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A Study of Serum Magnesium, Zinc and HbA1c% in Libyan with Type 2 Diabetes Mellitus

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A B S T R A C T

This study conducted during the period from October 2019 to April 2021 in Bani Waleed public hospital, Bani Waleed city, Libya. The 200 Libyan patients with type 2 diabetes mellitus and 50 healthy controls were involved in this study. The objective of this study was to assess the serum levels of Mg, Zn and Hb A1c% in Libyans with type 2 diabetes mellitus in comparison with healthy volunteers. Mg, Zn and Hb A1c were assayed for each participant using standard biochemical methods in the lab. The means of the serum levels of Magnesium and Zinc of the diabetic group were reduced (r:008, p=0.42)when matched to the control group, although the means of the blood levels of Hb A1c%of the diabetic group were considerably increased (r:0.31, p=0.00) when matched to the control group. The study showed a significant low negative between the serum levels of Magnesium and Hb A1c% (r= 0.32, p=0.00), and also showed inconsequential exceptionally low negative relationship between the serum levels of Zinc and Hb A1c% (r= -0.09, p= 0.43). According to the results, it is assumed that the serum levels of Magnesium and Zinc are considerably reduced in Libyan with type 2 diabetes mellitus compared to healthy controls. The serum levels of Magnesium have substantial negative relationship with Hemoglobin A1c% in the diabetic group.

Keywords: Hb1Ac, insulin resistance, diabetes mellitus

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مجلة جامعة فزان العلمية
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دراسة نسبة الماغنيسيوم والزنك و الهيموجلوبين Hb A1c% في السيرم في مرضى السكري من النوع الثاني

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الملخص

أجريت هذه الدراسة خلال الفترة من أكتوبر 2019 إلى أبريل 2021 في مستشفى بني وليد العام بمدينة بني وليد بليبيا. شارك في هذه الدراسة 200 مريض ليبي يعانون من داء السكري من النوع 2الثاني و 50 من الأصحاء. كان الهدف من هذه الدراسة هو تقييم مستويات المصل من الماغنسيوم و الزنك والهيموجلوبين A1c في الليبيين المصابين بداء السكري من النوع الثاني مقارنة بالمتطوعين الأصحاء. تم فحص Mg و Zn و Hb A1cلكل مشارك باستخدام طرق الكيمياء الحيوية القياسية في المختبر. انخفضت متوسطات مستويات الماغنيسيوم والزنك في الدم لمجموعة مرضى السكر(P=0.42, r:00.8) عند مطابقتها مع المجموعة الضابطة ، على الرغم من زيادة متوسط مستويات Hb A1c في الدم في مجموعة مرضى السكري بشكل كبير (P=0.31, r:00.0) عند مطابقة المجموعة الضابطة. أظهرت الدراسة انخفاض معنوي سلبي بين مستويات المغنيسيوم و Hb A1c في الدم(P=0.31, r:00.0) وأظهرت علاقة سلبية غير منطقية منخفضة بشكل استثنائي بين مستويات الزنك في الدم وHb A1c ٪ .(r = −0.09p = 0.43) من النتائج ، يُفترض أن مستويات المصل من المغنيسيوم والزنك تنخفض بشكل كبير في ليبيا مع داء السكري من النوع 2 مقارنة بالضوابط الصحية. مستويات المغنيسيوم في الدم لها علاقة سلبية كبيرة مع الهيموجلوبين A1c ٪ في مجموعة مرضى السكري.

الكلمات المفتاحية: السكرالتراكمي، مقاومة الانسولين، داء السكري

Introduction

Diabetes Mellitus is a clinical disorder characterized by abnormal carbohydrate metabolism leading to elevated risk for atherosclerosis and development of specific micro vascular and neurological problems (1). Type 2 (DM) is displaying the same as the pathophysiological characteristics with Type 1 (DM) but differs in etiology. Also, the nature of both disease complications is typically the same, but duration and

