RELATIONSHIP BETWEEN SERUM GLUCOSE AND HEMOGLOBIN CONCENTRATION IN TYPE II DIABETES PATIENTS

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Abstract

Glucose and heamoglobin are nutritional parameters that can signal certain abnormality in patients especially in the presence of diabetes. The co-presence of glucose and heamoglobin in the blood in certain ratio can signal health related problems and solutions. Blood glucose level is the amount of glucose present in the blood of a human. Glucose is the primarily source of energy for the body cells. These monomers are transported from the intestine through hepatic portal vein to other body cells regulated by the hormone. Heamoglobin is the iron containing oxygen transport metalloprotein in the red blood cells of vertebrates as well as the tissue of some invertebrate. The aim of this research is to determined glucose and heamoglobin concentration in type II Diabetes. *The blood glucose of the hundred patients was determined using Chemistry system selectra $_{PRO}$S. The results showed 11 patients with the glucose level 14.2mmol/L have a corresponding heamoglobin concentration of 10-11gm/dL. 56 patients with the glucose level of 12.5mmol/L with a corresponding heamoglobin concentration of 12-13gm/dL, and 33 patients with the glucose level of 10.3mmol/L have a corresponding heamoglobin concentration of 14-15gm/dL. Moreover the mean values of blood glucose and heamoglobin concentration are 12.0 ± 0.3mmol/L and 12.9 ± 0.3gm/dL respectively. From the result obtained, it was observed that as the glucose increased the heamoglobin decreased and vise versa. In conclusion, 56% of the study population are within the normal range and 44% deviate from normal. It was recommended that diabetic patients should give proper attention to avoid low heamoglobin as this may play an health related problem. Patients should regularly check their heamoglobin level and also advice to exercise regularly in order to avoid been obese. HbA1c should be carried out as a marker that can be used to determine average blood sugar of normal individuals.*

Keywords: Diabetes mellitus, blood glucose, haemoglobin, hyperglyceamia, HbA1c Blood Test

I. Introduction

Diabetes is a chronic, incurable disease that occurs when the body doesn't produce any or enough insulin. Which may leads to an excess of sugar in the circulation. Glucose is the main source of fuel for our body. When carbohydrate food is digested it is change into glucose. Sources of carbohydrate include bread, rice, pasta, potatoes, corn, fruit and milk products. Individuals with diabetes should eat carbohydrate but must do so in moderation (Gallagher, Bloomgarden and Roith, 2009). Glucose is then transferred to the blood and is used by the cells for energy. In order for glucose to be transferred from the blood into the cell, the hormone insulin is needed (Roglic et al., 2005). Insulin is produced by the β-cells in pancreas. In individuals with diabetes, this process is impaired. Diabetes develops when the pancreas fail to produce sufficient quantities of insulin. Type II diabetes either insulin produced is defective and cannot move glucose into cells (Goldman *et al*.,2006). Cells need this energy in order to function properly. Sugar builds up in the blood stream and is excreted in the urine. Eventually, the high

blood sugar caused by excessive amounts of glucose in the blood leads to a variety of complications, particularly for the eyes, kidney, nerves, heart and blood vessels (ADA, 2011).

Diabetes mellitus is a chronic endocrine disorder, characterized by hyperglycemia resulting from absolute insulin deficiency. There are a number of different causes of diabetes but by far the majority of cases are classified as either type I or type II diabetes (Roglic et al., 2005). The pathophysiology of type I diabetes derives from the autoimmune destruction of insulin-secreting pancreatic β-cells, resulting in insulin deficiency and subsequent hyperglycemia. Type I diabetes accounts for about 10-15% of all diabetics (ADA, 2011). Type II diabetes is characterized by abnormal insulin secretion due to peripheral resistance and accounts for 85-90% of all persons with diabetes. While type I diabetes usually manifests itself in childhood and type II diabetes at a later stage, clinical manifestation and progression vary considerably and some patients might not be clearly classified as having either type I or II initially. Type I diabetes may occur at any age and with late onset usually shows slower progression, and type II manifests itself more and more often earlier in life, even in childhood and adolescence, sometimes allowing for accurate diagnosis only over time (ADA, 2011).

