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ASSESSMENT OF SERUM MAGNESIUM AND CALCIUM LEVELS IN LONG STANDING TYPE 2 DIABETIC PATIENTS IN ELOBIED CITY

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ABSTRACT

Introduction: Globally, diabetes mellitus is the most prevalent disease among all races and ethnicities, and hence they attach to extraordinary medical important. Mg^{+2} and Ca^{+2} are of the trace elements that have enjoyed numerous experiments owing to involvement with insulin sensitivity and carbohydrate metabolism. **Objective**: to evaluate the serum levels of magnesium and calcium in long standing type 2 diabetes mellitus in comparison to normal healthy individuals. **Materials & Methods**: quantitative, descriptive, cross sectional study, carried in patient with long standing (>10 years) type 2 diabetes mellitus in Elobied Teaching Hospital and Wad Elyas Diabetic Center. Thirty patients with long standing type 2 diabetes mellitus (12male &18female) and thirty apparently healthy (non diabetic) volunteers as control group, age and sex of the test group were matched with that of the control group. The serum levels of magnesium and calcium were measured by using a spectrophotometer technique. **Results:** This study revealed a significant different of the mean levels of the magnesium and calcium of the test group when compared with the control group. **Conclusion**: The current study indicates that determination of magnesium and calcium is of value for diabetics since their serum levels were significantly decreased.

KEYWORDS: Electrolytes, North Kordofan, Diabetes Mellitus.

INTRODUCTION

Diabetes Mellitus (DM) is a chronic disease that occurs when the body cannot produce enough insulin or cannot use insulin effectively. Insulin is a hormone produced in the pancreas that allows glucose from food to enter the body's cells where it is converted into energy needed by muscles and tissues to do their function. A person with diabetes does not absorb glucose properly and glucose remains circulating in the blood (a condition known as hyperglycemia) which damaging body tissues over time. There are three main types of DM: Type 1 diabetes; result of an autoimmune process with very sudden onset and cause an absolute deficiency of insulin secretion (need insulin therapy to survive). Type 1 diabetes can affect children "juvenile diabetes". Type 2 diabetes; the cause is a combination of resistance to insulin action and an inadequate compensatory insulin secretary response; those affected are unaware of the long-term damage being caused by their disease. Gestational diabetes; which appears during pregnancy, can lead to serious health risks to the mother and her infant and increase the risk for developing type 2 diabetes later in life.[1]

Several minerals have been found to benefit people with diabetes, either because they help to cope up with the risk factors, or because of the beneficial effect on glucose metabolism. Amongst the most important minerals for supplementation are chromium, magnesium, vanadium and calcium.[2]

Magnesium is an essential mineral that is involved in many physiological and biochemical processes, especially in relation to cellular bioenergetics. A balanced magnesium status seems to be an important prerequisite for adequate carbohydrate metabolism, while magnesium deficiency has been correlated to type 2 diabetes and its pre-stages.[3] Magnesium is a vital cofactor for many enzymatic reactions and a key player in glucose metabolism and insulin homeostasis. Less than 1% of the total body Mg^{+2} is present in blood, one-third as protein bound, and two-third in ionized form. Small intestine is the main site for magnesium absorption, whereas magnesium excretion is mainly performed through renal pathways.[3]

Calcium is the most abundant intracellular element in the human body, the majority of the body's calcium is stored in the skeleton. Bones account for 99% of the body's calcium. Calcium requirement is dependent on the state of calcium metabolism, which is regulated by three main mechanisms: intestinal absorption, renal reabsorption and bone turnover. These in turn are regulated by a set of

interacting hormones, including parathyroid hormone 1, 25-dihydroxyvitamin D (1, 25(OH)$_2$ D) and Calcitonin in response to ionized calcium itself and their corresponding receptors in the gut, kidney and bone. Calcium is responsible for a wide range of essential functions, including extra-and intracellular signaling, nerve impulse transmission and muscle contraction.[4]

PATIENTS, MATERIALS AND METHODS
This is a quantitative, descriptive, cross sectional study conducted in Elobied Teaching Hospitals and Wad Elyas Diabetic Center in Elobied city during the period from October 2015 to April 2016. A thirty patients with long standing type 2 diabetes mellitus (>10 years) were included as (test group) in addition to thirty apparently healthy volunteers (age & sex matched) were involved as (control group). Permission of this study was obtained from the local authorities in the area of the study. An interview with the patients was done to obtain clinical data and to provide health education by using a questionnaire sheet recorded by each participant in this study. After informed consent, a local antiseptic (70% ethanol) was used to clean the skin. Venous blood (3ml) was taken from each participant in this study by standard procedures. Serum was separated after clot retraction by centrifugation at 3000 rpm for 5 minutes at room temperature. Magnesium and Calcium were measured using spectrophotometric technique. The precision and accuracy of all methods used in this study were checked

in each patch analyzed by including commercially prepared control sera.

Statistical Package for Social Science (SPSS version 20) computer software was used for data analysis. The mean and standard deviations of serum magnesium and calcium concentration were used to compare between the test group and the control group. The P. value was obtained using the (t) test. Correlation between the Serum magnesium, calcium concentration and the duration of the diabetes mellitus were tested by using Pearson correlation. P.value < 0.05 was considered statistically significant.

RESULTS
Table (1) shows a significant difference between the means of the serum levels of Magnesium & Calcium in the test group and control group. (P.value = 0.000, 0.005) respectively.

