

Prevalence of Dyslipidemia in Type 2 Diabetic Patients in Northern Kashmir

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Abstract

Background: Diabetes mellitus (DM) is one of the most common chronic diseases globally. Dyslipidemia is highly prevalent among type 2 diabetic patients. Dyslipidemia in DM increases the risk of atherosclerosis, resulting in increased incidence of atherosclerotic cardiovascular disease. In view of the high prevalence of type 2 DM in Kashmir, the present study aimed to completely evaluate dyslipidemia in type 2 diabetic patients.

Materials and Methods: This was a descriptive cross-sectional study in 500 type 2 diabetic patients (210 – male and 290 – female) with the age range of 20–85 years, which was conducted in tertiary care hospital, Government Medical College Baramulla, in Northern Kashmir, in UT of J and K, India. Data collection includes recording of demographic parameters (age, gender, and sex), biochemical parameters including fasting blood glucose. Fasting blood samples of the patients were taken to measure serum lipid profile.

Results: The result shows hypercholesterolemia in 26% patients, hypertriglyceridemia in 60% patients, increased low-density lipoprotein levels in 38% patients, and reduced high-density lipoprotein levels in 20% patients. The present study shows 76% prevalence of dyslipidemia among type 2 diabetic patients. Mixed dyslipidemia was the most prevalent type of dyslipidemia.

Conclusion: There is an increased prevalence of diabetes and associated dyslipidemia in North Kashmir, with a relatively higher prevalence in women with higher age group. The regular screening of blood lipid levels and appropriate intervention programs, especially in type 2 diabetic mellitus person is needed to prevent cardiovascular complications of diabetes and dyslipidemia.

Key words: Atherosclerosis, Atherosclerotic, Diabetes mellitus, Dyslipidemia

INTRODUCTION

India leads the world with largest number of diabetic patients and is often referred to as the diabetes capital of the world.^[1] Diabetes has evolved into an epidemic all over the world.^[1] This epidemic will be followed by a wave of cardiovascular disease (CVD).^[2] Diabetes is in fact a serious vascular disease with poor prognosis, and not only a disease characterized by elevated blood glucose.^[2] Diabetic patients are known to have high levels of serum low-density lipoprotein (LDL), serum

triglyceride (TG), and low levels of serum high-density lipoprotein (HDL).^[3] People with diabetes comprise 8.8% of the world's population, and International Diabetes Federation (IDF) predicts that the number of cases of diabetes will rise to 642 million by 2040.^[4] Diabetes mellitus (DM) is one of the most common chronic diseases globally and continues to increase in numbers.^[1] It is among the top five causes of mortality.^[1] The IDF estimates that worldwide, 415 million people have diabetes, 91% of whom have type 2 DM (T2DM).^[4] Individuals with T2DM have a number of potentially modifiable risk factors, including dyslipidemia, hypertension, and hyperglycemia.^[5] In persons with T2DM, the death rates are 15.4% for those without myocardial infarction (MI) and 42.0% in patients having a history of MI.^[4] The prevalence of T2DM has been steadily increasing over time.^[4] T2DM reduces life expectancy by as much as 10 years.^[4]

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Month of Submission : 03-2022
Month of Peer Review : 04-2022
Month of Acceptance : 04-2022
Month of Publishing : 05-2022

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A lipid profile includes four basic parameters. Total cholesterol (TC), TG, HDL-cholesterol (HDL-C), and LDL-cholesterol (LDL-C) are all synthesized and excreted by the liver.^[6] TGs are types of lipids constituted by a glycerol backbone and different fatty acids, while cholesterol is an unsaturated steroid alcohol lipid present in human diet.^[6] Cholesterols are transported by very-LDL (VLDL), low-density lipoproteins, high-density lipoproteins, and chylomicrons.^[6] Chylomicrons are carriers of large quantities of exogenous TG and a minute quantity of cholesterol from the small intestines to the liver.^[6] Similarly, VLDL is responsible for carrying endogenous TG and cholesterol from the liver to body tissues.^[6] LDL carries cholesterol and minute quantities of TG from the liver to body tissues.^[6] HDL is responsible for the transportation of cholesterol from body tissues to the liver (reverse transport) for excretion.^[6]

Dyslipidemia in DM increases the risk of atherosclerosis, resulting in increased incidence of atherosclerotic CVD, for example, coronary artery disease, cerebrovascular disease (CVD), and peripheral vascular disease.^[4,7] In the presence of other cardiovascular risk factors, for example, smoking and hypertension, it increases the risk of CVD manifold.^[4]

Diabetic dyslipidemia is characterized by:

1. High levels of LDL-C
2. Low levels of HDL-C
3. High levels of TGs
4. Predominance of small dense LDL particles
5. Postprandial lipemia
6. High cholesterol, which refers to high LDL and TG (www.medicalnewstoday.com).

