Estimation of blood minerals in people overusing sugar and in diabetic groups

Estimación de minerales en sangre en personas que abusan del azúcar y en grupos de diabéticos

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Abstract

Background: Diabetes type 2 (DM-2) is one of the most prevalent forms of the disease, afflicting nearly 90% of the diabetic population in the USA, that is growing gradually without certain and perceptible symptoms. The current study mainly attempts to estimate some blood minerals in people eating too much sugar and in diabetic groups when compared with control groups (healthy people). Methods: The present study was conducted over the course of 19th November to 19th December 2019 in teaching Azadi Hospital and Technical College / Kirkuk. Sixty blood samples were taken from individuals between ages of 20-to 50 years, which were collected from groups that eat too much sugar, the diabetic group, and the control group based on the history, clinical examination, and questionnaire form. 3 mL of fasting venous blood samples without a tourniquet were drawn from each person eating too much sugar group, the diabetic group, and the control group. Serum glucose, calcium, and magnesium were determined by the enzymatic method by using a spectrophotometer. Results: The results of the study demonstrated an increase in fasting blood sugar concentration (104.14mg/dl) in the eating too much sugars group and (197mg/dL) in the diabetic group compared to the control group ($p < 0.05$) Conclusion: The study indicates that there is a substantially low level of serum magnesium and calcium in people consuming too much sugars group and diabetic group which may be an essential factor in the early initiation of the disease in prone and vulnerable people.

Keywords: Diabetes, blood sugar, blood samples, blood minerals.

Resumen

Antecedentes: la diabetes tipo 2 (DM-2) es una de las formas más prevalentes de la enfermedad y afecta a casi el 90 % de la población diabética en los EE. UU., la cual va creciendo paulatinamente sin síntomas ciertos y perceptibles. El estudio actual intenta principalmente estimar algunos minerales en la sangre en personas que consumen demasiada azúcar y en grupos de diabéticos en comparación con grupos de control (personas sanas). Métodos: El presente estudio se llevó a cabo entre el 19 de noviembre y el 19 de diciembre de 2019 en el Hospital y Colegio Técnico Azadi / Kirkuk. Sesenta muestras de sangre se tomaron en personas de edades comprendidas entre 20 a 50 años y ~~se recolectaron~~ de grupos que comen demasiada azúcar, el grupo diabético y el grupo de control según la historia, el examen clínico y el formulario del cuestionario. Se extrajeron 3 mL de muestras de sangre venosa en ayunas sin torniquete de cada grupo que comía demasiada azúcar, el grupo de diabéticos y el grupo de control. La glucosa sérica, el calcio y el magnesio se determinaron por el método enzimático utilizando un espectrofotómetro. Resultados: Los resultados del estudio demostraron un aumento en la concentración de azúcar en sangre en ayunas (104,14 mg/dL) en el grupo que comía demasiados azúcares y (197 mg/dl) en el grupo diabético en comparación con el grupo control ($p<0,05$) Conclusión: El estudio indica que existe un nivel sustancialmente bajo de magnesio y calcio séricos en el grupo que consume demasiados azúcares y en el grupo diabético, lo que puede ser un factor esencial en el inicio temprano de la enfermedad en personas propensas y vulnerables.

Palabras Clave: Kirkuk, glucemia, muestras de sangre, enseñanza Hospital Azadi

Introduction

Diabetes Mellitus is a chronic metabolic disorder characterized by hyperglycemia and sweet urine. Minerals and trace elements are micronutrients that are essential to the human body but present only in traceable amounts. Nonetheless, they exhibit well-defined biochemical functions. Deficiencies in these micronutrients are related to widespread human health problems. Metals are naturally occurring inorganic elements, which are present in very small amounts in the living tissues but are important for the vital process of life[1]. There is mounting evidence that diabetes alters the metabolism of a variety of elements. The symptoms of frequent urination, increased appetite, and increased thirst are caused by an increase in blood sugar levels. Diabetic ketoacidosis and nonketotic hyperosmolar coma can occur if diabetes is left untreated. Long-term issues can lead to renal stroke, heart disease, foot ulcers, kidney failure, and eventually, vision impairment if not treated[2-4].

