

Study Role of Creatinine, Triglycerides, Urea, Cholesterol, Sugar in Patients with Diabetes Mellitus Type 1

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Abstract: Background:

Diabetes is a chronic disease caused by the pancreas producing insufficient insulin or the body utilizing insulin inefficiently. Diabetes comes in three primary forms: Diabetes type 1 diabetes type 2 pregnancy diabetes

Diabetes type 1, Often called insulin-dependent diabetes, this chronic condition results in complete lack of insulin production by the pancreas.

The hormone insulin is necessary for sugar, or glucose, to enter cells and start the process of producing energy. When the body is unable to utilise insulin efficiently or create enough of it, type 2 diabetes, a complicated chronic illness, develops. People with type 2 diabetes need therapy in order to keep their blood sugar and insulin levels under control.

Materials and methods:

The results of the analyzes data were collected (Hba1c, T.G., sugar, cholestrol, urea, creatinine). From the following hospitals:

1. Imam Hussain Medical Learning City (Holy Karbala)
2. Marjan Medical Educational City (Babylon)
3. Children's Teaching Hospital (Babylon)
4. Al-Moussawi National Hospital (Basra)

For the purpose of studying the effect of Hba1c on:

1. urea
2. cholesteol
3. creatinine
4. triglyceride
5. sugar

Results and Conclusion

Results

The results of our research showed that there is a significant relationship with sugar and there is no relationship with the rest

Conclusion

Diabetes is affected by the level of sugar in the blood, which in turn affects the values of Hba1c, and there must be periodic examination of diabetics to avoid side.

Introduction

1.1. Diabetes mellitus (diabetes mellitus)

It is a group of metabolic diseases characterized by consistently high blood sugar levels. Common symptoms include increased hunger, thirst, and frequency of urination. If diabetes is not controlled, a number of health problems could develop. Death or hyperglycemia are possible outcomes of severe effects. Serious long-term effects include things like foot ulcers, stroke, chronic kidney disease, cardiovascular disease, nerve damage, vision damage, and cognitive decline.

1.2. Diabetes causes

Each kind of diabetes has a different underlying etiology. However, hyperglycemia can result from diabetes, irrespective of its kind. Significant health issues arise when blood sugar levels are excessive. Among those with chronic diabetes mellitus encompass. Types 1 and 2 diabetes are both present. Diabetes disorders that are treatable include prediabetes and gestational diabetes. The term prediabetes refers to blood sugar levels that are above normal but not high enough to be classified as diabetes.

The pancreas produces insulin, and when the

Diabetes develops when the pancreas cannot create enough insulin, produces insufficient amounts, or the body reacts improperly to the hormone insulin. Diabetes can occur in a variety of ways, and its causes vary depending on the kind. The causes of diabetes for each type are as follows:

1. Diabetes Type 1 Causes. About 10% of adults have an autoimmune illness, in which the immune system targets and kills the pancreatic cells. has this kind of diabetes
2. Type 2 diabetes causes This kind happens when the body develops an insulin resistance, which causes blood sugar levels to rise.
3. Gestational diabetes causes. Because the placenta produces substances that block insulin during pregnancy, elevated blood sugar is the result of this form of diabetes.

1.3. Diabetic symptoms If the blood glucose level is noticeably elevated, two types of diabetes may present with symptoms that are very similar. High blood sugar symptoms include: 1. increased thirst; 2. increased urination. 3. An increase in appetite

In cases where blood glucose levels above 160 to 180 mg/dL (8.9 to 10.0 mmol/L), glucose contamination of the urine occurs. The kidneys release more water into the urine to dilute the high concentration of glucose when the amount of glucose increases. One prevalent sign of diabetes in humans is polyuria, or the kidneys' excessive excretion of urine. Atypical thirst is brought on by excessive urine output, or polydipsia. Weight loss may result from the extra calories expelled in urine. As a way to make up for it, people frequently feel. excess of appetite indulgence

