratio were compared between them. The studies of Santen et al and Peret et al observed mean serum triglyceride levels higher in obese diabetics in comparison to obese control subject.^{18,19} D Sharma and A Jain 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} Bijlani et al found HDL-C to be significantly lower in obese diabetics when compared to normal weight diabetics.²² While Yadav NK et al observed Serum HDL - cholesterol levels did not differ significantly (P >0.05) in the two study groups but level were low in obese diabetic compare to obese controls.²³

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Hypercholesterolemia and hypertriglyceridemia were seen in this study.²⁴ Hypertriglyceridemia predisposes the patients to life threatening complications like diabetic ketoacidosis, coronary artery disease and lipaemia retinalis.²⁵ Gambhir et al found that low HDL-C were independent risk factor for premature coronary artery disease.²⁶ Many studies have strongly suggested an inverse correlation of HDL-cholesterol level with the development of ischaemic heart disease.²⁷⁻²⁹ Most of the studies have revealed the inverse relationship of HDL- cholesterol with atherosclerosis to be independent of other lipid abnormalities. Several other studies have shown similar results as were obtained in our study.³⁰⁻³⁵

CONCLUSION: In conclusion obese type 2 DM are prone to develop dyslipidemia which is more severe compared to non-diabetic obese patients. This study shows that quite a good number of diabetic patients can have hypercholesterolemia, hypertriglyceridemia, high LDLc, high VLDLc and low HDLc levels which are well established risk factors for cardiovascular diseases. Realizing that most of the diabetics have a high probability of developing cardiovascular and cerebrovascular disease, it is essential that in an individual who is obese and diabetic (two strong risk factors for coronary artery disease) their dyslipidemia should be properly taken care of, to reduce morbidity and mortality in a diabetics.

REFERENCES:

1. Monteiro CA, Conde WL, Popkin BM. Obesity in developing countries: biological and ecological factors independent effects of income and education on the risk of obesity in Brazellian adult population. *J Nutr* 2001; 131: 881-886.
2. Definition, Diagnosis and Classification of Diabetes Mellitus and its Complications.
3. Report of a WHO Consultation, (publication W.H.O./NCD/NCS/99.2) Geneva, Switzerland: World Health Organization, 1999.
4. Wild S, Roglic G, Green A, Sicree R, King H, Global prevalence of diabetes: Estimates for the year 2000 and projections for 2030, *Diabetes Care*, 2004, 27, 1047-53.
5. Dan L. longo &. et al. Harrison's principles of internal medicine. 18 ed, 2012, chapter 344, pages 2995 to 2998; 77:628.
6. Kumar S K P, Bhowmik D, Srivastava S, Paswan S, Dutta A S. Diabetes Epidemic in India-- A Comprehensive Review of Clinical Features, Management and Remedies, the pharma journal 2012; 1(2):17-33.
7. WHO. 1998. Prevention and control of Diabetes Mellitus, Report of an Intercountry workshop, Dhaka, Bangladesh, 27-30 April 1998, SEA/NCD/40.
8. Mohan V, Sandeep S, Deepa R, Shah B, Varghese C, Epidemiology of type 2 diabetes: Indian scenario, *Indian J Med Res*, 2007, 125, 217-230.
9. Goldberg RB. Lipid disorders in diabetes. *Diabetes Care* 1981; 4: 561.
10. Taskinen MR. Hyperlipidemia in diabetes. *Clin Endocrinol Metab* 1990; 4: 743.
11. Kannel WB, Lipids, diabetes, and coronary heart disease: Insights from the Framingham Study, *American Heart Journal*, 1985, 110, 1100-1107.
12. Miller M. The epidemiology of triglycerides as a coronary artery disease risk factor. *Clin. Cardiol* 1999; 22 (Supl. II): 111-16.
13. Tietz. N.W. Fundamentals of clinical chemistry 2nd edition. W. B. Saunders Co., Toronto (1982).