The obesity/insulin-resistant metabolic disarray that is the root cause of the type 2 form of diabetes could, itself, lead to lipid abnormalities exclusive of hyperglycemia.^[8] These lipid changes are aggravated by increased inflammatory cytokines.^[9] These changes in lipids represent the major link between diabetes and the increased cardiovascular risk in diabetic patients.^[10]

MATERIALS AND METHODS

Type of Study

This was a cross-sectional descriptive study conducted from August 01, 2021 to December 31, 2021 at a tertiary care hospital, Government Medical College (GMC) Baramulla in Northern Kashmir, in UT of J and K, India.

Study Participants/Sample

A total of 500 patients with T2DM who visited Department of Medicine in GMC Baramulla participated in this study

and their records were collected according to their outpatient department number. Out of 500 diabetic patients – 210 were men and 290 were women with age range from 20 to 85 years. Patients data were collected regarding the demographic parameters (age of patient and gender), duration of type 2 diabetes (in years) since diagnosis, duration of hypertension (in years), duration of obesity (in years), duration of polycystic ovary disease (in years) and intake of any other oral anti-diabetic treatment, insulin and any lipid lowering drugs (in years), last lipid profile of the patient, and the pharmacologic treatment (s)he was on.

Inclusion Criteria

The inclusion criteria were included in the study:

1. Age more than 20 years
2. Diagnosed with DM of more than 4 years
3. Patients who were on regular follow-up.

Exclusion Criteria

The inclusion criteria were excluded from the study:

1. Age <20 years
2. Diagnosed with DM of <4 years
3. Patients with type 1 DM
4. Patients with coexisting diseases causing secondary dyslipidemia
5. Pregnant ladies
6. T2DM with uncontrolled sugars.

Experimental Analysis

Patient's blood sample preparation

A 5 ml of venous blood was collected by venipuncture after an overnight fast for 8–12 h. After collecting the blood from the patients, 3 ml of blood was transferred into serum tubes for lipid profile and 2 ml of blood was transferred into sodium fluoride tubes or bulbs for blood glucose estimation.

Diagnostic Analysis

The analysis was carried on an automated clinical chemistry analyzer; Beckman Synchron L ×20. Glucose concentrations were measured by oxygen rate method employing a Beckman oxygen electrode (glucose-oxidase). TC, LDL-C, HDL-C, and TG concentrations were measured by International Federation of Clinical Chemistry approved enzymatic methods. However, LDL-C can also be measured by Fried Ewald equation (TC- HDL -serum TG/5). VLDL-C was calculated by plasma TGs by 5.

Statistical Analysis

The mean and standard deviations were calculated for fasting blood sugar, TC, TGs, HDL, and LDL in both males and females separately [Table 1]. The data were further categorized according to age group. Serum

lipids were categorized as per NCEP-ATP III (National Cholesterol Education Programmed Adult Treatment Panel) Guidelines. According to these standard guidelines, hypercholesterolemia is defined as TC >200 mg/dl, LDL-C as >100 mg/dl, hypertriglyceridemia as TG >150 mg/dl, and HDL-C <40 mg/dl. Dyslipidemia is defined by presence of one or more than one abnormal serum lipid concentration. Mixed dyslipidemia is defined by the presence of two or more than two abnormal value of the above-mentioned lipid parameters.

For serum Glucose levels, we referred to American Diabetes Association Guidelines. Persons with fasting blood glucose >126 mg/dl or who were on medication for diabetes were considered as having DM. 2-D column chart was applied in comparison of diabetic males and diabetic females.

RESULTS

In the present study, the average age of the participants was 51.24 years. The average fasting blood glucose of the participants was 212.08 mg/dl. The average TC concentration, TG concentration, HDL levels, LDL levels, VLDL levels of the participants was 175.52 mg/dl, 236.88 mg/dl, 45.12 mg/dl, 95.75mg/dl, and 39.88 mg/dl, respectively [Table 2 and Figure 1].