Additional signs of diabetes include hazy vision Feeling sleepy emesis less endurance when exercising

1-4. Diagnosis

Diagnosing diabetes mellitus involves exhibiting any one of the following symptoms, which are associated with recurrent or persistent hyperglycemia: > 7.0 mmol/l (126 mg/dl) of fasting plasma glucose Two hours after an oral glucose load of 75 g, more than 11.1% mmol/l (200 mg/dl) of plasma glucose as measured by a glucose tolerance test. Unintentional plasma glucose levels greater than 11.1 - mmol/l (200 mg/dl) and hyperglycemia

2-1. The A1c Test?

The results of the hemoglobin A1c test indicate the mean blood sugar level throughout the preceding two to three months.

It is also known as glycohemoglobin, glycated hemoglobin test, and HbA1c. It is comparable to the season batting average of a baseball player. You cannot determine a player's career performance

from a single game. Also, the findings of a single test day do not provide you with a whole picture of the efficacy of your medication. Diabetics require this test on a regular basis to check if their blood sugar levels are within normal limits. It can determine whether your diabetic medications need to be adjusted. Diabetes is also diagnosed with the A1c test.

2-2. What Is Hemoglobin?

The hemoglobin protein is found in red blood cells. It is the one that gives blood its red color and transports oxygen throughout your body.

2-3. How the Test Works

Glucose is another name for the blood sugar. When sugar builds up in the blood, it attaches itself to hemoglobin in red blood cells. An A1c test is used to determine the quantity of glucose bound. Because red blood cells only have a three-month half-life, the test shows the mean blood sugar level during the three months prior.

If you've had high blood sugar levels in the last few weeks, your hemoglobin A1c test result will be larger.

2-4. What's a Normal Hemoglobin A1c Test?

Non-diabetic people usually have hemoglobin A1c readings between 4% and 5.6%. You have prediabetes and a higher chance of getting diabetes if your hemoglobin A1c is 5.7% to 6.4%. You have diabetes if the percentage is 6.5% or above.

2-5. Setting Goals for A1c Levels

Usually, a target A1c level for diabetics is less than 7%. Hemoglobin A1c raises your risk of acquiring diabetes-related issues. Untreated diabetes over an extended period of time may result in a level greater than 8%.

Your doctor may adjust your treatment plan to lower your blood sugar if you have diabetes and it is higher than desired. You can lower your levels with medication, diet, and exercise.

An A1c test should be performed on diabetics periodically to make sure their blood sugar levels are within the target range. If you take good care of your diabetes, you may be able to avoid blood testing as often.

However, doctors advise doing so at least twice a year. Individuals suffering from hemoglobin-related disorders, like anemia, could receive false positives from this test. High cholesterol levels and supplements like vitamins C and E might also have an impact on the hemoglobin A1c findings. Liver and kidney diseases may also have an impact on the exam.

Serum creatinine levels were found to be correlated with lipid profile and obesity, two major metabolic characteristics that are recognized risk factors for IGT. It has been demonstrated that those with IGT develop abdominal obesity. Serum creatinine level is a straightforward, affordable, and often used indicator of renal function as well as a diabetes risk factor.

In this study, creatinine was adversely correlated with BMI. Banfi and Fabbro's study⁹, which found a substantial correlation between creatinine concentrations and BMI, is not supported by the results. Our population's increased visceral fat and metabolically healthy folks may be the cause of this. The results of this investigation showed a strong correlation between age and serum creatinine. The findings align with a 2009 study carried out by Sheikh and associates.¹⁰ In 2006, Musch and his colleagues discovered a paradox, although they did not find any meaningful correlation. Ethnic differences could be the cause of this. There was a noteworthy correlation found between creatinine and HbA1c. It has been observed that serum creatinine, regardless of established metabolic risk factors, is significantly linked to several categories of poor glucose regulation in both genders.

The presence of small, dense LDL particles and variations in plasma lipoprotein-lipid concentrations are associated with the IGT state¹².

