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Original Article

Insights into Dyslipidemia Patterns among Diabetes Patients

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ABSTRACT

Introduction: *Diabetes mellitus presents a prevalent endocrine and metabolic challenge globally. Patients with type 2 diabetes are more likely to have dyslipidemia, which is characterized by elevated low-density lipoprotein (LDL), diminished high-density lipoprotein (HDL), or increased triglycerides (TG) levels.* ***Methods & Materials:*** *This cross-sectional observational study was conducted at the Outpatient Department (OPD) of Shaheed Ziaur Rahman Medical College Hospital, Bogura, from July 2018 to June 2019. Both male and female patients with Type 2 diabetes were considered as the study population. A total of 90 patients were selected as study subjects. Data analysis was performed by using SPSS (Statistical Package for Social Science) version 22.0.* ***Result:*** *The study found similar ages and BMI among groups. Elevated serum TC was noted in 31.6%, 19.2%, 26.7%, and 30% of subjects in A1, A2, B1, and B2 respectively. High serum TG levels were observed in 36.8%, 38.5%, 40%, and 66.7% of subjects in the respective groups. Dyslipidemia prevalence varied, with A1 at 57.9%, A2 at 53.8%, B1 at 46.7%, and B2 at 76.7%. High HbA1C was prevalent in B1 and B2 (100%).* ***Conclusion:*** *Dyslipidemia patterns among diabetes patients show significant variability, with elevated serum total cholesterol, triglycerides, and low-density lipoprotein levels, alongside reduced high-density lipoprotein levels. These findings underscore the importance of tailored lipid management strategies in mitigating cardiovascular risk in this high-risk population.*

Keywords: *Dyslipidemia, Diabetes Mellitus, Lipid Profile, Glycemic Control, Cardiovascular Risk.*

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INTRODUCTION

Dyslipidemia means an abnormal level of lipids in the bloodstream and is a significant comorbidity among patients with diabetes mellitus. The global burden of diabetes has reached unprecedented levels, with an estimated 463 million adults affected worldwide, and this number is projected to escalate to 700 million by 2045[1]. Among individuals with diabetes, dyslipidemia is prevalent, affecting up to 80% of patients[2]. Such a high prevalence underscores the importance of understanding the intricate relationship between dyslipidemia and diabetes and its implications for clinical management. Insulin resistance, a hallmark of type 2 diabetes mellitus (T2DM), plays a central role in dyslipidemia development. Insulin resistance impedes the suppression of lipolysis in adipose tissue, leading to increased free fatty acid release into circulation, which subsequently stimulates hepatic synthesis of triglycerides and secretion of very low-density lipoprotein (VLDL) particles[3]. Moreover, action of lipoprotein lipase, an enzyme that hydrolyzes triglycerides in circulating lipoproteins, is hampered by insulin resistance, which raises TG levels[4]. Dyslipidemia in diabetes is caused by a combination of genetic susceptibility, insulin resistance, and lifestyle factors like food and exercise. Polymorphisms in genes encoding key proteins involved in lipid metabolism, such as apolipoproteins and lipoprotein receptors, can influence lipid profiles and susceptibility to dyslipidemia[5]. Moreover, diets rich in saturated fats and refined carbohydrates exacerbate dyslipidemia by promoting hepatic lipogenesis and impairing lipid clearance mechanisms[6]. Sedentary behavior further compounds the dyslipidemic phenotype by exacerbating insulin resistance and promoting weight gain, which in turn aggravates dyslipidemia[7]. Understanding the specific dyslipidemia patterns among diabetes patients is crucial for risk stratification and tailored therapeutic interventions.

