

Correlation of Total Cholesterol and Glucose in Serum of Iraqi Patients with Atherosclerosis and Diabetes Mellitus Type 2

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ABSTRACT

Cholesterol is a fatty substance (lipid) classified as a waxy steroid of fat. It is absorbed by the intestine into blood stream and is packaged inside a protein coat a chylomicron. Blood glucose is a simple monosaccharide absorbed directly into the blood stream during digestion. The level of blood glucose normally represents a balance between the inflow of glucose into blood and it is uptake by the tissue. Atherosclerosis is a general term for a number of different medical conditions that affect the heart, this is occurs when the blood supply to a part of heart is interrupted, must commonly due to plaque, is build up in the coronary arteries consist of lipid cholesterol and calcium. It causes a damage of potential disease of heart muscle due to thickening and hardening of arteries. Diabetes mellitus is a disorder in which the level of blood glucose is persistently elevated above the normal range due to decrease secretion of insulin. The main objective of this study is to determine the concentrations of total cholesterol and glucose into blood serum of Iraq patients with atherosclerosis and diabetes mellitus type 2. This study included 60 specimens of patients with atherosclerosis and 60 patients with type 2 diabetes mellitus; their age range was 45-65 years. These patients were then matched by age and sex to 30 healthy individuals. Results revealed that there was highly significantly increased in the mean value of total cholesterol and glucose concentrations in patients of atherosclerosis ($p < 0.001$) and diabetes mellitus ($p < 0.001$) as compared with healthy individuals.

Key ward: Total Cholesterol, Glucose, Atherosclerosis and Diabetes Mellitus type 2.

usual glucose levels may be a sign of prediabetes or diabetes mellitus^[4], hyperglycemia^[4].

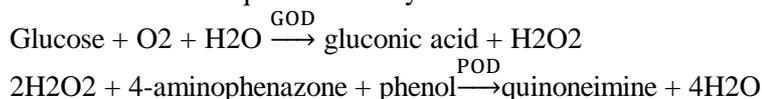
Atherosclerosis is a condition characterized by thickens of artery wall as a result of the accumulation of fatty materials such as cholesterol, this syndrome affecting arterial blood vessels, and it's a chronic inflammatory response in the walls of arteries, caused largely by the accumulation of macrophage white blood cells and promoted by low-density lipoproteins (LDL, plasma proteins that carry cholesterol and triglycerides) without adequate removal of fats and cholesterol from the macrophages by functional high-density lipoproteins(HDL)^[5]. Also atherosclerosis is commonly referred to as a hardening or furring of the arteries and it's caused by the formation of multiple plaques within the arteries^[6], these atherosclerotic lesions, or atherosclerotic plaques are separated into two broad categories: Stable and unstable.^[7]

Diabetes mellitus, or simply **diabetes**, is a group of metabolic diseases in which a person has high blood sugar, due to deficiency of insulin, or because cells do not respond to the insulin that is produced.^[8] This high blood sugar produces the classical symptoms of polyuria, polydipsia, and polyphagia. Type 2 DM results from insulin resistance, a condition in which cells fail to use insulin properly, unadequate secretion of insulin, sometimes combined with an absolute insulin deficiency. In the early stage of type 2, the predominant abnormality is reduced insulin sensitivity. At this stage, hyperglycemia can be reversed by a variety of measures and medications that improve insulin sensitivity or reduce glucose production by the liver^[9].

Patients & Methods: The prospective study comprised 60 Iraqi patients fulfilling the American Heart Association (AHA)/American College of Cardiology Foundation (ACCF) guidelines for the diagnosis of atherosclerosis^[10], and 60 patients with type 2 diabetes mellitus according to the European Association for the Study of Diabetes (EASD) and the American Diabetes Association (ADA)^[11], their age range was 45-65 years. These patients were then matched by age and sex to 30 healthy individuals. Blood samples were taken from individuals in both groups for estimating total cholesterol and glucose levels. Laboratory investigation which include: Hemoglobin (Hb), Erythrocyte sedimentation rate (ESR) was done in Laboratory Teaching center of Baghdad Hospital.

Determination of Cholesterol: Kit from fortress diagnostics limited company (United Kingdom) was used to determine total cholesterol. Cholesterol is present in serum as cholesterol esters and free cholesterol. The cholesterol esters present in serum are hydrolysed by cholesterol esterase and the cholesterol is then measured by oxidizing with cholesterol oxidase to form hydrogen peroxide. The hydrogen peroxide in turn reacts with phenol and 4-aminoantipyrine present to form the red quinoneimine dye. The intensity of the dye formed is directly proportional to the level of cholesterol present in the sample^[12].

Determination of Glucose: Kit from Randox Laboratories limited company (United Kingdom) was used to determine glucose. Glucose is determined after enzymatic oxidation in the presence of glucose oxidase. The hydrogen peroxide formed reacts, under catalysis of peroxidase, with phenol and 4-aminophenazone to form a red – violet quioneimine dye as indicator^[13].