Type 2 diabetes, obesity, heart disease, and poor dental health due to tooth decay are all linked to sugar consumption[5]. In many cases, an alteration in the metabolism of these minerals was demonstrated[6]. Some trace elements have been found to enhance insulin activity like zinc, magnesium, calcium, vanadium, molybdenum, manganese, and selenium[7]. The activation of insulin receptor sites is one of the proposed mechanisms of trace element enhancement of insulin activity[8]. Providing cofactors or components to enzyme systems included in glucose metabolism[9]. Insulin sensitivity is increased, and antioxidants reduce tissue lipid peroxidation (LPO)[10]. In instances of oxidative stress, LPO is characterized as oxidative damage that directly damages lipoproteins, cellular membranes, and other molecules that contain lipids (OD). The imbalance between reactive oxygen species (ROS) and antioxidant levels is referred to as oxidative stress[11]. The most prominent feature of diabetes metabolism is an abnormally high concentration of blood glucose[12]. People consume way too much sugar in the form of candy, soft drinks, and hidden sugar in our food[13]. Several minerals have been discovered to aid diabetics, either by assisting in the management of risk factors or by having a favorable effect on glucose metabolism. Chromium, magnesium, vanadium, and calcium are among the most important minerals to supplement[14]. The most abundant macro element in the human body is calcium. In the bones and teeth, calcium and phosphorus combine to generate calcium phosphate. Calcium is necessary for nerve and muscle function, and it also plays a role in blood coagulation (as factor IV) and numerous enzymatic functions. Calcium supplementation is critical in the treatment of osteoporosis, a disease that can affect diabetes patients, particularly as they get older. Diabetes mellitus is one of the disorders that increase the risk of developing osteoporosis[15]. Magnesium is a cofactor for several carbohydrate-metabolizing enzymes. It's critical for insulin efficacy. Magnesium also plays an important role in insulin signaling modulation, the phosphorylation of insulin receptor kinase, insulin's post-receptor activity, and insulin-mediated cellular glucose absorption[16]. Insulin resistance, glucose intolerance, dyslipidemia, and diabetes complications have all been linked to it lack. Because of its wide-ranging impact on diabetic management, the link between diabetes and hypomagnesemia is strong[1].

Diabetes UK have claimed that 'home-monitoring is critical in regard to diabetes education for self-management' and NICE have proposed it needs to be taught as a part of integrated self-care[17,18]. On the other hand, Kocot et ak.[19] state that the evidence regarding the efficiency of testing is insufficient and that consensus recommendations aren't proper in that regard.

Thus, the main aim of the study was to evaluate the concentrations of serum calcium and magnesium in people who eat too much sugar and diabetics compared with the control group.

Subject and Patients

Teaching Azadi Hospital and Technical College in Kirkuk performed descriptive cross-sectional research from November 19th to December 19th, 2019. Out of 60 samples, those aged 20 to 50 years were collected and divided into diabetic patients (14 females and 6 males), consuming too much sugar group (12 females and 8 males), and control group (12 females and 8 males). The samples were chosen based on the patient's medical history, and physical examination. All volunteers (control group) were healthy, with no history of systemic disorders and a healthy diet, with no symptoms. The health of those who consume too much sugar was normal, however their diet was unhealthy. In each group, three millimeters of fasting venous blood was collected without the use of a tourniquet. A serum tube was used to measure fasting blood sugar, calcium, and magnesium.

Statistical analysis

The results were presented as means ± standard deviation (mean ± SD) values. The student t-test was used to compare mean values between groups. A P value of ($p < 0.05$) was considered indicative of a statistically significant difference. Moreover, Pearson Correlation is utilized to demonstrate the correlation between diabetic patients and Serum magnesium levels.

There are four main hormones that are primarily responsible for creating those feel-good emotions and sensations. They moderate our feelings of well-being and are influenced by our stress levels, self-care, and lifestyle choices. The main happiness chemicals in the body are: Endorphins which primarily helps one deal with stress and reduce feelings of pain; Serotonin which is a mood stabilizer – wellbeing, happiness; Dopamine is a Pleasure – Motivational role in brain's reward system; and related to Oxytocin bonding – Love and trust.