In the uncontrolled state, both types of diabetes are characterized by increased hepatic glucose output and decreased glucose uptake in the muscles and adipose tissue. Patients with type I diabetes are at risk of severe lipolysis leading to diabetic ketoacidosis (Goldman *et al*.,2006). The remaining insulin activity in type II diabetes usually inhibits lipolysis and ketone production such that these patients are less likely to develop ketoacidosis but are more likely to develop a hyperosmolar, non-ketotic state (Cologiuri, Lee and Balkau, 2011). Worldwide, the incidence and prevalence of diabetes continues to raise due to both an increasing incidence of type I diabetes in children, and of type II diabetes due to lifestyle changes particularly in developing countries of the world (Cologiuri, Lee and Balkau, 2011).

Physical exercise entails multiple physiological and psychological benefits for the diabetic patient (Roglic et al., 2005). In type I diabetes, physical exercise plays a fundamental role in both physical and mental development. In type II diabetes, it is a major factor in improving insulin sensitivity and plasma glucose control. Accordingly, participation in sports should be encouraged and therapy optimized to enable these individuals to meet their full potential (Gallagher, Bloomgarden and Roith, 2009).

Diabetes mellitus is recognized as being a syndrome, a collection of disorders that have hyperglycemia and glucose intolerance as their hallmark, due either to insulin deficiency or to the impaired effectiveness of insulin's action, or to a combination of these. In order to understand diabetes, it is necessary to understand the normal physiological process occurring during and after a meal (Goldman et *al*., 2006). Food passes through the digestive system, where nutrients, including proteins, fat and carbohydrates are absorbed into the bloodstream. The presence of sugar, signals to the endocrine pancreas to secrete the hormone insulin. Insulin causes the uptake and storage of sugar by almost all tissue types in the body, especially the liver, musculature and fat tissues (Roussel, 2005; Cologiuri, Lee and Balkau, 2011).

Unfortunately, there is no cure for diabetes yet but by controlling blood sugar levels through a healthy diet, exercise and medication the risk of long-term diabetes complications can be decreased. Long-term

complications that can be experienced are: eyes, cataracts and retinopathy, that may lead to blindness, kidneys disease and kidney failure, nerves neuropathy, feet-ulcers, infections, gangrene, cardiovascular system hardening of arteries, heart disease and stroke (Heart foundation, 2003).

The progressive nature of the disease necessitates constant reassessment of glycemia control in people with diabetes and appropriate adjustment of therapeutic regimens (Roglic et al., 2005). When glycemia control is no longer maintained with a single agent, the addition of a second or third drug is usually more effective than switching to another single agent (Soumyanath, 2006). Normal values ranges may vary slightly among different laboratories. Many factors affect a person blood sugar level. A body homeostatic mechanism when operating normally, restore the blood sugar level to a narrow range of about *3.6-6.4* mmol/l measured by a fasting blood sugar sample.

The normal blood glucose level (while fasting for non-diabetics should be between 70 and 100mg/dL, the mean normal blood sugar level in human is about 5.5mmol/l. However, this level fluctuates throughout the day. Blood sugar levels for those without diabetes and who are not fasting should be below 125mg/dL. The blood glucose target range for diabetes according to the American Diabetes Association should be 90-130mg/dl before meals and less than 180mg/dl after meal (Davidson et al., 2011). If blood sugar levels remain too high the body suppresses appetite over the short term. Long-term hyperglycemia causes many of the long-term problems including heart disease, eye, kidney, and nerve damage. The most common cause of hyperglycemia is diabetes. When diabetes is the cause, physicians typically recommend an anti-diabetic medication as treatment. From the perspective the majority of patients, treatment with an old, will be the safest, most effective, lease expansive, most comfortable, route of managing the condition (Consumer Report, 2012).

Fasting blood glucose levels may be higher than the post meal blood glucose in many of the healthy subjects. Such individuals may be said to have physiological insulin resistance and may develop diabetes mellitus as long term complication. In clinical and laboratory practice, many of the time a healthy normal subject will present a fasting blood glucose value higher than the post meal blood glucose value. This creates confusion since there is a common perception that in blood, postprandial glucose level should be higher than fasting glucose level. The repeated investigation subsequently yields some-what similar type of result (Warade, 2014). If blood sugar levels drop too low, a potentially fatal condition called hypoglycemia develops. Symptoms may include lethargy, impaired mental functioning; irritability shaking, twitching, weakness in arm and leg muscles, pale completion, sweating, paranoid, aggressive mentality and loss of consciousness.