In the present study, most of the participants were having dyslipidemia as one or two parameters of the lipid profile were outside the target recommended by the guidelines of National Cholesterol Education Program. Out of 500 diabetic patients, 130 (26%) patients were having hypercholesterolemia, 300 (60%)

patients were having hypertriglyceridemia, 190 (38%) patients were having increased LDL levels, and 100 (20%) patients were having reduced HDL levels and 210 (42%) patients were having VLDL s [Table 3]. Out of 290 females, 100 (34.5%) patients were having hypercholesterolemia, 150 (51.72%) patients were having hypertriglyceridemia, 120 (41.4%) patients were having increased LDL levels, 40 (13.79%) patients were having reduced HDL levels, and 130 (44.83%) patients were having VLDL levels [Table 3]. Out of 210 males, 30 (14.3%) patients were having hypercholesterolemia, 150 (71.43%) patients were having hypertriglyceridemia, 70 (33.33%) patients were having high LDL levels, 60 (28.57%) patients were having reduced HDL levels, and 80 (38.1%) patients were having VLDL levels [Table 3]. Thus, dyslipidemia was observed more in female diabetic patients [Figures 2-6].

- Total blood glucose concentration in all age groups in the diabetic males and females
- TC concentration in all age groups in the diabetic males and females
- TG concentration in all age groups in the diabetic males and females
- HDL concentration in all age groups in the diabetic males and females
- LDL concentration in all age groups in the diabetic males and females
- VLDL concentration in all age groups in the diabetic males and females.

DISCUSSION

In the present study, 52% patients have mixed dyslipidemia with more than one lipid parameter out of range but with normal levels of HDL and 10% patients have mixed dyslipidemia with more than one lipid parameter out of range but with low levels of HDL [Tables 4 and 5]. The prevalence of dyslipidemia in the present study is found as 76% [Table 6], which is higher than the study conducted in Nepal, with prevalence (63.1%). Insulin resistance, relative insulin deficiency, and obesity are found to be associated with dyslipidemia in T2DM.^[11] In the present study, the hypercholesterolemia was 26%, hypertriglyceridemia was 60%, increased LDL level was 38%, and lower HDL level was 20%. In the study conducted in Telangana, India by Dyakar *et al.* the prevalence of dyslipidemia in type 2 diabetic patients

Table 1: Representation of various baseline clinical parameters in diabetic subjects

Parameters	Male diabetic patient		Female DIABETIC PATIENT	
	mean (mg/dl)	SD	mean (mg/dl)	SD
Glucose	212.4286	101.118421	211.74	91.20295369
TC	165.3635	38.04574492	185.6803448	38.90981663
TG	282.1115	256.8900381	191.6485714	78.52334921
HDL-C	42.8605	8.401129665	47.3776	13.4388083
LDL-C	87.78	37.99093069	103.722	40.07806659
VLDL	41.41333	18.3708635	38.34428571	15.69686164

LDL-C: Low-density lipoprotein cholesterol, TG: Triglyceride, HDL-C: High-density lipoprotein cholesterol, TC: Total cholesterol, VLDL: Very low-density lipoprotein

Table 2: Elaborative description of type 2 diabetic patients

Gender	Age (Years)	No. of Patients	Glucose (mg/dl)	TC (mg/dl)	TG (mg/dl)	HDL (mg/dl)	LDL (mg/dl)	VLDL (mg/dl)
Male	53.380	210	212.428	165.363	282.111	42.860	87.78	41.413
Female	49.103	290	211.74	185.680	191.648	47.377	103.722	38.344

LDL: Low-density lipoprotein, TG: Triglyceride, HDL: High-density lipoprotein, TC: Total cholesterol, VLDL: Very low-density lipoprotein

Table 3: Number of lipid parameters out of range in diabetic males and females

Lipid Profile	Males (210)	Females (290)	Total Patients (500)
TC	30	100	130
TG	150	150	300
LDL	70	120	190
HDL	60	40	100
VLDL	80	130	210

LDL: Low-density lipoprotein, TG: Triglyceride, HDL: High-density lipoprotein, TC: Total cholesterol, VLDL: Very low-density lipoprotein

Table 4: Prevalence of single and mixed dyslipidemia in female type 2 diabetic patients (n=290)

S. No	Lipid Profile	No. of Patients
1	High TC only	0
2	High TG only	0
3	High LDL only	10
4	Low HDL only	10
5	Any one lipid parameter out of range with low HDL	0
6	Mixed with low HDL	30
7	Mixed without low HDL	150
8	All lipid parameters within range	90

LDL: Low-density lipoprotein, TG: Triglyceride, HDL: High-density lipoprotein, TC: Total cholesterol

Table 5: Prevalence of single and mixed dyslipidemia in male type 2 diabetic patients (n=210)

S. No	Lipid Profile	No. of Patients
1	High TC only	0
2	High TG only	10
3	High LDL only	0
4	Low HDL only	20
5	Any one lipid parameter out of range with low HDL	20
6	Mixed with low HDL	20
7	Mixed without low HDL	110
8	All lipid parameters within range	30