مجلة جامعة فزان العلمية
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appearance time are different from each other. Findings show that the oxidative stress has the highest role in developing problems (2). People with diabetes area at increased risk of cardiovascular, peripheral vascular and cerebrovascular disease (3). The role of trace elements in biological systems begins to focus on fireplace in body's metabolism. Direct association of trace elements with health and disease is already established (4). It is not always obvious whether diabetes mellitus and hyperglycemia affect mineral metabolism or changes in mineral homeostasis influence carbohydrate metabolism (5). Magnesium increases the body's ability to utilize calcium, phosphorus, sodium, potassium, vitamins C, E and B complex (6). Magnesium, meanwhile, has a slight inclination over the plasma, and plays the additional role of amore long-term regulatory element (7). Changes of intracellular or extracellular magnesium concentration can affect cell function through its effect on calcium processing (8). The involvement of Zinc in diabetes mellitus is hardly surprising because Zinc is a key trace element critical for the function of over 300 enzymes including members of all enzyme classes (9). Zinc plays a part in processes like DNA/RNA synthesis, cell division and apoptosis (10). Only 2–4 g of Zinc is present in the human body, and 12–16 μm can be usually measured in plasma, a mobile zinc pool necessary for distribution of Zinc (11). Regarding the slow quantities of Zinc and the importance of this metal for enzyme function, it is logical that Zinc concentration in the human body is strictly regulated by Zinc transporters and Zinc binding proteins like metallothionein (MT), which is capable of tightly binding Zinc on one hand and of releasing the metal dependent on the redox status on the other hand (12-13) .

MATERIALS and METHODS

In this study, we investigated the serum levels of Magnesium, Zinc and blood hemoglobin A1c of 200 patients diagnosed with type 2 Diabetes Mellitus (based on their glucose results) as a test group (113 males and 87 females) and 50 apparently healthy individuals (27 males and 23 females),non-diabetic, as a control group. The test group and the control group have been matched for age and gender. Permission of this study was derived from local health authorities in the study. Interviews were

مجلة جامعة فزان العلمية
Fezzan University scientific Journal
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made to all participants to obtain clinical data and to provide health education. Clinical assessment for each participant was made by a physician. A Questionnaire was designed specifically to obtain information which helps in either including or excluding individuals in or from the study. 5 ml of venous blood were collected from each participant (2.5 mls in lithium heparin for measurement of Serum magnesium and zinc and 2.5 mls in EDTA for determination of HbA1c). Serum magnesium and Zn levels were measured using Biosystem BTS-305 Spectrophotometer(14). Hemoglobin A1c was measured using Ichroma II (15).

Statistical Analysis:

The SPSS (version 11.5) computer analytic tool was used to analyze the data gathered in this study. The averages and standard deviations of serum magnesium, zinc, and blood hemoglobin A1c percent levels were collected for the test and control groups. For comparison, the t-test was utilized (p value of 0.05 was considered significant). Linear regression analysis was utilized to determine the relationship between serum magnesium and zinc levels and hemoglobin A1c percent.

RESULTS:

Table 1 shows that the means of age and height of the test and control groups which are insignificantly different. The same table demonstrates substantial variations between the test and control groups' means of body weight and BMI. The diabetes group had higher (86±17)body weight and (32.6± 3.8)BMI. Table (2) demonstrates substantial variations (0.00) between the test and control groups' serum levels of magnesium, zinc, and blood Hb A1c percent. The serum levels of magnesium and zinc were dramatically lowered(0.94±0.23), although the blood Hb A1c was significantly enhanced(6.0±0.9) .

Table (1): Test group and the control group

Variable	Diabetic group	Control group	P value
Age (Years)	60.3 ±6.9 (45-75)	58.3 ±6.4 (43-71)	0.63*
Body weight (Kg)	86 ±17 (71-133)	75 ±15 (56-95)	0.00*
Height (cm)	174 ±7.5	173 ±9	0.55*

مجلة جامعة فزان العلمية
Fezzan University scientific Journal
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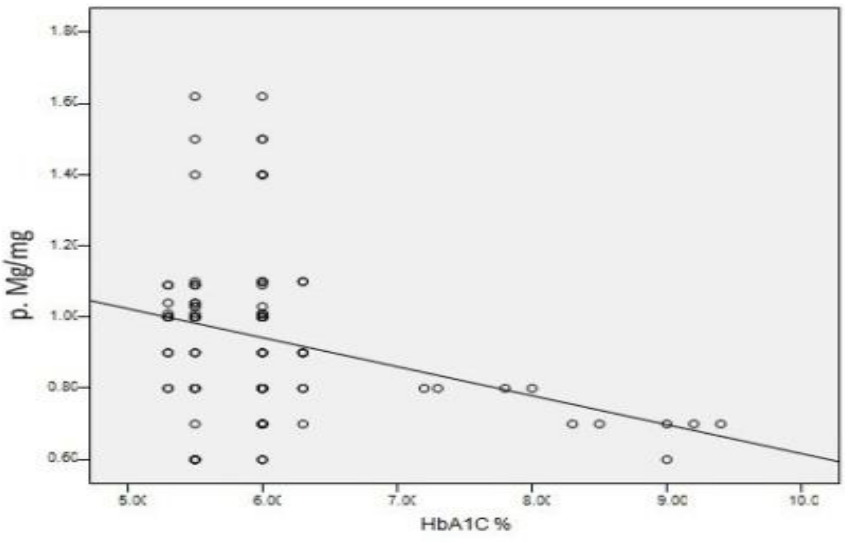
	(155-195)	(153-192)	
BMI (kg/m2)	32.6 ±3.8 (26-45)	24.6 ±4.6 (22-30)	0.00*
Gender Male/ Female	113 (56%) 87 (44%)	27 (54%) 23 (46%)	