Individuals with IGT had also been reported to have low total bilirubin, high amounts of free fatty acids, and hypertension.

Serum creatinine showed a significant relationship with biochemical indicators that were significantly higher in prediabetes, such as blood glucose levels at 30, 60, and 120 minutes after fasting, and body mass index. Our sample's low level of HDL may have resulted from disruption of lipid metabolism, even if their serum total cholesterol was within acceptable limits. Lipid metabolism disruption appears to be an early event in the development of type 2 diabetes and may have occurred several years before the diagnosis.

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By comparing the Hba1c values for patients and healthy controls with the mentioned values for patients and healthy subjects as well

In this study, blood samples (300 samples) were obtained from children, women and men of different age groups with type 1 diabetes, and (85 samples) were selected to work on them.

Samples were collected from healthy people without infection as a standard group to compare with the values of patients

Result and discussion

4.1. Creatinine

Creatinine is One waste product that results from the regular strain that the body's muscles endure is creatinine. Creatinine is present in the blood of all people.

4.1.1. What is the average creatinine level?

That is dependent upon your body size, age, race, and gender.

Can the level of creatinine in my blood tell my doctor whether my kidneys are functioning properly?

Nope. It's not the best indicator of renal health to look at your blood creatinine level. This is so because factors such as age, race, gender, and physical size all affect the amount of creatinine in your blood. (To put it another way, these variables determine what is deemed "normal"). The most accurate method of determining the health of your kidneys is to check your glomerular filtration rate (GFR).

	Hba1c	Creat.	P value
	Mean\pmSD mg/dl	Mean\pmSD mg/dl	
Patients	8.971429 \pm 0.24	112.584906 \pm 7.77	0.0604654
Health	3.963095 \pm 0.11	88.4345238 \pm 1.03	0.0074417

* mean no significant at (0.05)

GFR is a standard laboratory test that is listed on your blood work report. GFR is an equation that takes into account your age, gender, race, and weight in addition to your creatinine. Your healthcare professional can determine whether you have renal disease based on your GFR number. If your GFR is: You may be suffering from renal disease. Three months with a score below 60 damage (one indicator of kidney damage is the presence of protein in the urine)

4.1.2. Relationship between creatinine with HbA1c

Serum creatinine, irrespective of established metabolic risk factors and lifestyle factors, is substantially linked to many categories of glucose regulation. In diabetes, HbA1c and creatinine level correlations can be useful predictors. Ion-exchange high-performance liquid chromatography (HPLC) is recognized by the National Glycohemoglobin Standardization Program (NGSP) as one of the principal approved methods for detecting hemoglobin A1c. But in certain clinical situations—like hemolysis, transfusions, high vitamin C and E doses, dialysis, HIV infection, and pregnancy—(which result in decreased HbA1c levels) and splenectomy, aplastic anemia, aging, and iron deficiency (which result in increased HbA1c levels) in the case of the former, its reliability is compromised. It is unclear whether other factors, such as uremia, salicylates, alcohol, triglycerides, and opiate usage, can affect the reliability of the HbA1c test. In clinical practice, failing to acknowledge these elements could influence the process of making decisions and even pose a threat.

the patients' health by making their treatment more difficult to administer, raising their chance of unfavorable side effects (such hypoglycemia), or improperly reducing the intensity of their treatment plan.

4.2. Triglycerides

Triglycerides are a type of fat (lipid) found in your blood. Your blood contains triglycerides, a kind of fat (lipid). Triglycerides are created by your body from any extra calories it doesn't need to immediately after a meal. The fat cells in your body store triglycerides. Hormones then cause the release of triglycerides, which provide you energy between meals. Hypertriglyceridemia, or elevated triglycerides, can occur if you consistently consume more calories than you burn, particularly from diets heavy in carbohydrates.

4.2.1. What's considered normal?

Find out if your triglycerides are within a healthy range with this easy blood test: 1.7 millimoles per liter (mmol/L) or less than 150 milligrams per deciliter (mg/dL) is considered normal.