LDL: Low-density lipoprotein, TG: Triglyceride, HDL: High-density lipoprotein, TC: Total cholesterol

Table 6: Prevalence of single and mixed dyslipidemia in type 2 diabetic patients (n=500)

S. No.	Lipid Profile	No. of Patients
1	High TC only	0
2	High TG only	10
3	High LDL only	10
4	Low HDL only	30
5	Any one lipid parameter out of range with low HDL	20
6	Mixed with low HDL	50
7	Mixed without low HDL	260
8	All lipid parameters within range	120

LDL: Low-density lipoprotein, TG: Triglyceride, HDL: High-density lipoprotein, TC: Total cholesterol

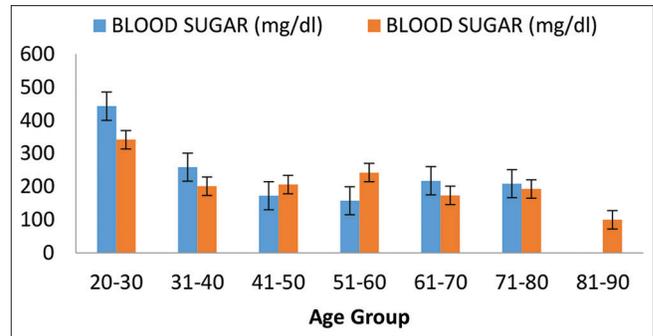


Figure 1: Fasting glucose concentration

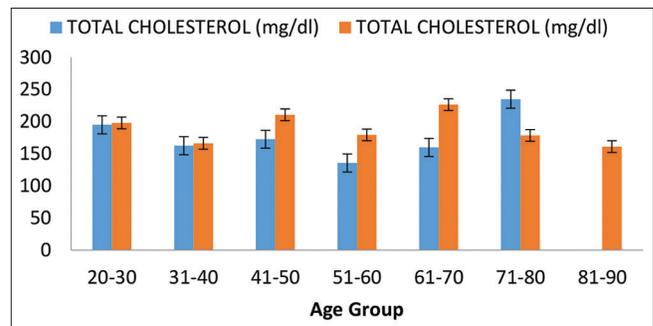


Figure 2: Total cholesterol concentration

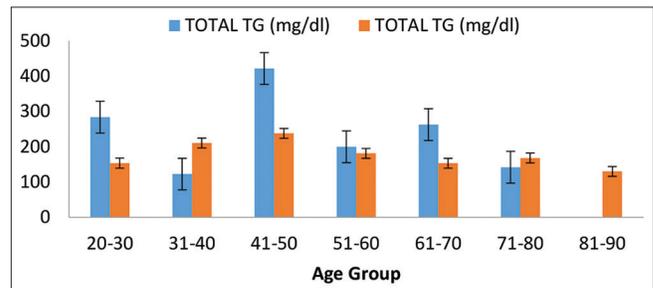


Figure 3: Triglyceride concentration

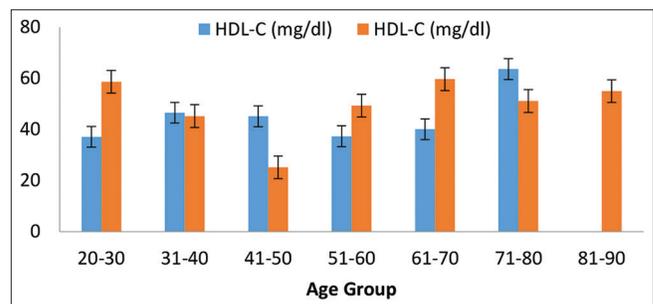


Figure 4: High-density lipoprotein cholesterol concentration

was reported as 86.9% with 58.6% of type 2 diabetic patients had hypercholesterolemia, 36.9% had hypertriglyceridemia, 65.2% had increased LDL levels, and 93.4% had reduced HDL levels. Incidence of hypertriglyceridemia was low with