ORIGINAL ARTICLE

14. Allain CC, Poon IS, Chan CHG, Richmond W. Enzymatic determination of serum total cholesterol. *Clin. Chem.* 1974; 20: 470-71.
15. Jacobs NJ, Van Denmark PJ. Enzymatic Determination of Serum Triglycerides. *Biochem. Biophys* 1960; 88: 250-55.
16. Gordon T, et al. An Enzymatic Method for the Determination of the Serum HDL-Cholesterol. *Am. J. Med* 1977; 6: 707-08.
17. Friedewald WT, Levy RI, Fredrickson DS. Estimation of the Concentration Of LDL-Cholesterol. *Clin. Chem* 1972; 18 (6): 499-515.
18. Betterridge DJ. Diabetic dyslipidemia. *Diabetes Care* 2000; 2 (Suppl 1): 31-6.
19. Santen JR, Park W Willis, Stefan S. Atherosclerosis in diabetes mellitus correlation with serum lipid levels, adiposity and serum insulin levels. *Arch Int Med* 1972; 130.
20. Paret AD, Rowes A, Shahmanesh M. Blood lipids in treated diabetics. *Diabetologia* 1974; 10: 115.
21. Sharma D, Bansal BC, Prakash C. Serum lipid studies in the insulin dependent diabetics below the age of 30 years. *J Indian Med Assoc* 1970; 54 (9): 416-20.
22. Jain AP and Gupta DP. Study of Blood Lipid in Diabetics without any Manifest Vascular Complications. *J.Dia. Asso. Ind* 1980; 199: 29-34.
23. Bijani PK, Shah Kokila, Reheja BS, HDL Cholesterol in Diabetes JAPI; 1984: 32.
24. Yadav NK, Thanpari C, Shrewastwa MK, Mittal RK Comparison of Lipid Profile In Type-2 Obese Diabetics And Obese Non-Diabetic Individuals. A hospital Based Study from Western Nepal Kathmandu Univ Med J 2012; 39 (3): 44-47.
25. Addisu Y Mengesha, MD Lipid profile among diabetes patients in Gaborone, Botswana article Gaborone City Council, Health Department, PO Box 46318, Gaborone, Botswana *S Afr Med J* 2006; 96: 147-148.
26. Oh RC, Lanier JB. Management of Hypertriglyceridemia. *Am Fam Physician* 2007; 75 (9): 1365-71.
27. Gambhir JK, Kaur H, Gambhir DS, Prabhu KM. Lipoprotein (a) as an independent risk factor for coronary artery disease in patients below 40 years of age. *Indian Heart J* 2002; 52: 411-5.
28. Castelli WP, Doyle JT, Gordon T, et al. HDL cholesterol and other lipids in coronary heart disease: The cooperative lipoprotein phenotyping study. *Circulation* 1977; 55: 767.
29. Miller NE, Forde OH, Thelle DS, Mjos OD. The Tromso heart study. High density lipoprotein and coronary heart disease: a prospective case controlled study. *Lancet* 1977; 1: 965.
30. Goldbourt, U, Medalie JH. High density lipoprotein cholesterol and incidence of coronary heart disease; the Israel Ischaemic Heart Disease study. *Am J Epidemiol* 1979; 109: 296.
31. Cohen AM, Fidel J, Cohen B, Furst A, Eisenberg S. Diabetes, blood lipids, lipoproteins, and change of environment: restudy of the " new immigrant Yemenites" in Israel. *Metabolism* 1979; 28 (7): 716-28.
32. Zargar AH, Wandroo FA, Wadhwa MB, Laway BA, Masoodi SR, Shah NA. Serum lipid profile in non- insulin - dependent diabetes mellitus associated with obesity. *Int. j. diab. Dev. Countries* 1995; 15: 9-13.
33. Nagila A, Bhatt M, Poudel B, Mahato P, Gurung D, Prajapati S, Arun Kumar, Tamrakar Bk Thyroid Stimulating Hormone And Its Correlation With Lipid Profile In The Obese Nepalese Population. *Journal of Clinical and Diagnostic Research.* 2008 Aug; (2): 932-937.

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34. Samatha P, Venkateswarlu M, Siva Prabodh V. Lipid Profile Levels in Type 2 Diabetes Mellitus from the Tribal Population of Adilabad in Andhra Pradesh, India. Journal of Clinical and Diagnostic Research. 2012 May (Suppl-2); 6 (4): 590-592.
35. Idogun ES, Unuigbe EI, Ogunro PS, Akinola OT, Famodu AA. Assessment of the serum lipids in Nigerians with type 2 diabetes mellitus complications. Pak. J. Med. Sci. (Part 1) 2007; 23 (5): 708-12.
36. Ratna manjula songa, siddhartha.k, dr.sudhakar.k research article"lipid profile in type 2 diabetes mellitus with obesity" bulletin of pharmaceutical and medical sciences (bopams) 1(2); 2013.