Mechanisms that restore satisfactory blood glucose levels after extreme hypoglycemia 40mg/dL, must be quick and effective to prevent extremely serious consequences of insufficient glucose. Confusion and seizures, it is far more dangerous to have too little glucose in the blood than too much, at least temporarily. In healthy individuals, blood glucose-regulating mechanisms are generally quite effective, and symptomatic hypoglycemia is generally found only in diabetics using insulin or other pharmaceutical treatment. Hypoglycemia episode can vary greatly between people and from time to time, both in severity and swiftness of onset. For severe case, prompt medical assistance is essential, as

damage to brain and other tissues and even death will result from sufficiently low blood glucose levels (Consumer Report, 2012). The hemoglobin levels are expressed as the amount of hemoglobin in gram (gm) per deciliter (dL) whole blood. The normal ranges for hemoglobin defend on the age and, beginning in adolescence, the gender of the person. The normal ranges are: Newborns: 17 to 22gm/dL, Children: 11 to 13gm/dL, Adult Male: 14 to 18gm/dL and Adult Women: 12 to 16gm/dL

Heamoglobin (Hb), is the iron-containing oxygen-transport metalloprotein in the red blood cells of all vertebrate as well as the tissue of some invertebrates. Hemoglobin in the blood carries oxygen from the respiratory organs to the rest of the body. There it releases the oxygen to permit aerobic respiration to provide energy to power the function of the organism in the process called metabolism (Cagno, 2009). All these values may vary slightly between laboratories. Some laboratories do not differentiate between adult and "after middle age" hemoglobin values. Pregnant females are advised to avoid both high and low as heamoglobin levels to avoid increasing risks of stillbirths caused by high hemoglobin and premature birth or low-birth-weight baby (low hemoglobin) (Michael, 2015). The aims of this research work are to determine the concentration of serum glucose and hemoglobin concentration in Type II diabetes patients and establish the correlation between the two parameters.

II. Materials and Method

***METHOD*:** Cyanmethemoglobin method

Sample Collection

The blood were collected in fluoride oxalate sample container, all the test tubes were properly labeled as; blank, standard and test respectively. The sample was spin in a centrifuge at 3000 rp for 5mins and the plasma separated.

Procedure for Glucose Test

The test tube was arranged Blank, Standard, and Test respectively. 1000 microliter (1ml) of glucose reagent was dispense to respective test tubes and 10 microliter of glucose standard was added into standard test tube and 10 micro liter of plasma was added into test, It was mixed and incubate in water bath at 37˚C for 10 minute and also 1ml of distilled water was added into standard, and it was read calorimetrically at 540nm wavelength.

Procedure for Hemoglobin Estimation

The test tube were arranged and labeled as blank, standard and test, 5mls of drabkins solution was added to all the tube, 0.02ml of blood was added to the test. It was then mixed and allowed to stand for 10mins at room temperature, the absorbance were read at 540nm wavelength.

Study Subjects

A total of hundred (100) individuals were select for this study. The individual selected are from diabetes population of age 40 to 70 years. And both sex were choose with known case of Type II diabetes mellitus.

III. RESULT

Age, sex, glucose and hemoglobin distribution, for relationship between serum glucose and hemoglobin concentration in Type II diabetes mellitus patients**,** were respectively shown below:

