# Evaluation of Lipid Profile Among Non-Obese Type-2 Diabetes Mellitus Patients in a Tertiary Care Teaching Hospital

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## ABSTRACT

**Background:** Diabetes mellitus is a disorder of multiple etiologies characterized by chronic hyperglycemia associated with abnormal carbohydrate, protein and lipid metabolism.

**Materials and Methods:** Non-obese (BMI less than 25) type-2 diabetes patients in the age group 30 to 65 years, attending both outpatient and inpatient departments of medicine. For the comparative study, non-obese adults in the age group of 30 to 65 years were selected from the same society, individuals accompanying the patients. We have followed convenient sample consisting of 35 patients and 35 controls.

**Results:** Statistical significance was observed over the lipid profile levels among the non-obese type-2 diabetic patients when compared non-obese, non-diabetic control group; especially with total cholesterol, triglycerides and LDL levels. HDL was observed statistically insignificant.

**Conclusion:** The present study has documented several abnormalities in lipid profile among type-2 diabetic patients and revealed that the dyslipidemia was high among non-obese diabetic patients when compared to non-obese people without diabetes.

**Keywords:** Type-2 Diabetes., Non-obese, Lipid Profile, Dyslipidemia.

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## 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. Type-2 Diabetes Mellitus is the most prevalent endocrine disorder in India and throughout the world. The increasing incidence of type-2 Diabetes among adolescent individuals is the key point in both the developed and developing nations.[3]

Prevalence of type-2 Diabetes among the individuals over 18 years of age has risen from 4.7% in 1980 to 9.4% in 2019.[4] Worldwide, the number of people with diabetes has increased significantly between 1980 and 2019, from 108 million to a current figure which is six times higher. 40% of this increase was estimated to result from increased population over years, 28%

from a rise in age related prevalence, and 32% from the interaction between the two groups.[5] Population aged between 40 to 60 years from the Eastern Mediterranean countries has experienced the greatest rise in prevalence of type-2 Diabetes.[6] Recent study by Indian Council of Medical Research (ICMR) have shown that the prevalence of dyslipidemia is common among Indian population and this unique lipid distribution is due to genetic as well as dietary factors. Elevated triglycerides and decreased HDL cholesterol are common among type-2 diabetic patients in India.[7]

Indian populations develop diabetes at an earlier age compared to western population and this was established in various studies.[8] Indian population predominantly have truncal obesity, high prevalence of Hypertension, coronary artery diseases and thrombo-embolytic events.[9]

Most of the studies on diabetes with dyslipidemia was conducted in obese diabetes patients and less number of studies have been conducted in non-obese type-2 diabetes patients. Insulin deficiency and insulin resistance are the key points of type-2 diabetes mellitus and it was well recognized that insulin resistance can lead to dyslipidemia in type-2 diabetes mellitus. Disturbances

in lipid metabolism may manifest few years before the actual onset of type-2 diabetes mellitus.[10] Present study was aimed to evaluate the Lipid profile in Non-obese type-2 Diabetes mellitus patients and to compare the same with Non-Obese adults without type 2 diabetes mellitus in a tertiary care teaching hospital.

## MATERIALS AND METHODS

This cross-sectional study was conducted in the Department of Medicine, Narayan medical college & Hospital, Jamuhar, Sasaram, Bihar, in collaboration with Biochemistry department during the period from January 2019 to January 2020. Non-obese (BMI less than 25) type-2 diabetes patients in the age group 30 to 65 years, attending both outpatient and inpatient departments of medicine. For the comparative study, non-obese adults in the age group of 30 to 65 years were selected from the same society, individuals accompanying the patients. We have followed convenient sample consisting of 35 patients and 35 controls. Patients with type-1 Diabetes Mellitus, Major systemic illness, Tuberculosis, prolonged fever, Pregnancy and Endocrine disorders were excluded from the study. Informed consent was taken from all the participants and from control group in present study. Details regarding type-2 Diabetes Mellitus, duration of onset, progression, and complications were recorded. Anthropometric parameters and BMI were calculated. All patients with BMI less than 25 were included and their lipid profile was assessed after overnight fasting. Diagnosis of normal lipid level and Dyslipidemia was considered as per the ATP III Guidelines (Table 1).[11] Data was analyzed using Microsoft Excel and SPSS - 20 software and P value < 0.05 was taken as statistically significant.