Figure (1) shows no correlation between the duration of type 2 diabetes mellitus in (years) and the serum magnesium concentration (mg/dl) among patients with long standing type 2 diabetes mellitus (r =0.00, P =0.676).

Figure (2) shows no correlation between the duration of type 2 diabetes mellitus in (years) and the serum calcium concentration (mg/dl) among patients with type 2 diabetes mellitus (r =0.08, P =0.110).

Table 1: Comparison of means of the serum magnesium concentration among the test group and control group.

Variable	Test group n = 30	Control group n = 30	P. value
Serum Magnesium concentration (mg/dl)	(1.89± .27)	(2.09 ± .41)	0.000
Range	(1.4 – 2.4)	(1.8 – 2.4)	
Serum Calcium concentration (mg/dl)	(8.61± .99)	(8.63 ± .45)	0.005
Range	(6.3 – 10.3)	(8.2 – 10.2)	

- The table shows the mean ± SD, range in brackets () and probability (P. value).
- T-test was used for comparison.
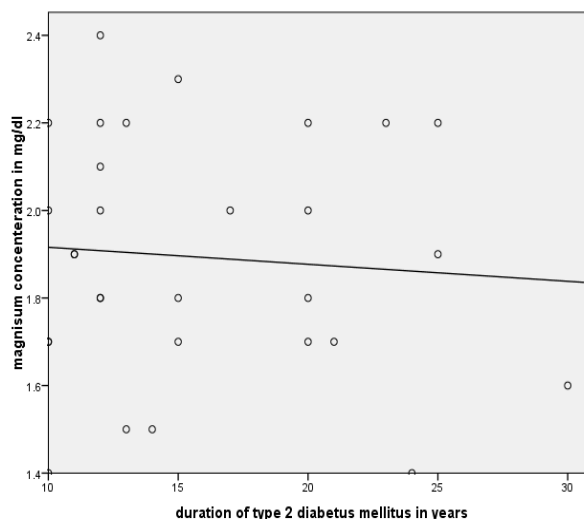- P. value ≤ 0.05 is considered significant.

Fig 1: The relationship between the duration of long standing type 2 diabetes mellitus in (years) and the serum magnesium concentration (mg/dl) (r =0.00, P =0.676).
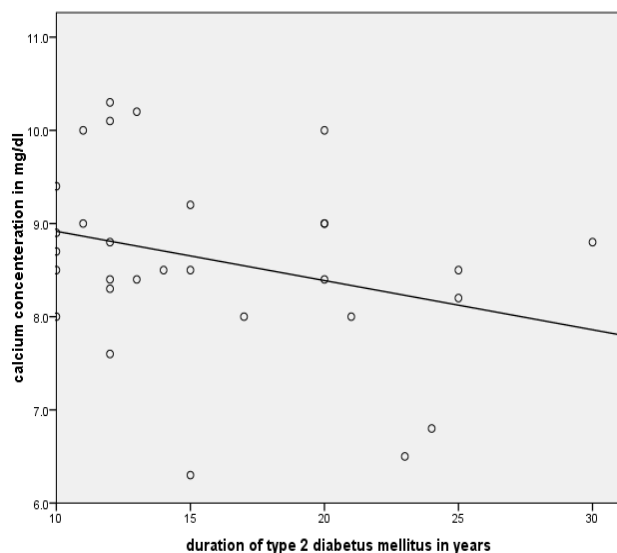
Fig 2: The relationship between the duration of long standing type 2 diabetes mellitus in (years) and the serum calcium concentration (mg/dl). (r =0.08, P =0.110).

DISCUSSION
Diabetes Mellitus is a chronic metabolic disorder characterized by hyperglycemia and sweet urine. 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. There is accumulating evidence about the alteration in the metabolism of many elements in diabetes.[5]

In the current study there is a significant difference between the mean of the serum magnesium in the test group when compared with that of the control group, the mean of the test group is significantly reduced as shown in (Table 1) (P. value = 0.000). This may be due to increase urinary loss of magnesium among long standing type 2 diabetic patients. This hypomagnesaemia may be a possible risk factor in development and progress of diabetic complications. This agrees with previous study.[6] who reported that; there was a significant reduction of the serum magnesium concentration in type 2 diabetes mellitus.

Furthermore this study there is a significant difference between the mean of the serum calcium in the test group when compared with that of the control group, the mean of the test group is significantly reduced as shown in (Table 1) (P. value = 0.005) . The calcium reduction in this study may be due to changes in calcium in primary insulin target tissues contribute to alterations in insulin action. This agrees with previous study[7] who reported that; there was a significant reduction of the serum calcium concentration in type 2 diabetes mellitus.

CONCLUSION
From this study it was concluded that; there was a significant different in the means of serum levels of magnesium and calcium in long standing type 2 diabetes

group when compared with healthy control group with no correlations of magnesium and calcium with the duration of diabetes mellitus. Hypomagnesaemia and hypocalcaemia occur at an increased frequency among patients with type 2 diabetes mellitus.

Recommendations
1. Magnesium and Calcium concentrations need for special attention among diabetic patients.
2. Dietary supplementation with magnesium and calcium in addition to classical therapies for diabetes may help in prevention or delaying of diabetic complication.
3. Regular follow up of diabetics patients to avoid diabetes mellitus complications as possible.

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