Characteristics	Categories	Case N (%)	Control N (%)	P value
Age	31-40 years	41 (41.0%)	27 (27.0%)	0.134
	41-50 years	27 (27.0%)	40 (40.0%)	
	51-60 years	27(27.0%)	29(29.0%)	
	61-70 years	5 (5.0%)	4 (4.0%)	
Gender	Male	77 (77.0%)	71 (71.0%)	0.420
	Female	23 (23.0%)	29 (29.0%)	

Table 1: Demographic characteristics of the study population

*p value<0.05: statistically significant difference

Characteristics	Mean±SD
Mean Total cholesterol value of cases	225.95±24.51 mg%
Mean Total cholesterol value of controls	171.51±33.77 mg%
Mean Serum Triglyceride levels in cases	175.35±24.45 mg%
Mean Serum Triglyceride levels in controls	155.12±23.85 mg%
Mean HDLc levels in cases	21.29±8.21 mg%
Mean HDLc levels in controls	37.03±7.84 mg%
Mean LDLc levels in cases	170.77±18.86 mg%
Mean LDLc levels in controls	100.08±36.88 mg%
Mean VLDLc levels in cases	35.07±4.89 mg%
Mean VLDLc levels in controls	33.39±2.43 mg%
Mean HDLc /LDLc ratio in cases	0.13±0.05
Mean HDLc /LDLc ratio in controls	0.44±0.25

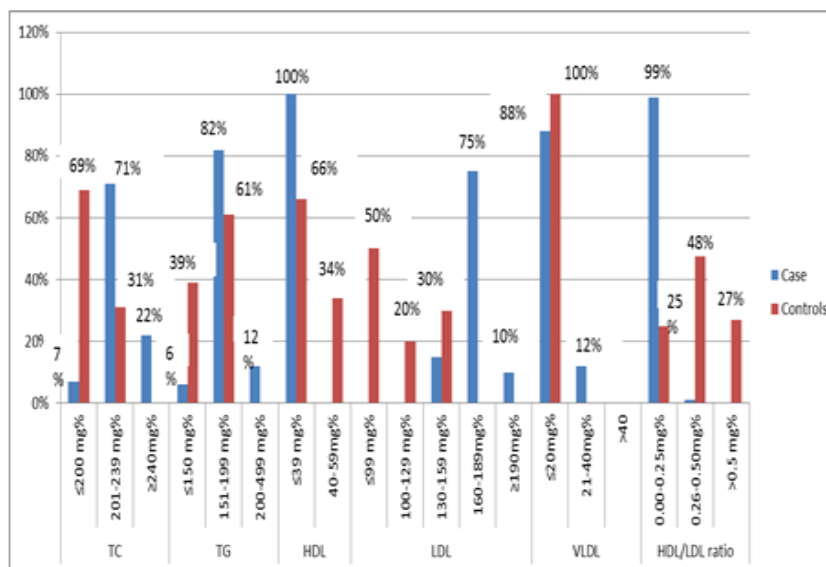
Table 2: Mean Serum lipid profiles of the study population

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Characteristics	Categories	Case N (%)	Control N (%)	P value
Total cholesterol (TC)	≤200 mg%	7 (7.0%)	69 (69.0%)	<0.0001*
	201-239 mg%	71 (71.0%)	31 (31.0%)	
	≥240mg%	22 (22.0%)	0 (0.0%)	
Triglyceride (TG)	≤150 mg%	6 (6.0%)	39 (39.0%)	<0.0001*
	151-199 mg%	82 (82.0%)	61 (61.0%)	
	200-499 mg%	12(12.0%)	0 (0.0%)	
High density Lipoprotein (HDLc)	≤39 mg%	100 (100.0%)	66 (66.0%)	<0.0001*
	40-59mg%	0 (0.0%)	34 (34.0%)	
Low density lipoprotein (LDLc)	≤99 mg%	0 (0.0%)	50(50.0%)	<0.0001*
	100-129 mg%	0(0.0%)	20(20.0%)	
	130-159 mg%	15(15.0%)	30(30.0%)	
	160-189mg%	75(75.0%)	0(0.0%)	
	≥190mg%	10(10.0%)	0(0.0%)	
Very low density lipoprotein (VLDLc)	≤20mg%	88(88.0%)	100(100.0%)	<0.0001*
	21-40mg%	12(12.0%)	0(0.0%)	
	>40	0(0.0%)	0(0.0%)	
HDLc /LDLc ratio	0.00-0.25	99 (99%)	25 (25.0%)	<0.0001*
	0.26-0.50	1(1.0%)	48 (48.0%)	
	>0.5	0(0.0%)	27(27.0%)	

Table 3: Distribution of study population based upon serum lipid profile

*p value<0.05: statistically significant difference.



Graph: Distribution of study population based upon Serum Lipid Profiles

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