**Table 1: ATP III Classification of TC, TG, LDL and HDL (mg/dL)**

| Variables | Low | Above optimal | High | Very high |
|---|---|---|---|---|
| Total Cholesterol | 200 | 200-239 | > 240 | - |
| Triglycerides | 150 | 150-199 | 200-499 | > 500 |
| HDL | < 40 | - | > 60 | - |
| LDL | <100 | 100-159 | 160-189 | > 190 |

## 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 46.72 ± 9.38 years. The mean age of cases was found to be 45.82 ± 8.71 years, whereas the mean age of the controls was found to be 46.42 ± 7.64 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 24.10 ± 4.34 kg/m2 whereas the mean BMI value for the controls was found to be 22.41 ± 3.08 kg/m2. No significant differences were found between cases and controls (P value 0.16). The mean fasting blood sugar level for cases were found to be 166.7 ± 69.51 mg/dl respectively which was higher than the mean fasting blood sugar levels reported in controls. Statistical significance was observed over the lipid profile levels among the non-obese type-2 diabetic patients when compared non-obese, non-diabetic control group; especially with total cholesterol, triglycerides and LDL levels. HDL was observed statistically insignificant table-2.

**Table 2: BMI, FBS and Lipid profile in both the groups**

| Variables | Non-Diabetic (N=35) (Mean ± S.D.) | Diabetic (N=35) (Mean ± S.D.) | p value |
|---|---|---|---|
| Age in yrs | 46.42 ±7.64 | 45.82±8.71 | 0.24* |
| BMI | 22.41 ± 3.08 | 24.10 ± 4.34 | 0.16* |
| FBS (mg/dl) | 108.63±42.44 | 166.7±69.51 | 0.01 |
| TC (mg/dl) | 189.4 ± 52.2 | 206.4 ± 57.2 | 0.014 |
| TG (mg/dl) | 152.7 ± 82.6 | 175.4 ±59.7 | 0.021 |
| HDL (mg/dl) | 41.4 ± 2.3 | 40.6 ± 9.2 | 0.18* |
| LDL (mg/dl) | 104.6 ± 46.2 | 126.3 ± 60.2 | 0.05 |

## DISCUSSION

This present study is a further step towards understanding the biochemical changes in serum lipid profile in Non-obese type-2 Diabetes mellitus patients and to compare the same with Non-Obese adults without type 2 diabetes mellitus in a tertiary care teaching hospital. The relationship between body mass index and Triglycerides levels was shown in the study done by Ali et al[12], and also the relationship between lipid profile and body fat distribution was shown in the study done by Arora et al.[13] The findings in the study (Ali et al) were similar to present study. Dyslipidemia, a well-known risk factor for cardiovascular manifestations, was mostly observed in the population of the Asian continent. People with Type-2 Diabetes had an increased cardiovascular morbidity and mortality, when compared with non-diabetics. Recent studies done by Ali et al[11], Hussain et al[14], and Khaw et al[15], shown that the prompt recognition and accurate management of 'Type-2 Diabetes mellitus with associated dyslipidemia' is the key step towards the controlling the risk of cardiovascular disease. Observations in the study done by Tanzil et al[16], proved that obesity was linked with abnormal lipids and poor cardiovascular outcomes; similar findings were observed in present study. Study done by Aljabri et al[17], shown that the prevalence of high LDL levels in men as well as women with diabetes mellitus (23% and 31%, respectively) did not differ significantly from the rates in non-diabetic men and women (18% and 28%, respectively). The prevalence of high HDL levels in men as well as in women with diabetes mellitus (25% and 27%, respectively) did not differ significantly from those seen in non-diabetic men and women (23% and 25%, respectively). In contrast to the prevalence of elevated plasma triglycerides levels in type-2 Diabetes (30% in men and 32% in women) was significantly higher than in those without type-2 Diabetes, when compared to present study. In the studies done by Kannel et al[18], and Manley et al[19], a similar profile of altered 'plasma lipid profile' was observed, with the exception of low levels of HDL. Other study by Arbeeny et al[20], shown that; it is more common in diabetics when compared to non-diabetics due to four-fold increase in VLDL triglyceride. The studies conducted by Santen et al[21], and Perrett et al[22], observed higher mean serum triglyceride levels in obese diabetics when compared to non-obese control subjects. In the study done by Kingstrom et al[23], total cholesterol level among type-2 diabetics was reported as 204mg/dl, which was similar to present study. 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] 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.[28]

## CONCLUSION

These finding suggest that, the present study has documented several abnormalities in lipid profile among type-2 diabetic patients and revealed that the dyslipidemia was high among non-obese diabetic patients when compared to non-obese people without diabetes. 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.