Total cholesterol and glucose levels in serum of patients with atherosclerosis and type (2) diabetes mellitus were estimated with colorimetric method

Statistical analysis

Descriptive statistics for all data of each set were expressed as a mean \pm SD. and compared using independent sample (t) test $p < 0.05$ were considered statistically significant. The overall productive values for the results in studied groups were performed according to program of office xp.

Results: Table (1 and 2) show a total of 120 subjects 60 were suffering from atherosclerosis and 60 of type (2) diabetes mellitus they were compared with 30 healthy subjects.

The mean values of glucose levels in serum of patients with atherosclerosis were significantly higher as compared to healthy control group ($P < 0.001$), also the mean values of type (2) diabetes mellitus levels were significantly higher as compared to healthy control group ($P < 0.001$), as shown in table 3 and 4. By using a correlation analysis, there was a positive relationship found between total cholesterol and glucose levels in patients with atherosclerosis ($r = 0.341$) as shown in Figure (1). Also there was a positive relationship ($r=0.534$) found between total cholesterol and glucose levels in patients with type (2) diabetes as shown in Figure (2).

Discussion: inflammation is important in all phases of heart disease including the early initiation of atherosclerosis plaque within the arteries, as well as the acute rupturing of this plaque, that result in heart attack of all two often sudden death. The present study showed a significant increase in serum glucose concentration of patients with atherosclerosis as compared with healthy control and this agree with a study that blood glucose may affect the development of arteriosclerosis by impairing endothelial function^[14], and elevated glucose increases the risk for coronary artery disease (CAD)^[15]. Hyperglycemia can damage both the kidney and the arterial wall through deposition of advanced glycation end products, generation of reactive oxygen species^[16]. In this study there is a significant increase in total cholesterol concentration in patients with type (2) diabetes mellitus as shown in a study that people with type 2 diabetes have dangerously high levels of LDL "bad" cholesterol and triglycerides that circulate in the blood stream, these elevated levels are associated with an increased risk of cardiovascular disease^[17], also agree with a study that type 2 diabetes is associated with a marked increased risk of cardiovascular disease (CVD)^[18]. Another study showed that adults with diabetes have elevated triglycerides, low levels of HDL cholesterol, and increased presence of small, dense LDL particles^[19], and have a two to four times higher risk of experiencing cardiovascular events than adults without diabetes^[20,21]. There is appositve correlation between glucose and total cholesterol concentrations in both atherosclerosis and type (2) diabetes mellitus patients and this due to that long chain of fatty acid inhibit enzymes of the control points in glycolysis which lead to increase of glucose concentration, and in another hand elevated glucose provide an energy as adenosine triphosphate (ATP) which inhibit the metabolism of cholesterol^[22].

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Table (1) Characteristics of atherosclerosis patients and controls.

Parameters	Patients with atherosclerosis (N = 60) Mean ± SEM	Healthy Control (N= 30) Mean ± SEM	P-value	Sig.
Age (y)	56.86± 2.54	58.32 ± 2.76	0.45	NS
BMI (kg/m2)	27.32 ± 0.51	26.31 ± 0.45	0.30	NS

Table (2) Characteristics of type (2) diabetes mellitus patients and controls

Parameters	Patients with type(2) diabetes mellitus (N = 60) Mean ± SEM	Healthy Control (N= 30) Mean ± SEM	P-value	Sig.
Age (y)	59.43± 2.23	58.32 ± 2.76	0.47	NS
BMI (kg/m2)	27.45± 0.75	26.31 ± 0.45	0.33	NS

Values are the (mean ± SD), BMI=body mass index, NS=not significant, and N=number of samples.

Table (3) Serum glucose levels (mean ± SD) in patients with atherosclerosis (N=60) and controls (N=30).

Parameters	Patients with atherosclerosis (N = 60) Mean ± SEM	Healthy Control (N= 30) Mean ± SEM	P-value	Sig.
Glucose (mg/dl)	204.65± 5.54	91.09 ± 3.66	0.001	HS
Total cholesterol (mg/dl)	320± 4.46	158.89 ± 3.54	0.001	HS

Table (4) Serum Total cholesterol levels (mean ± SD) in patients with type (2) diabetes mellitus (N=60) and controls (N=30).