	Hba1c	T.G.	P value
	Mean\pmSD mg/dl	Mean\pmSD mg/dl	
Patients	8.971429 \pm 0.24	1.5952381 \pm 0.07	0.0350686
Health	3.963095 \pm 0.11	1.22857143 \pm 0.02	0.0201105

* mean significant at (0.05)

150–199 mg/dL (1.8–2.2 mmol/L), slightly above high. 200–499 mg/dL (2.3–5.6 mmol/L) is elevated. • Very high: 5.7 mmol/L or greater, or 500 mg/dL or higher Typically referred to as a lipid panel or lipid profile, a cholesterol test includes your doctor will typically check for elevated triglycerides. For an accurate measurement of your triglycerides, you will need to fast before having blood collected.

4.2.2. Relationship between Triglycerides with HbA1c

Hypertriglyceridemia is common in people with diabetes (>30–60%), and uncontrolled hyperglycemia can cause it to spike abruptly. This typically happens in patients who have just received a diabetes diagnosis or who have inadequate glycemic control (because of insufficient insulin action and lipolysis). Since most evidence comes from single instances with conflicting findings or in vitro studies, the impact of hypertriglyceridemia on the reproducibility of HbA1c remains unclear. The triglyceride levels in these reports—which are typically >1000 mg/dL—do not match the ranges typically observed in patients with diabetes (150-500 mg/dL). Moreover, HbA1c was not measured using the accepted standard, HPLC. However, clinical judgments in the typical scenario of concomitant hyperglycemia and hypertriglyceridemia need to be built and evaluated in an empirical study; if there is

It would have important therapeutic and diagnostic implications for triglyceride levels and HbA1c.

When it comes to HbA1c measurement, triglycerides have no discernible impact on clinical results. The fact that many patients with uncontrolled hyperglycemia also have contemporaneous hypertriglyceridemia has important clinical implications for ordinary clinical practice. Patients and healthcare providers can now be more certain that hypertriglyceridemia shouldn't be taken into account when interpreting HbA1c results.

4.3. Urea

Urea is the diamide of carbonic acid, often known as car amide. H_2NCONH_2 is its formula. Among its many use are as a feed additive and fertilizer, as well as a raw material for the production of polymers and pharmaceuticals. That cry is colorless.

	Hba1c	urea	P value
	Mean\pmSD mg\dl	Mean\pmSD mg\dl	
Patients	8.971429 \pm 0.24	6.1297619 \pm 0.31	0.0963996
Health	3.963095 \pm 0.11	15.5464286 \pm 0.78	0.060213

* mean no significant at (0.05)

material that is stalline, melts at 132.7°C (271°F), and breaks down before boiling. The main nitrogenous byproduct of all mammals' and certain fishes' protein metabolism is urea. The substance is found in all mammals' blood, bile, milk, and perspiration in addition to their urine. The amino acids that make up proteins partially undergo the removal of amino groups (NH_2) during the breakdown process. The body converts these amino groups to ammonia (NH_3), which needs to be changed by the liver into urea since it is poisonous. Urine is the final organ that the urea leaves after passing through the kidneys.

4.3.1. Relationship between urea with HbA1c

If your diabetes is not well managed, you could develop End-Stage Renal Disease (ESRD). Diabetic nephropathy is the most common cause of end-stage renal disease (ESRD) in most nations. The most accurate way to determine chronic glycaemia is through the widely accepted and utilized glycosylated hemoglobin (HbA1c) test. The HbA1c test's main objective is to evaluate changes in metabolic control that occur after a prescription change. The HbA1c shows the overall blood glucose levels across a two- to three-month period. Patients with diabetes frequently experience nephropathy, which is typically linked to vascular problems.