## 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: 881-6.
2. Definition, Diagnosis and Classification of Diabetes Mellitus and its Complications.
3. World Health Organization. Definition and diagnosis of diabetes mellitus and intermediate hyperglycemia. Diabetes Mellitus: Report of a WHO Study [Internet]. World Health Organization. 2006. Available from: http://www.idf. org/webdata/docs/WHO
4. Bernard RA. In Nutritional Aspects of Aging. Hypertension 2018; 2:175-94.
5. Ezzati M. Worldwide trends in diabetes since 1980: A pooled analysis of 751 population-based studies with 4 million participants. Lancet 2016;387(10027):1513-30.
6. World Health Organization. Diabetes in the South-East Asia Region. WHO South-East Asia Journal of Public Health.  2016; 5(1): 1-75.
7. Joshi SR, Anjana RM, Deepa M, Pradeepa R, Bhansali A, Dhandania VK, et al. Prevalence of dyslipidemia in urban and rural India: The ICMR¬INDIAB study. PLoS One. 2014;9(5): e96808.
8. Rhee EJ. Diabetes in Asians. Endocrinology and Metabolism. 2015;30: 263-9.
9. Ramachandran A, Snehalatha C, Satyavani K, Sivasankari S, Vijay V. Type-2 diabetes in Asian-Indian urban children. Diabetes Care. 2003;26(4):1022-5.
10. Robert R, Janine K, Klaus Eder. Role of carnitine in the regulation of glucose homeostasis and insulin sensitivity: evidence from in vivo and in vitro studies with carnitine supplementation and carnitine deficiency European Journal of Nutrition 2012;51:1-18.
11. National Cholesterol Education Program. NIH Publication No.01-3305 May 2001.
12. Ali Z, Al-Zaidi MS. The association between body mass index, lipid profile and serum estradiol levels in a sample of Iraqi diabetic premenopausal women. Oman Med J. 2011;26(4):263-6.
13. Arora M, Koley S, Gupta S, Sandhu JS. A Study on Lipid Profile and Body Fat in Patients with Diabetes Mellitus. Anthropol. 2007;9(4):295-8.
14. Hussain A, Ali I, Ijaz M, Rahim A. Correlation between hemoglobin A1e and serum lipid profile in Afghani patients with type 2 diabetes:

hemoglobin A lc prognosticates dyslipidemia. Ther Adv Endocrinol Metab. 2017;8(4):51-7.
15. Khaw KT, Wareham N, Bingham S, Luben R, Welch A, Day N. Association of hemoglobin A lc with cardiovascular disease and mortality in adults: The European prospective investigation into cancer in Norfolk. Ann Intern Med. 2004;141(6):413-42.
16. Tanzil S, Jamali T. Obesity, An Emerging Epidemic In Pakistan-A Review Of Evidence. Journal of Ayub Medical College. 2016; 28: 597-600.
17. Aljabri KJ, Bokhari S, Akl A. The relation between overweight, obesity and plasma lipids in Saudi adults with type 2 diabetes. J Heal Spec. 2016;4(2):140-5.
18. Kannel WB. The Framingham Study: ITS 50-year legacy and future promise. Journal of atherosclerosis and thrombosis. 2000; 6: 60-6.
19. Manley SE. U.K. Prospective diabetes study 27: Plasma lipids and lipoproteins at diagnosis of NIDDM by age and sex. Diabetes Care. 1997;20(10):1683-7.
20. Arbeeny CM, Nordin C, Edelstein D, Stram N, Gibbons N, Eder HA. Hyperlipoproteinemia in spontaneously diabetic guinea pigs. Metabolism. 1989; 38(9): 895-900.
20. Santen RJ, Willis PW, Fajans SS. Atherosclerosis in Diabetes 1Mellitus: Correlations With Serum Lipid Levels, Adiposity, and Serum Insulin Level. Arch Intern Med. 1972;130(6):833-43.
22. Perrett AD, Rowe AS, Shahmanesh M, Allison SP, Hartog M. Blood lipids in treated diabetics. Diabetologia. 1974;10(2):115-8.
23. Kingstrom M, Skoog W. Diabetes in Saudi Arabia. Saudi Med J. 1986;7(2):130-42.
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: 147-8.
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. 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.