Table (2): A cross-check of the means of the serum levels of Mg, Zn and blood HbA1c% of the test group and the controls.

Variable	Diabetic group N=200	Control group N=50	P value
Plasma Mg mg/dl	0.94± 0.23 (0.60-1.62)	1.95 ±0.47 (1.0-3.1)	0.00*
Plasma Zinc mg/dl	80±17 (41-107)	96±13 (61-111)	0.00*
HbA1c%	6.0±0.9 (5.3-9.4)	4.2±0.4 (2.0-5.0)	0.00*

Figure (1) shows considerable weak negative correlation between the serum levels of Magnesium and HbA1c%.



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Fezzan University scientific Journal
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Fig. (1): Ratio between HbA1C% and the serum level of Mg in the diabetic group, (r:0.31, p= 0.00).

Figure (2) shows a negligible very weak negative correlation with serum levels of Zinc and HbA1c%.

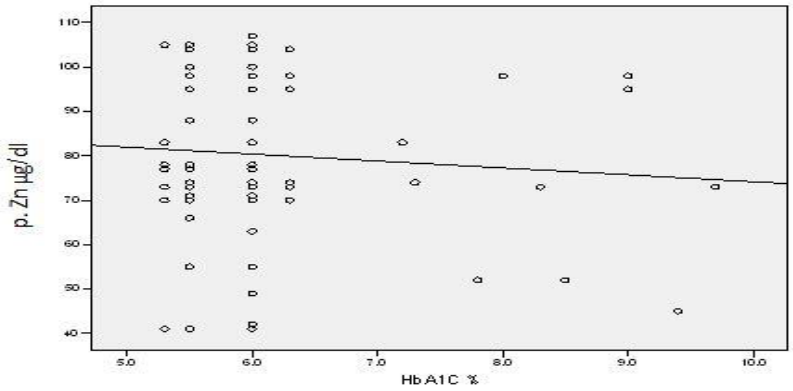

Fig. (2): The relationship between HbA1C% and the serum level of Zn in the diabetic group, (r:-008, p= 0.42).

DISCUSSION:

Diabetes Mellitus is a worldwide metabolic illness that causes significant morbidity and mortality. Recent scientific studies have revealed fresh information regarding the expanding number of metals involved in diverse human biological pathways. A lack or excess of certain microelements in the human body can cause a variety of disorders. (16, 17, 18, 19) Formalized paraphrase Diabetes Mellitus is now a widespread illness with serious medical and societal effects. Recent study has revealed a close relationship between a few eigenelements and Diabetes Mellitus, with implications for the disease's development and vascular consequences. (20, 21, 18, 19, 22) The serum levels of magnesium and zinc in the diabetes group were significantly lower in the current investigation; this drop has been documented by many authors in different countries (23, 24) and may be attributable to magnesium and zinc depletion due to osmotic diuresis or poor food intake. In diabetic participants, Serum zinc concentrations and the zinc-magnesium ratio were lower (24), despite diabetic subjects having lower Serum magnesium. Serum magnesium

مجلة جامعة فزان العلمية
Fezzan University scientific Journal
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concentrations correlated positively with diabetes duration, although there was no correlation between age and Serum magnesium concentrations. In the diabetic group, the current study found a significant weak negative link between blood HbA1c percent and serum magnesium levels, and an insignificant very weak negative correlation between serum zinc levels and Hb A1c percent. This study revealed that low magnesium and zinc levels are associated with poor glycemic control. According to the findings of the current study, patients with diabetes should take magnesium and zinc supplements to prevent long-term diabetes problems**.**

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