Blood samples were drawn while fasting in order to assess blood urea, HbA1c, and blood glucose. HbA1c was calculated using glycohemoglobin spectrophotometry, and the concentration of urea was determined using the Berthelot reaction. Using SPSS (Statistical Package for Social Sciences) and the student t-test, the statistical analysis of HbA1c and urea levels increased significantly ($P < 0.01$) in the diabetic group compared to the control group. A p-value of less than 0.05 was considered statistically significant. Regression and correlation analysis results showed a substantial positive association between serum urea levels and HbA1c.

	Hba1c	Chol.	P value
	Mean\pmSD mg\dl	Mean\pmSD mg\dl	
Patients	8.971429 \pm 0.24	4.677381 \pm 0.15	0.0050655
Health	3.963095 \pm 0.11	144.0417 \pm 4.12	0.0384118

* mean no significant at (0.05)

Cholesterol

All of the body's cells contain cholesterol, a waxy, fatty-like material. To keep the body functioning properly, cholesterol is required. The human body encapsulates cholesterol within lipoproteins, facilitating its circulation via the bloodstream.

LDL and HDL, or low-density lipoproteins and high-density lipoproteins, are the two main types of lipoproteins. Lipid-deficient lipoprotein (LDL) cholesterol is often called "bad" cholesterol since it can lead to atherosclerosis, or the accumulation of plaque in your arteries. HDL cholesterol, also called "good" cholesterol, transports cholesterol to your liver from other parts of your body where it is excreted. Diabetes mellitus escalates the effects of other established risk factors such as smoking, hypertension, and dyslipidemia when it is considered a separate risk factor for cardiovascular disease (CVD).

4.4.1. Relationship between Cholesterol with HbA1c

For DM patients, the HbA1c test indicates the likelihood of developing diabetes complications. In addition to traditional risk factors for CVD, high cholesterol and hemoglobin A1c are independent risk factors. According to estimates, for every 1% increase in absolute HbA1c levels in the diabetic population, there is an 18% higher risk of CVD. Even in cases where HbA1c is within the normal range, a positive connection between HbA1c and CVD has been shown in non-diabetic individuals.

Notably different cholesterol values between the two HbA1c groups ($\leq 7.0\%$ and $>7.0\%$). This could mean that, in addition to glycemic management, HbA1c can be utilized as a potential biomarker for dyslipidemia prediction in T2DM patients. As a result, very cheap blood tests can be used to get an early diagnosis and to identify DM patients who are at high risk for prompt lipid-lowering medication treatment.

4.5. Sugar

Among the many different sweet, colorless, and water soluble compounds found in the sap of seed plants and the milk of mammals, sugar is the most basic type of carbohydrates. Sweetened with sucrose, the most common type of sugar used in industries and on tables. There are numerous foods and beverages that contain it.

It is common to refer to all carbohydrates with the general formula $C_n(H_2O)_n$ as "sugar" in chemical terminology. One molecule of glucose and one molecule of fructose combine to form sucrose, a disaccharide commonly known as double sugar. Sucrose's formula, $C_{12}H_{22}O_{11}$, is derived from the general formula $C_n[H_2O]_n - 1$ because one water molecule (H_2O) is lost during the condensation process that unites glucose and fructose.

Even though almost all plants contain sucrose, only sugarcane (*Saccharum officinarum*) and sugar beets (*Beta vulgaris*) have concentrations high enough for profit. Whereas the former is a large grass that thrives in tropical and subtropical locations, the later is a temperate zone root crop.

	Hba1c	Sugar.	P value
	Mean\pmSD mg\dl	Mean\pmSD mg\dl	
Patients	8.971429 \pm 0.24	11.66905 \pm 0.61	0.000001
Health	3.963095 \pm 0.11	3.87710843 \pm 0.11	0.0529877

*mean no significant at (0.05)

4.5.1. Relationship between sugars with HbA1c

When sugar enters your bloodstream, it attaches to hemoglobin, a protein present in red blood cells. There is a sugar component to hemoglobin in all people, but the sugar content increases with blood sugar levels. The A1C test measures the proportion of sugar-coated hemoglobin in your red blood cells.

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