**Original Article**

# Diabetic dyslipidemia and association of glycemic status with lipid profile, body mass index and abdominal obesity

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**Objective:** To determine the frequency of diabetic dyslipidemia and its association of glycemic status with lipid profile, body mass index and abdominal obesity.

**Methodology:** The study was conducted at District Head Quarter Hospital, Jamshoro @Kotri and included 134 patients with Type 2 Diabetes Mellitus. Blood sample was analyzed for hemoglobin A1C, total cholesterol (TC), high-density lipoprotein (HDL), triglycerides (TGs), and low-density lipoprotein (LDL). BMI and waist hip ratio were calculated and analyzed by SPSS version 22.0

**Result:** Among 134 patients, 92(68.66%) had dyslipidemia. When glycemic status was compared among normal (n=28), overweight (n=66) and obese (n=40), diabetic patients glycemic status was >8.0 among 11(39.3%) normal BMI, 52(78.8%) overweight and 29(72.5%) obese. Anthropometric variations and lipid profile compared between the diabetic people with glycemic control of HbA1c 8.0%(n=92) by independent test. P value was statistically significant for waist hip ratio, waist circumference, BMI and HDL levels while it was insignificant for serum cholesterol, triglycerides, LDL and VLDL levels.

**Conclusion:** There was strong direct association of increased glycemic status among diabetic dyslipidemic patients with abdominal obesity, decreased HDL levels and increase in BMI. (Rawal Med J 202;45:265-268).

**Keywords:** Body mass index, Diabetes, Dyslipidemia, Hemoglobin A1c, Lipid profile.

## INTRODUCTION

Type 2 diabetes mellitus (DM) is an endocrinological dysfunction leading to hyperglycemia that disturbs carbohydrate, protein and lipid meta-bolisms due to ineffective insulin action and/or secretion.[1] Hemoglobin A1C is common parameter for assessing glycemic control and a surrogate marker for development of complications among type 2 diabetic patients.[2,3] Maintenance of good glycemic and lipid profile is pivotal in preventing micro- and macro-vascular complications of diabetes.[4,5] Black persons show significantly higher $HbA_{1c}$, glycated albumin, and fructosamine levels than white persons.[6] HbA1c reflects the average plasma glucose status over a period of 2-3 months, hence effectively used as a marker for assessing glucose level.

Currently Type 2 DM is affecting 415 million adults globally and by 2040 may reaches up to 642 million.[7] HbA1c can also be used as a predictor of dyslipidemia, therefore early diagnosis of dyslipidemia can be used as a preventive measure for the development of CVD in patients with T2DM.[8] BMI is strongly associated with hypertension, and waist circumference is strongly associated with T2DM and dyslipidemia amomg Chinese[9] as well as the Mexican Americans.[10] Diabetics have lipid and lipoprotein abnormalities.[11] The objective of this study was to determine the frequency of dyslipidemia among diabetic patients and to determine association of glycemic status with lipid profile, body mass index and abdominal obesity.

## METHODOLOGY

This cross sectional/descriptive study was conducted in outpatient department of Medicine at District Head Quarter Hospital Jamshoro @ Kotri from July 2019 to January 2020 on 134 patients of both gender diagnosed with T2DM according to American Diabetes Association criteria. After Ethical approval for study and informed consent from all patients, 5cc blood sample was drawn and sent to for measuring hemoglobin A1c, total cholesterol (TC), high-density lipoprotein (HDL), triglycerides (TGs), and low-density lipoprotein (LDL). BMI was calculated by taking weight in kilograms and height in cm. Waist hip ratio was

calculated by dividing waist circumference in cm with hip circumference in cm.

Dyslipidemia was considered when TC were >240 mg/dl, TGs >250 mg/dl, and HDL<35 mg/dl.[12] BMI of 18 to 24.9 kg/m2 was considered normal weight, 25.0-29.9 kg/m2 overweight and 30 kg/m2 or higher obesity. Waist and hip circumference were measured as per the WHO guidelines.[13] Abdominal obesity was considered when the waist-hip ratio was beyond 0.90 for males and above 0.85 for female patients, according to WHO guidelines.[14]

Statistical Analysis: Data were entered and analyzed on SPSS version 22.0. Anthropometric variations and lipid profile were compared between the diabetic people with glycemic control by applying independent t- test.