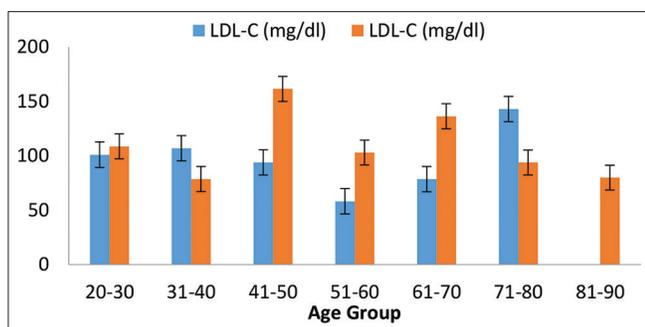


Figure 5: Low-density lipoprotein cholesterol concentration

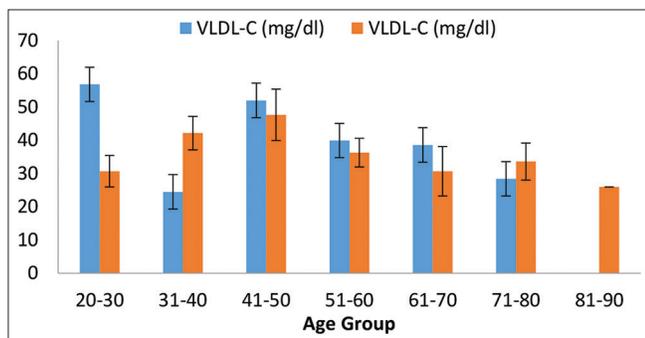


Figure 6: Very low-density lipoprotein cholesterol concentration

the present study results, but the incidence of increased hypercholesterolemia, LDL and reduced HDL were too high when compared with the present study. Similarly in the other study conducted in Western Cape, South Africa by Omodanisi *et al.*,^[6] the prevalence of dyslipidemia in type 2 diabetic patients was reported as 89%, with 56% type 2 diabetic patients had hypercholesterolemia, 64% had hypertriglyceridemia, 61% had high LDL levels, and 65% had low HDL levels. Incidence of increased hypercholesterolemia, LDL, and reduced HDL was too high when compared with the present study, but the incidence of hypertriglyceridemia was coinciding with the present study results. The high prevalence of hypercholesterolemia (high TC), hypertriglyceridemia (high TG), and low HDL is a major cause of concern.^[12] The contributing factor for hypertriglyceridemia in our population can be our diet rich in fat and carbohydrates.^[12] High TG levels have been associated with increased levels of small low dense lipoprotein levels which are considered to be highly atherogenic.^[12] Diet with high fat and calorie intake and lack of physical activity could be the major culprits of dyslipidemia in our population.^[12] References have shown that our diets are rich in saturated fats.^[12] Besides, it also involves overcooking of food which results in destruction of nutrients such as folate, deep frying, and refrying in the same oil leading to trans fatty acids formation which probably contributes to increase of dyslipidemia in our population.^[12] Moreover, high glucose and low HDL-C are significant occurrences in type 2 diabetic patients which contributes to the worsening of diabetic

(glycemic) control.^[6] Hence, the incidence of occurrence of dyslipidemia is very high in type 2 diabetic patients.^[11] Health education should be provided to all the patients of T2DM about the dyslipidemia.^[11] Along with the blood sugar levels, the lipid profile also should be monitored regularly to evaluate and treat dyslipidemia.^[11]

CONCLUSION

The study has been carried out in the GMC Baramulla and Associated Hospital. A large number of patients in this study shows uncontrolled blood glucose levels and have dyslipidemia with an increase in TC, TG, and LDL, VLDL and with a noticeable decrease in HDL. There is an increasing trend of diabetes and dyslipidemia in North Kashmir, with a relatively high prevalence among women with an increasing age. Dyslipidemia in this patient population was associated with gender and age. Majority of our diabetic patients failed to achieve all standard goals of dyslipidemia management. Combination lifestyle therapies, that is, enhanced physical activity and dietary modification and therapeutic intervention would help us in treatment and management of dyslipidemia. The optimal care of diabetic patients should include regular monitoring of blood sugar and full range serum lipid profile. Specific efforts to educate patients and increase their awareness regarding the need to change behaviors and regularly take medication would be a positive step toward decreasing dyslipidemia prevalence in diabetic patients. Thus, this result highlights the regular need for screening blood lipid levels and appropriate intervention programs, especially in type 2 diabetic mellitus person. I hope that the data in this study will help to demonstrate the importance of regular surveillance and screening of all the diabetic patients for dyslipidemia.

ACKNOWLEDMENT

We are thankful to the principal of GMC Baramulla for giving us permission to conduct the study. We are also thankful to the patients who participated in this study.

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Khan, *et al.*: Prevalence of Dyslipidemia in Type 2 Diabetic Patients

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How to cite this article: Khan NA, Shafi A, Sheikh FA. Prevalence of Dyslipidemia in Type 2 Diabetic Patients in Northern Kashmir. *Int J Sci Stud* 2022;10(2):78-83.

Source of Support: Nil, **Conflicts of Interest:** None declared.