In the general population, high LDL-C level is a well-established risk factor for atherosclerotic cardiovascular disease (ASCVD), its significance in diabetes-associated dyslipidemia is nuanced. Recent evidence suggests that LDL-C particles in diabetes patients may be smaller and denser, rendering them more atherogenic compared to larger, buoyant LDL-C particles typically observed in non-diabetic individuals[8]. Consequently, traditional LDL-C targets may

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underestimate risk of ASCVD in diabetes patients, necessitating a more comprehensive lipid profile approach that incorporates particle size and composition analyses. Furthermore, dyslipidemia in diabetes is often characterized by a concomitant reduction in HDL-C levels, impairing reverse cholesterol transport and exacerbating atherogenesis[9]. HDL-C functionality, rather than absolute value, may be a more pertinent determinant of cardiovascular risk in diabetes patients. Dysfunctionality of HDL particles, manifested by impaired cholesterol efflux capacity and anti-inflammatory properties, has been implicated in the pathogenesis of ASCVD in diabetes[10]. Moreover, elevated TG levels, a common feature of dyslipidemia in diabetes, have emerged as an independent predictor of cardiovascular events, particularly in patients with concomitant insulin resistance and central obesity[11]. Hypertriglyceridemia contributes to atherogenesis through multiple mechanisms, including increased production of small dense LDL-C particles, inhibition of HDL-C maturation, and promotion of pro-inflammatory and pro-thrombotic states[12]. In light of the evolving understanding of dyslipidemia patterns among diabetes patients, there is a pressing need for personalized lipid management strategies that address the unique metabolic and cardiovascular risk profiles of individual patients. This study aimed to investigate dyslipidemia patterns among patients with diabetes mellitus to enhance understanding of lipid profiles and their implications for cardiovascular risk management.

METHODS & MATERIALS

This cross-sectional observational study was conducted at the Outpatient Department (OPD) of Shaheed Ziaur Rahman Medical College Hospital, Bogura, from July 2018 to June 2019, involving both male and female patients with Type 2 diabetes. A total of 90 patients were selected based on inclusion criteria (age above 18 years, both sexes, Type 2 diabetes mellitus whether newly diagnosed or on therapy, BMI 18.5 to ≤30 Kg/m^2, Bengali ethnicity) and exclusion criteria (renal failure, cardiac disease, liver disease, malabsorption syndrome, malignancy, replacement or supplementation therapy, Type 1 diabetes mellitus, Type 2 diabetes mellitus with complications, pregnancy, psychological and mental disorders, history of sickle cell disease, glucose-6-phosphate dehydrogenase deficiency, recent blood loss or transfusion or erythropoietin therapy). Participants were divided into two groups: Group A (45 diabetic patients on therapy, with subgroups A1: 19 males and A2: 26 females) and Group B (45 newly diagnosed diabetic patients, with subgroups B1: 15 males and B2: 30 females). Informed written consent was obtained from participants, and detailed personal, medical, and drug histories were recorded in a prefixed questionnaire. Anthropometric measurements and blood pressure were taken. Data analysis was performed using SPSS version 22.0, with results presented as mean ± SD. One-way ANOVA and unpaired Student's "t" tests were conducted to compare groups, and results were presented in tables. Ethical clearance was obtained from the ethical committee of Shaheed Ziaur Rahman Medical College Hospital.

RESULTS

Table – I: Age and BMI in different groups of the study subjects (*n*=90)

Groups	n	Age (years)	BMI (kg/m^2)
A_1	19	52.68±12.78 (32.0 – 75)	23.91±2.09 (20.10 – 29.0)
A_2	26	49.19±9.45 (32.0 – 70.0)	24.90±2.68 (21.0 – 29.40)
B_1	15	52.20±10.27 (30.0 – 65.0)	23.91±2.06 (19.0 – 26.10)
B_2	30	46.23±8.11 (27.0 – 60.0)	25.66±3.20 (21.0 – 30.0)
p-value		0.107^{ns}	0.083^{ns}