## RESULTS

Among 134 patients, 62(46.27%) were female and 72(53.73%) males. Out of these, 92(68.66%) had dyslipidemia. When glycemic status compared among normal (n=28), overweight (n=66) and obese (n=40) type 2 diabetic patients, HgA1c was >8.0 in 11(39.3%), normal BMI, 52 (78.8%) overweight and 29(72.5%) obese. HgA1C was <8.0 among 17(60.7%) normal, 314(21.2%) overweight and 11(27.5%) obese diabetic type 2 people (p=0.001) (Table 1). Out of 134 patients, 52(38.81%) had no abdominal obesity and 82(61.19%) had abdominal obesity. Among 82 diabetics, 16(19.6%) and 66(80.5%) revealed with Hba1c <8.0 and Hba1c>8.0, respectively (p=<0.001) (Table 2).

**Table 1. Association of BMI with Glycemic status in study population (n=134).**

| | | | Glycemic status | | Total | P value |
|---|---|---|---|---|---|---|
| | | | Hba1c<8.0 | Hba1c>8.0 | | |
| BMI status | normal | Number | 17 | 11 | 28 | |
| | | % | 60.7% | 39.3% | 100.0% | *0.001 |
| | overweight | Number | 14 | 52 | 66 | |
| | | % | 21.2% | 78.8% | 100.0% | |
| | obese | Number | 11 | 29 | 40 | |
| | | % | 27.5% | 72.5% | 100.0% | |
| Total | | Number | 42 | 92 | 134 | |
| | | % | 31.3% | 68.7% | 100.0% | |

*Shows statistically significant. **Shows highly significant. Chi square value= 14.647088565333908 with df2

**Table 2. Association of glycemic status with abdominal obesity (n=134).**

| | | | Glycemic status | | | P value |
|---|---|---|---|---|---|---|
| | | | Hba1c <8.0 | Hba1 c>8.0 | Total | |
| Abdominal obesity | Yes | Number | 16 | 66 | 82 | <0.001** |
| | | % | 19.5% | 80.5% | 100.0% | |
| | No | Number | 26 | 26 | 52 | |
| | | % | 50.0% | 50.0% | 100.0% | |
| Total | | Number | 42 | 92 | 134 | |
| | | % | 31.3% | 68.7% | 100.0% | |

Chi square value=13.744760894813917 with df 2. *Shows statistically significant.
**Shows highly significant

**Table 3. Comparison of Waist circumference, waist hip ratio, BMI and lipid profile among patients with Hba1c <8.0 and Hba1c >8.0 (n=134)**

| | Glycemic status | N | Mean | Std. Deviation | P value |
|---|---|---|---|---|---|
| Waist hip ratio | Hba1c<8.0 | 42 | 0.8640 | 0.07 | 0.002** |
| | Hba1c>8.0 | 92 | 0.9184 | 0.09 | |
| Waist circumference (cm) | Hba1c<8.0 | 42 | 82.2262 | 5.06 | 0.009* |
| | Hba1c>8.0 | 92 | 84.9022 | 5.55 | |
| BMI | Hba1c<8.0 | 42 | 26.7976 | 5.06 | 0.021* |
| | Hba1c>8.0 | 92 | 28.9022 | 4.71 | |
| HDL(mg/dl) | Hba1c<8.0 | 42 | 39.5952 | 6.87 | 0.001** |
| | Hba1c>8.0 | 92 | 32.5435 | 6.87 | |
| Serum cholesterol (mg/dl) | Hba1c<8.0 | 42 | 1.5990E2 | 11.86 | |
| | Hba1c>8.0 | 92 | 1.6064E2 | 11.74 | 0.738 |
| Triglycerides (mg/dl) | Hba1c<8.0 | 42 | 1.2607E2 | 6.77 | 0.113 |
| | Hba1c>8.0 | 92 | 1.2438E2 | 5.11 | |
| LDL (mg/dl) | Hba1c<8.0 | 42 | 1.2029E2 | 3.70 | 0.797 |
| | Hba1c>8.0 | 92 | 1.2045E2 | 3.16 | |
| VLDL (mg/dl) | Hba1c<8.0 | 42 | 26.1667 | 3.35 | 0.904 |
| | Hba1c>8.0 | 92 | 26.0978 | 2.89 | |