Parameters	Patients with type(2) diabetes mellitus (N = 60) Mean ± SEM	Healthy Control (N= 30) Mean ± SEM	P-value	Sig.
Total cholesterol (mg/dl)	247.03± 5.88	158.89 ± 3.54	0.001	HS
Glucose (mg/dl)	291.78±3.67	91.09 ± 3.66	0.001	HS

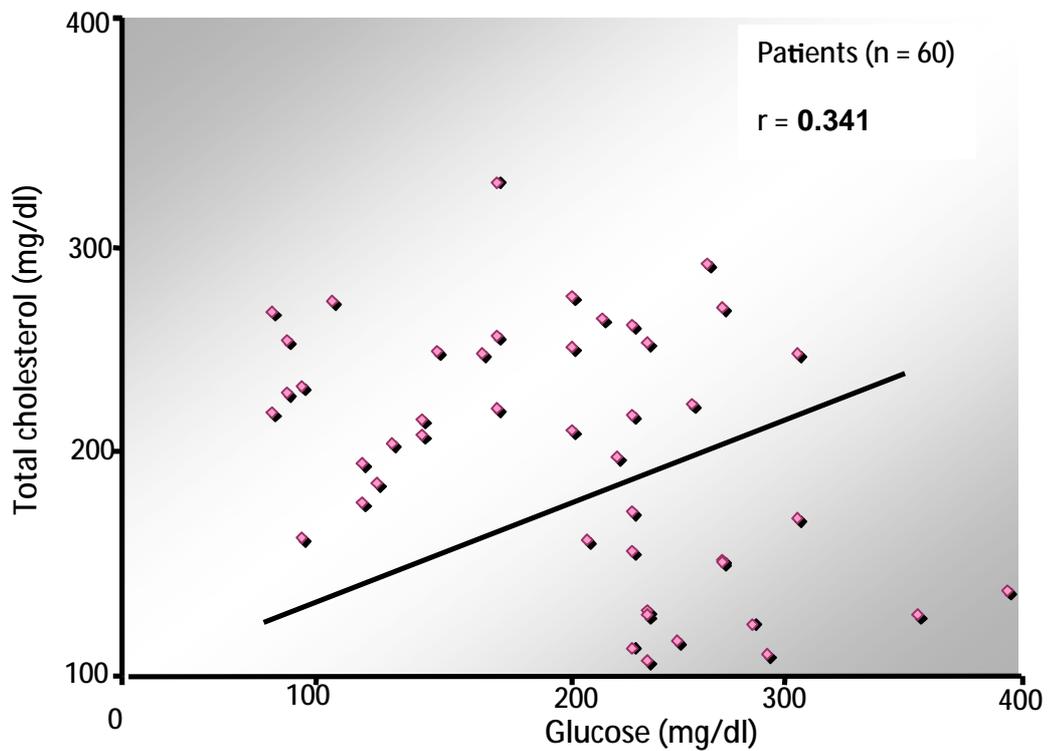


Figure (1) Correlation between total cholesterol and glucose in patients with atherosclerosis.

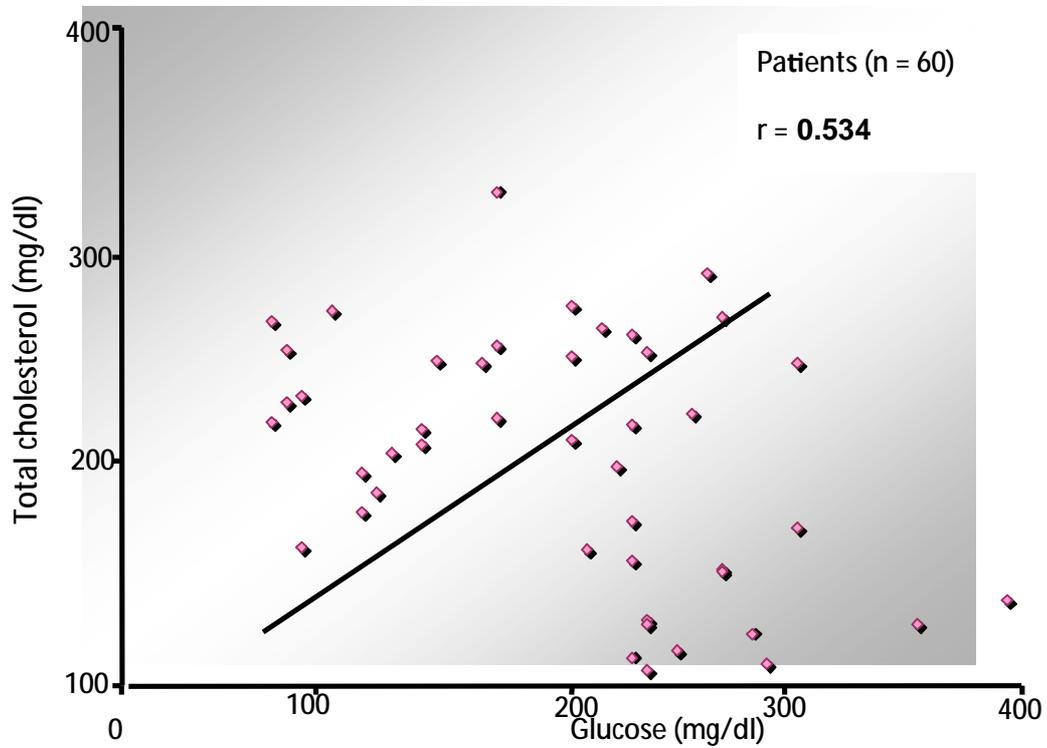


Figure (2) Correlation between total cholesterol and glucose in patients with type (2) diabetes mellitus.