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Measurement of Serum Magnesium in Type 2 Diabetes Mellitus

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Abstract:

Background*: Diabetes is global disease, rising on the waves of increasing obesity and increasing age in developing countries. Type 2 diabetes mellitus is currently estimated to affect 285 million people, rising to 435 million; 6.6% of people aged 20–79 years are believed to be affected. (2) Magnesium plays a key role in regulating insulin action, insulin-mediated-glucose uptake and vascular tone(5).*

Methodology: *This is comparative cross sectional study. Study was conducted hospital in Khartoum state**.** In this study 50 diabetic patients. Their age varied from20 to 80 years, and there were 50 healthy controls with age group of 20 to* ***80*** *years. Blood glucose and serum magnesium was done in these patient's fasting blood samples. Blood glucose was measured using bioSystem reagent and serum magnesium was measured by cobas 311. Results: The mean of serum magnesium concentrations for patients and control was 1.768mg/dl and 1.94 mg/dl respectively. Plasma magnesium was*

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found to be lower in case group compared to control group with P value =0.00.

Conclusion: *There is association between hypomagnesemia and risk of type 2 diabetes mellitus.*

Key words: Magnesium, Diabetes, Sudan

INTRODUCTION

Diabetes mellitus is a group of metabolic disorders characterized by hyperglycaemia resulting from defect in insulin secretion, insulin action or both.(1) Diabetes is global disease, rising on the waves of increasing obesity and increasing age in developing countries. Type 2 diabetes mellitus is currently estimated to affect 285 million people, rising to 435 million; 6.6% of people aged 20–79 years are believed to be affected. Although quantitatively less important, type 1 diabetes is also on the increase in many populations, and has doubled its incidence in Europe over the past 20–25 years.(2)

In turn, the rise in diabetes is expected to influence cardiovascular morbidity and mortality. In 2013, 382 million people had diabetes; this number is expected to rise to 592 million by 2035. Most people with diabetes live in low- and middle-income countries and these will experience the greatest increase in cases of diabetes over the next 22 years.(2) in Sudan The crude prevalence was 3.4% (men, 3.5%; women, 3.4%) for diabetes and 2.9% (men, 2.2%; women, 3.3%) for impaired glucose tolerance (IGT). The highest crude prevalence was in the northern parts of Sudan (5.5%) and the lowest in the western desert-like parts (0.9%).(3)

Magnesium is a cofactor in more than 300 enzyme systems that regulate diverse biochemical reactions in the body, including protein synthesis, muscle and nerve transmission, neuromuscular conduction, signal transduction, blood glucose control, and blood pressure regulation.(4) Magnesium plays a key role in regulating insulin action, insulin-mediated-glucose

uptake and vascular tone[5] Diabetes mellitus has been suggested to be the most common metabolic disorder associated with magnesium deficiency.[6]

There are a number of reports in the literature examining the between hypomagnesemia and type 2 diabetes mellitus. One of the studies done by Jayaraman SMT, et al in 2016 to assess the levels of serum magnesium among newly diagnosed type 2 diabetes patients and its correlation with their glycemic status. They conclude that hypomagnesaemia was present in patients with type 2 DM .[7] In a subsequent study by Velayutharaj A et al. in 2016, serum magnesium was significantly lower in type 2 DM patients. [8]

Another recent study by Ramadass S et al. in 2015, serum magnesium levels were decline with rise in HbA1C levels and with duration of diabetes mellitus. [9] Hata A etal (2013) determine the association between magnesium intake and incidence of type 2 diabetes mellitus, they found that incidence of type 2 diabetes significantly decreased with increasing magnesium intake. [10]

MATERIAL AND METHOD

This is a comparative cross sectional study based on data collected by direct interview based questioner and results of blood samples in different hospital in Khartoum state.

The data were collected by hospitals and clinics between November 2016 and March 2017. And the study was approved by the University of Medical Science & Technology Ethics Committee. The selected subject represented the Sudanese population geographically, east, west, north, south, and central location of Sudan.

100 subjects were enrolled in the study, 50 diabetic patients and 50 health people with exclude patients with GIT disorder, renal disorder, endocrine disorder, cardiovascular and bone disorder.

For internal quality control, normal and pathological control sera were included in every batch of chemical analysis.