**Highly significant<0.01. *Significant <0.05

Among 42 diabetic patients with Hb A1C<8.0, mean and SD of waist hip ratio, waist circumference, BMI, HDL, serum cholesterol. TGs, LDL and VLDL were 0.86±0.07, 82.22cm±5.06, 26.79±5.06, 39.59mg/dl±6.87, 0.599E2mg/dl±11.86, 0.2607E2mg/dl±6.77, 0.202E2mg/dl±3.70 and 26.16mg/dl±3.35,

respectively vs. among 72 diabetic patients with Hba1c>8.0 were 0.91±0.09, 84.90 cm ±5.55, 28.90±4.71, 32.54 mg/dl±6.87, 0.606E2mg/dl±11.74, 0.243E2mg/dl±6.77, 0.204E2mg/dl±3.16 and 26.09 mg/dl±2.89, respectively (p=0.002, 0.009, 0.021, 0.001, 0.738, 0.113, 0.797 and 0.904, respectively) (Table 3).

## DISCUSSION

In this study, 68.66% had diabetic dyslipidemia and 31.34% did not. Shafique et al reported 55% cases with diabetic dyslipidemia and 45% without dyslipidemia.[11] The prevalence of dyslipidemia in diabetic patients remained higher than in non-diabetic subjects, despite hypoglycemic therapy.[12,15] Lipolysis in these patients is also suppressed due to the presence of insulin resistance in adipose tissue which further contributes to dyslipidemia. There is also deficiency of adipocytokines, which are also considered as the contributing factors in causing the alteration in lipid metabolism.[11]

This study revealed that the glycemic status was >8.0 i.e. not controlled among 39.3% normal BMI, 78.8% overweight and 72.5% obese type 2 diabetics while controlled, i.e., <8.0gm% in 60.7% normal, and only 21.2% overweight and 27.5% obese diabetic type 2 people, uncontrolled glycemic status prevalent among obese and overweight. Correspondingly glycemic status observed >8.0gm% among 80.5% people with abdominal obesity. Elkhidir et al concluded that both T2DM and obesity (mainly abdominal obesity) were predisposing factors for metabolic as well as the vascular complications including ischemic heart diseases and leading cause of disability-adjusted life years.[16] T2DM is a disease closely related to lifestyle, and adiposity is a significant reason for the progress to T2DM and it is projected that about 90% of T2DM is attributable to overweight.[17]

Rådholm et al found that patients of T2DM who are suffering from abdominal obesity were on additional risk to progress to CVD.[18] This study revealed strong association of glycemic status with abdominal obesity, HDL levels and BMI that is similar to Cui et al that displayed insulin resistance and T2DM are largely escorted by diabetic dyslipidemia that converses threat of CVD.[19]

The linear relationship has been comprehended between HbA1C and dyslipidemia. Levels of HDL cholesterol were meaningfully worse in patients with poorer glycemic control when compared to the patients of better glycemic control.[20] The low levels of HDL strongly magnifies the lipid gathering in arterial vessels and the plaque constitution.[12] Managing diabetic dyslipidemia reduces the risk for CVD events, that's why it is essential to evaluate at-risk patients.[21]

So early detection and treatment of deranged lipid markers and WHR from normal value in human body especially with hyperglycemia can prevent the progression of disease and limit the morbidity and mortality due to cardiovascular events, and cerebrovascular accident.

## CONCLUSION

There was strong direct association of increased glycemic status among diabetic dyslipidemic patients with abdominal obesity, decreased HDL levels and increase in body mass index. Hence, early detection and management of deranged lipid markers among diabetic people may prevent the progression of disease.

**Author contributions:**
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