The mean (±SD) ages of the study subjects were 52.68±12.78, 49.19±9.45, 52.20±10.27, 46.23±8.11 years in group A_1, A_2, B_1 and B_2 respectively. All the values were almost similar and no statistically significant differences of the ages were observed among the groups. The mean (±SD) BMI of the subjects were 23.91±2.09, 24.90±2.68, 23.91±2.06 and 25.66±3.20 kg/m^2 in group A_1, A_2, $B_1$and B_2 respectively. All the values were almost similar and showed no statistically significant differences in BMI among the groups. [Table I]

Table – II: Distribution of the study subjects of both sexes by the presence of high total cholesterol (TC), high triglycerides (TG), high low-density lipoprotein (LDL) and low high-density lipoprotein (HDL) (*n*=90)

Groups	n	High TC	High TG	High LDL	Low HDL
A_1	19	6(31.6%)	7(36.8%)	6(31.6%)	6(31.6%)
A_2	26	5(19.2%)	10(38.5%)	3(11.5%)	10(38.5%)
B_1	15	4(26.7%)	6(40.0%)	4(26.7%)	1(6.7%)
B_2	30	9(30.0%)	20(66.7%)	8(26.7%)	18(60.0%)

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In this study, 31.6%, 19.2%, 26.7%, and 30% of the study subjects had high serum TC in groups A_1, A_2, B_1, and B_2 respectively whereas 36.8%, 38.5%, 40%, and 66.7% had high serum TG in group A_1, A_2, B_1 and B_2 respectively. Moreover, 31.6%, 11.5%, 26.7%, and 26.7% of the study subjects had high serum LDL in groups A_1, A_2, B_1, and B_2 respectively whereas 31.6%, 38.5%, 6.7%, and 60% of the study subjects had low HDL in group A_1, A_2, B_1 and B_2 respectively. [Table II]

Table – III: Distribution of the study subjects of both sexes by the presence of dyslipidemia (*n*=90)

Groups	n	Dyslipidemia	Desirable lipid profile
A_1	19	11(57.9%)	8(42.1%)
A_2	26	14(53.8%)	12(46.2%)
B_1	15	7(46.7%)	8(53.3%)
B_2	30	23(76.7%)	7(23.3%)

In this study, in group A_1 57.9% of the study subjects had dyslipidemia and 42.1% had desirable lipid profiles whereas in group A_2 53.8% of the study subjects had dyslipidemia and 46.2% had desirable lipid profiles. Furthermore, in group B_1 46.7% of the study subjects had dyslipidemia and 53.3% had a desirable lipid profile whereas in group B_2 76.7% of the study subjects had dyslipidemia and 23.3% had a desirable lipid profile. Moreover, in the male study subjects 52.9% had dyslipidemia and 47.1% had a desirable lipid profile whereas in the female study subjects 66.1% had dyslipidemia and 33.9% had a desirable lipid profile. [Table III]

Table – IV: Distribution of study subjects of both sexes by the presence of high Glycated hemoglobin (HbA_{1C}) (*n*= 90)

Groups	n	High HbA_{1C}	Desirable HbA_{1C}
A_1	19	3(15.8%)	16(84.2%)
A_2	26	4(15.4%)	22(84.6%)
B_1	15	15(100.0%)	0(0.0%)
B_2	30	30(100.0%)	0(0.0%)

In this study, in group A_1 15.8% of the study subjects had high HbA_{1C} and 84.2% had desirable HbA_{1C} whereas in group A_2 15.4% of the study subjects had high HbA_{1C} and 84.6% had desirable HbA_{1C}. Again, in this study, in both groups B_1 and B_2, 100% of the study subjects had high HbA_{1C} and none of the study subjects had desirable HbA_{1C}. [Table IV]

