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RESEARCH TITLE :
**STUDY OF SERUM LEVEL OF TRIGLYCERIDE IN
PATIENT WITH DIABETES MELLITUS TYPE 2**

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ABSTRACT :

A triglycerides test measures the amount of triglycerides in type 2 diabetic patients .

BACKGROUND:

Hypertriglyceridemia is present in approximately one-third of the general population and in more than half of patients with diabetes. Patients with diabetes develop elevated TG from an overproduction of very-low-density lipoprotein (VLDL) and/or impaired TG lipolysis. The increased production of fatty acids by adipose cells results in the packing of this excess into VLDL, which is transported out of the liver. Also, patients with insulin resistance have less effective lipoprotein lipase, which is essential for breaking down TG in the circulation.

AIM AND OBJECTIVE:

This study aims to evaluate serum level of triglyceride in patients with diabetes mellitus type 2.

PATIENTS OF METHODS :

The study was under taken 10 patient with diabetes mellitus type 2.

RESULTS :

Type 2 diabetes patients showed elevated in level of serum triglycerides .

CONCLUSION:

Diabetes is a disease of insulin which strictly regulates both glucose and lipid metabolism. Hyperlipidemia is the commonest complication of Diabetes Mellitus . Common lipid abnormalities in diabetes are raised Triglycerides and total cholesterol.

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1- INTRODUCTION

Lipid abnormalities are common in diabetics and frequently seen in type 2 diabetes. Dyslipidemias make diabetics prone to development coronary heart disease (CDH) and other complications of atherosclerosis.

Diabetes Mellitus (DM) is a group of metabolic disease characterised by increase blood glucose level resulting from defects in insulin secretion, insulin action or both. Hyperglycaemia and atherosclerosis are related in type 2 diabetes

1.1 WHAT ARE TRIGLYCERIDES?

Triglycerides are fats from the food we eat that are carried in the blood. Most of the fats we eat are in triglyceride form. Extra calories, alcohol and sugar in the body turn into triglycerides and are stored in fat cells throughout the body. ⁽¹⁾

1.2 HOW ARE TRIGLYCERIDES DIFFERENT FROM CHOLESTEROL?

Triglycerides and cholesterol are both fatty substances called lipids. But triglycerides are fats; cholesterol is not. Cholesterol is a waxy, odorless substance made by the liver. It is used to build cell walls, helps the nervous system and plays an important role in digestion and sex hormone production.⁽¹⁾

1.3 HOW DO TRIGLYCERIDES CIRCULATE IN THE BLOOD?

Pure cholesterol cannot mix with or dissolve in the blood. Instead, the liver packages cholesterol with triglycerides and proteins called lipoproteins. The lipoproteins move this fatty mixture to areas throughout the body. Types of these lipoproteins include very low-density lipoproteins (VLDLs), high-density lipoproteins (HDLs) and low-density lipoproteins (LDLs). ⁽¹⁾

1.4 INSULIN AND LIPID METABOLISM

Insulin stimulates fatty acid synthesis in adipose tissue, liver and lactating mammary glands along with formation and storage of triglycerides in adipose tissue and liver. Insulin critically regulates serum VLDL concentrations by suppressing hepatic VLDL production and stimulating VLDL removal by activation of lipoprotein lipase. Eventually prevent elevated of LDL level in blood circulation.⁽²⁾

1.5 PATHOPHYSIOLOGY OF HYPERTRIGLYCERIDAEMIA IN TYPE 2 DIABETES

Triglycerides, which originate from the intestine postprandially or endogenously from the liver, are packaged into lipoprotein particles containing apolipoprotein B-48 (apoB-48; chylomicrons) and apolipoprotein B-100 (apoB-100; very-low density lipoprotein, VLDL), respectively .

Abnormalities in triglyceride-rich lipoprotein (TRL) metabolism are cardinal features of type 2 diabetes . Metabolic dysregulation resulting in HTG include enhanced hepatic secretion of TRL due to insulin resistance and delayed clearance of TRL involving lipoprotein lipase (LPL)-mediated lipolysis.⁽³⁾

Insulin resistance activates *de novo* lipogenesis, resulting in oversecretion of hepatic TRLs. This is also evident in the postprandial state, with enterocytic oversecretion of TRLs in the form of chylomicrons. With both secretion pathways on overdrive, competition between the TRLs and their remnants for lipolytic and receptor-mediated clearance further induces HTG.

Insulin resistance is also associated with increased rates of apolipoprotein C-III (apoC-III) secretion, which further impairs receptor-mediated uptake of hepatic chylomicron remnants. Glucose has also found to activate apoC-III transcription, which may be the link between hyperglycaemia, HTG and CVD in type 2 diabetics.⁽³⁾

Both LPL and hepatic lipase (HL) control the clearance of triglycerides. HL plays a particularly important role in the delipidation cascade from VLDL to LDL. Triglyceride-rich VLDL derives small, dense LDL particles which are more susceptible to oxidation.

1.6 WHAT IS A HIGH TRIGLYCERIDE LEVEL?

High triglycerides (hypertriglyceridemia) can be dangerous to your health. Unfortunately, high triglycerides, like high cholesterol, rarely causes symptoms. It's vital to get routine lipid blood tests to check cholesterol numbers

A triglycerides test measures the amount of triglycerides in the blood. It is usually part of a lipid profile. A lipid profile is a test that measures the level of fats in your blood, including triglycerides and cholesterol. If your triglycerides and LDL cholesterol are high, but your HDL is low, you have an increased risk of heart attack and stroke.