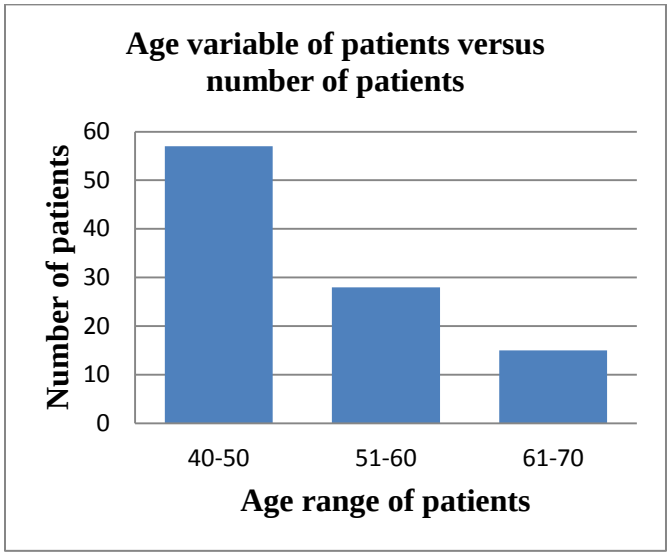

Figure 1: Bar chart presenting Age across their frequency

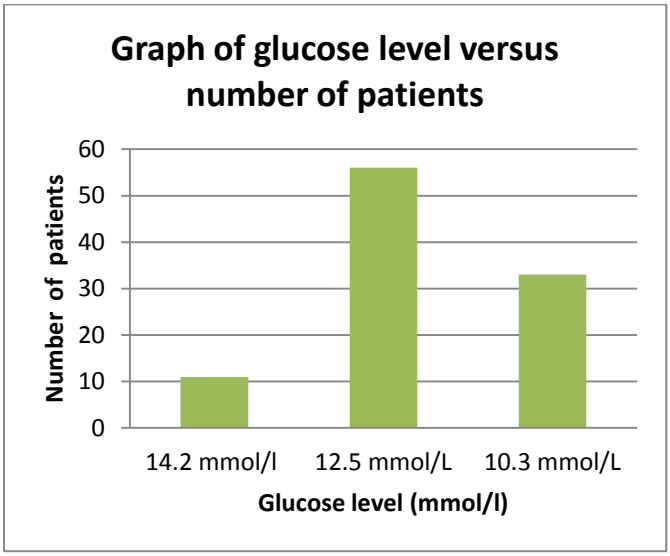

Figure 3: Bar chart presenting serum glucose across their frequency

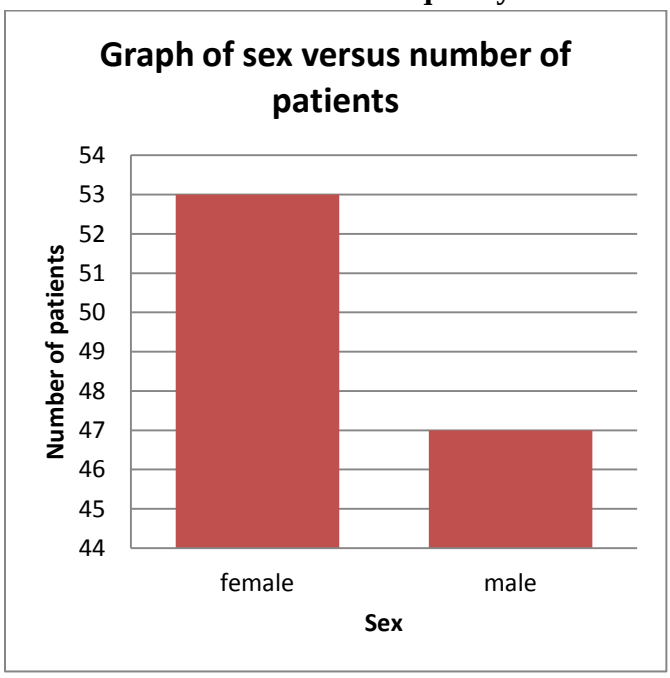

Figure 2: Bar chart presenting sex across their frequency

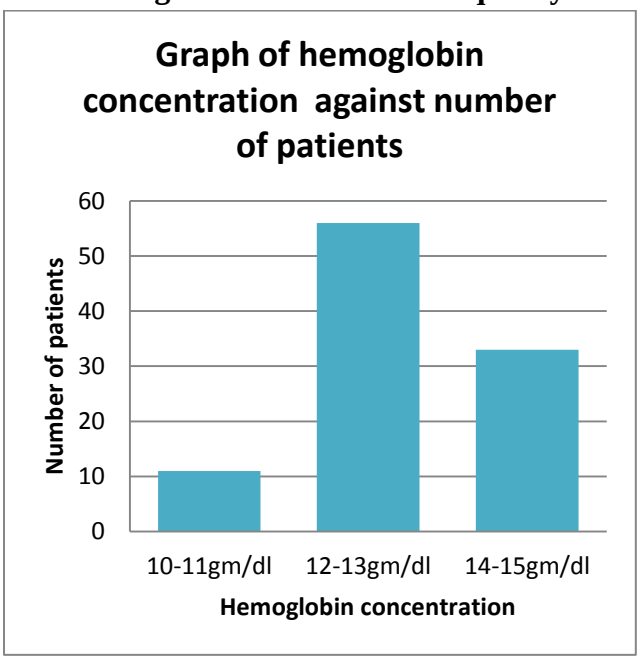

Figure 4: Bar chart presenting hemoglobin concentration across their frequency

IV. DISCUSSION

The study was conducted on hundred (100) subjects who Ages are ranging from 40-70. Sex matched who were classified into two group male = 47 and female =53. From the result obtained female have the

higher glucose level than the male. The findings emphasize how diabetes affects female and male differently. The reasons include the following. Female often receive less aggressive treatment, factors and conditions related to diabetes. Hormones and inflammation act differently in female. Some of the complications of diabetes in female are more difficult to diagnose. Some of the symptoms are unique to female which include Vaginal and oral yeast infections and Vaginal thrush.

The sample of 100 hyperglyceamia were collected for analysis , 11 patients have the highest glucose level 14.2mmol/L which is also kwon as hyperglycemia, long term hyperglycemia causes many of the long term problems including heart disease, eye, kidney, hypertension and nerve damage. High blood sugar food is generally occurring when there is an insufficient amount of insulin in the body. Sometimes, high blood sugar is not the result of diabetes. Other medical condition that can causes the condition include: pancreatitis, pancreatic cancer, hyperthyroidism, unusual tumors that secrete hormones, including glucagonoma, pheochromocytoma. 56 patients, have the corresponding glucose level of 12.5mmol/L which is also high, 33 patients have the corresponding glucose level of 10.3mmol/L. Out of the sample analysed, none of patients have the low glucose level. The normal blood sugar level in human is 4.5mmol/L. The mean values for serum glucose in T2DM are 12.0 ± 0.3 mmol/L in our finding.