Although sugar activates the brain's "feel-good hormone," it has certain detrimental consequences for humans, particularly when consumed in excess, which outweighs the benefits to health. Obesity and vitamin D deficiency have previously been linked to the development of insulin resistance[17].

Table 1. Comparison of Diabetic group, consuming too much sugar group and Control group based on mean ± SD. Deviation of glucose levels, calcium, and magnesium level.

Parameters	Diabetic group Mean ±SD	Consuming too much sugar group Mean ±SD	Control group Mean ±SD
S. Glucose (mg/dL)	197±43*	104±6.84*	92.35±6.36
S. Calcium(mmol/L)	7.135±0.7*	7.31±0.8*	8.91±0.428
S. Magnesium(mmol/L)	1.2±0.48	1.23±0.192	2.24±0.356

The current study revealed an increase in fasting blood sugar concentration (104.14mg/dL) in the eating too much sugar group (197mg/dL) and in the diabetic group compared with the control group ($p<<0.05$) (Table 1). Similar findings were observed by Marwa et al.[18] and Kocot et al.[19]. For instance, Marwa's study demonstrated a correlation among calcium, vitD, and magnesium ($r=0.2365,0.4467$) in turn, and inversely correlated with phosphorus ($r=0.4467$), despite the fact that there wasn't any different in the mean of phosphorus, calcium, and magnesium between 2 groups (blood glucose>180mg/dl and blood glucose<180 mg/dl)P-value <0.05. Regarding Kocot's study, in diabetic patients, a weakly negative correlation has been discovered between total Cholesterol and plasma magnesium and also between plasma magnesium and triglycerides. Positive correlations have been revealed between glycosylated hemoglobin and plasma calcium.

In addition, a significant decrease in blood calcium concentration (7.31 mmol/L) in the group who ate too much sugar group and (7.135 mmol/l) in the diabetic group when compared to the control group was observed (Table 1). Thus, an inverse relationship between calcium levels in the blood and diabetic patients was observed. These data are in concordance with those of Sun et al.[20], who demonstrated that serum Ca^2 was significantly and positively correlated with glucose and insulin resistance in non-DM subjects after adjustment for 25-OH vitamin D and PTH.

Also, there was a non-significant decrease in serum magnesium level (1.23 mmol/L) in the eating too much sugar group and (1.2 mmol/L) and in diabetic group compared to the control group. The serum levels of magnesium are inversely proportional related in diabetic patients. This finding agree with the previous study done by Asha and Hiren[21], who clarified that there was a significant reduction of the serum magnesium concentration in type 2 diabetes mellitus. Low magnesium levels may be presumed also to lead to the reduction of protective enzymes against oxidative stress[22-25].

Table 2. Pearson Correlation between diabetic patients and Serum magnesium level

		N	Pearson Correlation	P value
diabetic patients	Magnesium	60	0.192	0.461

P value < 0.05, considered as statistically significant.
P value < 0.001, considered as highly significant.

Table 2 shows the negative correlation between diabetic patients and serum magnesium level, which is statically not significant.

Conclusions

To sum up, the prevailing study tried to analyze and estimate some blood minerals in people overconsuming sugar and in diabetic groups when compared with control groups (healthy people). To that end, Sixty blood samples were obtained from people between aged 20 to 50, which were gathered from groups that consume too much sugar, the diabetic group, and the control group based on the history, clinical examination, and questionnaire form. Serum glucose, calcium, and magnesium were calculated by the enzymatic method utilizing a spectrophotometer.

The study outcomes indicate a rise in fasting blood sugar concentration (104.14mg/dl) in the group overconsuming sugars and (197mg/dL) in the diabetic group in comparison to the control group (p 0.05). It can be concluded that there is a significantly low level of serum magnesium and calcium in individuals eating too much sugars group and diabetic group which could be a influential element in the early initiation of the illness in susceptible individuals.

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