For the most accurate reading, you should fast 8 to 12 hours before a lipid blood test. A healthy number for triglycerides is below 150 milligrams per deciliter (mg/dL)⁽⁴⁾

Your healthcare provider classifies high triglyceride levels as:

- **Mild: 150-199 mg/dL.**
- **Moderate: 200-499 mg/dL.**
- **Severe: Greater than 500 mg/dL.**

1.7 HOW OFTEN SHOULD YOU GET TRIGLYCERIDE TESTS?

High triglyceride levels become more of a problem with age. As the risk rises, your healthcare provider might recommend tests more often. Younger adults may need cholesterol tests every four to six years. If you have diabetes, a family history of high cholesterol or other heart disease risk factors, you may need more frequent tests. Men ages 45 to 55 and women ages 55 to 65 need annual tests.

Children also need cholesterol and triglyceride tests. Your child usually gets tested between 9 and 11 and again during young adulthood (between 17 and 21)⁽⁵⁾

1.8 WHAT ARE RISK FACTORS FOR HIGH TRIGLYCERIDES?

Factors that may raise triglyceride levels include:

- Excessive alcohol use.
- Family history of high cholesterol.
- Liver disease or kidney disease.
- Medications, including diuretics, hormones, corticosteroids and beta blockers.
- Menopause.
- Obesity.
- Smoking.
- Thyroid disease.
- Uncontrolled diabetes.
- A diet high in sugar and simple carbohydrates.⁽⁶⁾

1.9 WHAT ARE THE COMPLICATIONS OF HIGH TRIGLYCERIDES?

High levels of triglycerides increase your risk of pancreatitis. This severe and painful inflammation of the pancreas can be life-threatening.

High triglyceride levels also increase your risk of heart and vascular disease, including:

- Carotid artery disease.
- Coronary artery disease and heart attack.
- Metabolic syndrome (a combination of high blood pressure, diabetes and obesity).
- Peripheral artery disease (PAD).
- Strokes.⁽⁶⁾

1.10 HOW CAN YOU PREVENT OR LOWER HIGH TRIGLYCERIDES?

Certain dietary and lifestyle changes can lower triglyceride numbers. To keep triglycerides and total cholesterol within a healthy range:

- Be physically active for at least 30 minutes every day.
- Eat a heart-healthy diet with less unhealthy fats and simple sugars (carbohydrates) and more fiber.
- Control high blood pressure and diabetes.
- Cut back on alcohol.
- Get enough sleep.
- Lose weight (if needed) and maintain a healthy weight.
- Manage stress.
- Quit smoking.⁽⁷⁾

1.11 HOW ARE HIGH TRIGLYCERIDES TREATED?

People at high risk for heart attacks, strokes or other problems may need medications to lower triglycerides. These may include cholesterol-lowering drugs such as statins ⁽⁷⁾

2- MATERIALS AND METHODS

Patient with type 2 Diabetes Mellitus were included in this study . We evaluate the laboratory parameters of Blood glucose, total cholesterol and triglycerides for 10 diabetic patients during period lasting from January 2022 to March 2022 in Baquba teaching hospital.

Blood samples were collected from participants after 8 hours of fasting . Blood samples were centrifuged at 3000 rpm for 15 minutes within 2 hours of collection . Separated plasma and serum for the estimation of biochemical markers were stored at $- 20^{\circ}\text{C}$.

Plasma glucose levels were measured by the hexokinase method with an enzymatic UV test using Beckman coulter Au-5800 clinical chemistry analyser .

The serum cholesterol and triglycerides were determined by using the serum analyser .

The samples were collected from 10 diabetic patients (5 men and 5 women) within the age range of 45–60 years . The patient who didn't fast , pregnant women and patient with chronic disease were excluded. All patient included in this study were diagnosed with type 2 diabetes for a minimum of one year.

3- RESULTS

	Blood glucose (mg/dl)	Total Cholesterol (mg/dl)	Triglycerides. (mg/dl)
Case 1	270	289	260
Case 2	250	290	173
Case 3	187	285	185
Case 4	310	200	400
Case 5	200	206	228
Case 6	220	256	320
Case 7	235	260	280
Case 8	247	295	268
Case 9	250	260	222
Case 10	270	213	230

Table(1):Hyperlipidemia and Hypercholesterolemia in patients with type 2 DM

4- DISCUSSION

Hypertriglyceridemia is the most common serum lipid abnormality in diabetic populations. Serum TG levels are not simply elevated along with the degree of hyperglycemia, but hyperinsulinemia compensated by insulin resistance is closely correlated with TG levels. TG consists of three molecules of fatty acids, the availability of circulating fatty acids (free fatty acids (FFA)) plays a crucial role in TG production in the liver .(8)

serum triglyceride (TG) is a leading predictor of atherosclerotic cardiovascular disease, comparable to low-density lipoprotein (LDL)-cholesterol (C) in populations with type 2 diabetes, which exceeds the predictive power of hemoglobinA1c. Atherogenic dyslipidemia in diabetes consists of elevated serum concentrations of TG-rich lipoproteins (TRLs), a high prevalence

of small dense low-density lipoprotein (LDL), and low concentrations of cholesterol-rich high-density lipoprotein (HDL) (good cholesterol)⁽⁹⁾

Dyslipidemia can lead to cardiovascular disease, which can be symptomatic. High LDL cholesterol (bad cholesterol) levels are associated with coronary artery disease (CAD), which is blockage in the arteries of your heart, and peripheral artery disease (PAD), which is blockage in the arteries of your legs. CAD can lead to chest pain and eventually a heart attack. The main symptom of PAD is leg pain when walking.⁽¹⁰⁾

Persistent hyperglycaemia causes glucosyl of all proteins especially collagen cross linking and matrix proteins of arterial walls , this eventually causes endothelial cells dysfunction. The dyslipidemia is a major risk factor for coronary heart disease (CHD) .

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