Data was analyzed using the Statistical Package for the Social Sciences (SPSS). Values are expressed as mean. The level $p<0.05$ was considered as the cut off value for significance.

RESULTS

50 patients with type 2 diabetes mellitus as a test group and 50 apparently healthy Sudanese volunteers as control group were involved in this study. Both groups were matched for age and sex. Table (1).

3.1 Blood glucose:

The mean of blood glucose concentrations for patients and control was 152.64 mg/dl and 97.68 mg/dl respectively. (Table 2) Plasma glucose was found to be higher in case group compared to control group. There was significance different between case and control (P value =0.00) .Table (3).

3.2 Serum magnesium:

The mean of serum magnesium concentrations for patients and control was 1.768mg/dl and 1.94 mg/dl respectively. (Table 2) Plasma magnesium was found to be lower in case group compared to control group. There was significance different between case and control (P value =0.00). Table (3).

Table (1) gender distribution in cases and control

		Case		Control	
		Frequency	**Percent**	**Frequency**	**Percent**
Gender	Male	25	50	29	58
	Female	25	50	21	42
	Total	50	100	50	100

Table (2) mean and standard deviation of Glucose and Mg level in cases and control:

	PARAMETER	Number	Minimum	Maximum	Mean	Std. Deviation
Case	Glucose	50	80	350	152.64	58.516
	Mg	50	1.3	2.2	1.768	0.2104
Control	Glucose	50	74	119	97.68	13.312
	Mg	50	1.4	2.4	1.94	0.2109

Table (3) comparison in Glucose and Mg level between cases and control:

	Type	Number	Mean	Std. Deviation	Sig.
Mg	Case	50	1.768	0.2104	0.000
	Control	50	1.94	0.2109	
Glucose	Case	50	152.64	58.516	0.000
	Control	50	97.68	13.312	

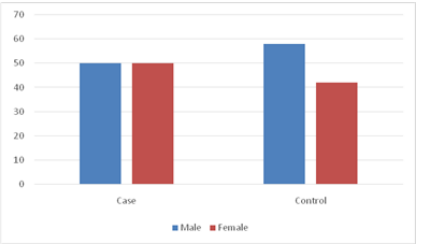

Figure (1) gender distribution in cases and control.

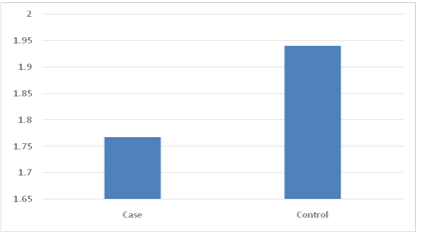

Figure (2) mean Mg level in cases and control.

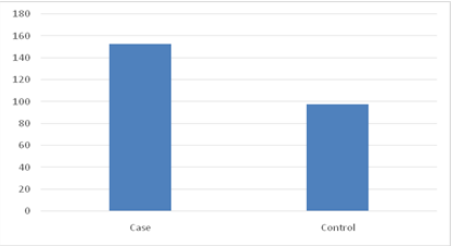

Figure (3) mean glucose level in cases and control.

DISCUSSION

Hypomagnesaemia is known to occur among patients with type 2 diabetes compared with those who are non-diabetics. [9] It has been linked to the development of diabetes mellitus as well as poor glycemic control.[7] The objective of this study was to assess the levels of serum magnesium in type 2 diabetes patients .

In this study serum magnesium level in type 2 diabetes patient was considerably lower than in health control, and this agree with Jayaraman SMT [7], VelayutharajA [8], Ramadass S[9] and Resnick LM, etal [11].

The reason why magnesium deficiency is common in diabetic patient include increase urinary losses of magnesium due to polyuria, the other reason could by lower dietary magnesium intake or lower magnesium absorption, as Konishi K,et al. [12] and Hruby A, et al.[13] reported.

Patient with type 2 diabetes may have a complication such as cardio vascular disease, nephropathy and retinopathy. Some studies show that hypomagnesaemia may increase the risk of diabetes complication, as Velayutharaj A, et al. [8] reported.

Increase magnesium intake or take magnesium supplement may improve insulin sensitivity, as Hata A, [10] and Rodriguez-Moran M. et al. [14] reported.

CONCLUSION

This study concludes that, there is association between hypomagnesaemia and risk of type 2 diabetes.

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