DISCUSSION

The findings presented in the study provide valuable insights into the dyslipidemia patterns among diabetes patients, shedding light on the prevalence of dyslipidemia, lipid profiles, and glycemic control within different patient groups. Understanding these patterns is crucial for optimizing management strategies and reducing cardiovascular risk in this high-risk population. The study illustrates the age and BMI distribution among study subjects across different groups. The mean ages ranged from 46.23 to 52.68 years, with no statistically significant differences observed among the groups. Similarly, BMI values were comparable across groups, ranging from 23.91 to 25.66 kg/m^2, with no significant differences noted. These findings align with prior studies that have demonstrated a close association between age, BMI, and dyslipidemia among diabetes patients[13,14]. While advancing age and higher BMI are recognized risk factors for dyslipidemia, the absence of significant differences among the groups suggests that other factors, such as genetic predisposition and metabolic disturbances, may exert a more prominent influence on lipid profiles in these patients. The present study provides insights into the distribution of study subjects based on lipid profiles, including total cholesterol (TC), triglycerides (TG), low-density lipoprotein (LDL), and high-density lipoprotein (HDL) levels. Notably, a substantial proportion of subjects across all groups exhibited dyslipidemia, characterized by elevated TC, TG, and LDL levels, alongside decreased HDL levels. These findings are consistent with previous studies highlighting the high prevalence of dyslipidemia among diabetes patients[15,16]. Elevated TG levels were particularly prevalent, with percentages ranging from 30% to 66.7% across groups, underscoring the significant burden of hypertriglyceridemia in this population. Das et al. conducted a study to evaluate lipid profiles among diabetes patients in a South Indian population. The findings revealed elevated serum TC, TG, and LDL levels, along with decreased HDL levels, consistent with the dyslipidemia phenotype commonly observed in diabetes[17]. Similarly, Parikh et al. investigated lipid abnormalities in a cohort of diabetes patients in India and reported a high prevalence of dyslipidemia, characterized by elevated TC and TG levels alongside reduced HDL levels[18]. Furthermore, Firdous et al. investigated lipid abnormalities among diabetes patients in Pakistan and observed elevated TC, TG, and LDL levels, alongside reduced HDL levels, indicative of dyslipidemia and increased cardiovascular risk[19]. It further elucidates the prevalence of dyslipidemia among study subjects, delineating between desirable lipid profiles and dyslipidemic states. Notably, a considerable proportion of patients in all groups exhibited dyslipidemia, ranging from 46.7% to 76.7%. These findings corroborate previous reports indicating a high prevalence of dyslipidemia in diabetes patients, with rates varying depending on population characteristics and study methodologies[20,21]. Importantly, the higher prevalence of dyslipidemia in group B2 compared to other groups suggests that factors unique to this cohort, such as disease duration or severity, may influence lipid profiles and contribute to increased cardiovascular risk. The present study also examines glycemic control among study subjects based on glycated hemoglobin (HbA1C) levels. Notably, a significant proportion of patients in groups B1 and B2 exhibited high HbA1C levels, indicative of suboptimal glycemic control. These findings are concerning as poor glycemic control exacerbates dyslipidemia and increases cardiovascular risk among diabetes patients [22,23]. The lack of desirable HbA1C levels in groups B1 and B2 underscores the urgent need for intensified glycemic management strategies,

including lifestyle modifications and pharmacotherapy, to mitigate cardiovascular risk in these high-risk individuals.

Limitations of The Study

The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community.

CONCLUSION

Dyslipidemia patterns among diabetes patients exhibit significant variability, with elevated serum total cholesterol, triglycerides, and low-density lipoprotein levels, alongside reduced high-density lipoprotein levels, commonly observed. These findings underscore the importance of tailored lipid management strategies in mitigating cardiovascular risk in this high-risk population.

RECOMMENDATION

It is recommended to implement personalized lipid management strategies tailored to the specific dyslipidemia patterns observed in diabetes patients. This includes regular monitoring of lipid profiles, aggressive treatment of elevated triglycerides and LDL cholesterol, and promotion of lifestyle modifications such as a healthy diet and regular physical activity. Additionally, optimizing glycemic control is essential for improving lipid profiles and reducing cardiovascular risk in diabetes patients. Moreover, further studies should be conducted involving a large sample size and multiple centers.

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