Furthermore, 11 patients with hemoglobin ranges between 10-11gm/dL have the lowest hemoglobin. Low hemoglobin levels usually indicate that a person has anemia. Anemia can also be caused by other conditions, such as kidney disease and chemotherapy for cancer, which can also affect the body's ability to make red blood cells. New born have a temporary anemia which they are six to eight (6-8) weeks old. This occurs when they run out of the red blood cells; they are born with but their bodies have not made new red blood cells. This condition will not be affecting the baby adversely unless they are sick for some other reason. Babies can also have anemia from breaking down cells too quickly, which result in yellowing skin, a condition known as jaundice. This often occurs if the mother and baby have incompatible blood types. 56 patients have hemoglobin ranges between 12-13gm/dL which is normal and 33patients also have hemoglobin range between 14-15gm/dL which is also normal. The mean value of hemoglobin in T2DM was 12.9 ± 0.3.

In general, patients with highest average concentration of glucose 14.2 mmol/L have the lowest average concentration of hemoglobin 10-11gm/dL, whereas patients with lowest average concentration of serum glucose 10.5mmol/L have the highest concentration of hemoglobin 14-15gm/dL. The result shows that the higher the serum glucose the lower the hemoglobin and the higher the hemoglobin the lower the serum glucose. Furthermore, the result showed a decrease in mean values of hemoglobin and serum glucose.

V. CONCLUSION

From the result obtained, as the glucose increased the hemoglobin level is decrease from its normal value in type II diabetic sampled, so attention should be given in order to avoid low heamoglobin which can causes anemia such as iron deficiency anemia, pregnancy-related anemia, vitamin-deficiency anemia and heamolytic anemia.

VI. RECOMMENDATIONS

Based on the research finding the following recommendations are made:-

a. In order to avoid high hemoglobin it's recommended that adequate attention be given to serum glucose control. With this, the patient will have less likeness to encounter complication.
b. And also to avoid low hemoglobin level in diabetes, it is recommended that adequate attention be given to serum glucose control.
c. Patient should regularly check their heamoglobin or glycated heamoglobin AbA1c level; Patients should exercise regularly to avoid obesity.

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