

**ORIGINAL RESEARCH**

# Serum magnesium concentration in patients with type 2 diabetes mellitus

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**ABSTRACT**

**Background:** The present study was undertaken for assessing the serum magnesium levels in diabetic patients. **Materials & methods:** A total of 50 diabetic subjects were enrolled. Another set of 50 subjects were included as healthy controls. Complete demographic and clinical details of all the subjects was obtained. Blood samples were obtained and serum magnesium levels were evaluated by using auto-analyser. All the results were recorded in Microsoft excel sheet and were analysed using SPSS software. **Results:** Mean serum magnesium levels among subjects of diabetic group and control group was 1.95 mg/dL and 2.39 mg/dL respectively (p-value < 0.00.) Significant results were obtained while correlating serum magnesium levels with glycemic profile. Hypomagnesemia was seen in 36 percent of the subjects. **Conclusion:** A significant decrease in the serum magnesium levels in patients with Type 2 DM was seen; hence it is important to insist magnesium supplementation on uncontrolled Type 2 diabetes.

**Key words:** Diabetes mellitus, Magnesium

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**INTRODUCTION**

Diabetes mellitus is a group of metabolic diseases characterized by chronic hyperglycemia resulting from defects in insulin secretion, insulin action, or both. Metabolic abnormalities in carbohydrates, lipids, and proteins result from the importance of insulin as an anabolic hormone. Low levels of insulin to achieve adequate response and/or insulin resistance of target tissues, mainly skeletal muscles, adipose tissue, and to a lesser extent, liver, at the level of insulin receptors, signal transduction system, and/or effector enzymes or genes are responsible for these metabolic abnormalities.<sup>1</sup>

Symptoms of marked hyperglycemia include polyuria, polydipsia, weight loss, sometimes with polyphagia, and blurred vision. Impairment of growth and susceptibility to certain infections may also accompany chronic hyperglycemia. Acute, life-threatening consequences of uncontrolled diabetes are hyperglycemia with ketoacidosis or the nonketotic hyperosmolar syndrome.<sup>2,3</sup>

Magnesium (Mg) is an electrolyte of chief physiological importance in the body, being the most abundant divalent intracellular cation in the cells, the second most abundant cellular ion next to potassium and the fourth cation in general in the human body.<sup>4</sup> Mg deficiency can be present without

hypomagnesemia. However, hypomagnesemia, when present, is usually indicative of an important systemic Mg deficit. A depletion in intracellular and/or ionized plasma Mg can be found in individuals with normal total serum Mg. However, most of the studies in the literature have measured total serum Mg instead of the free, ionized (bioactive) or the intracellular Mg concentrations, which make it a challenge to correlate Mg deficits to diseases.<sup>5,6</sup> Hence; under the light of above-mentioned data, the present study was undertaken for assessing the serum magnesium levels in diabetic patients.

**MATERIALS & METHODS**

The present study was undertaken for assessing the serum magnesium levels in diabetic patients and its correlation with HbA1c levels. A total of 50 diabetic subjects were enrolled. Another set of 50 subjects were included as healthy controls. Complete demographic and clinical details of all the subjects was obtained. Blood samples were obtained and serum magnesium levels were evaluated by using auto-analyser. All the results were recorded in Microsoft excel sheet and were analysed using SPSS software.

## RESULTS

Mean age of the patients of diabetic subjects and control group was 49.5 years and 45.8 years respectively. Majority proportion of subjects of both study group and control group were males. Mean serum magnesium levels among subjects of diabetic

group and control group was 1.95 mg/dL and 2.39 mg/dL respectively (p-value < 0.00.) Significant results were obtained while correlating serum magnesium levels with glycemic profile. Hypomagnesemia was seen in 36 percent of the subjects.

**Table 1: Serum magnesium levels**

Magnesium levels (mg/dL)	Diabetic group	Control group
Mean	1.95	2.39
SD	0.45	1.85
p- value	0.00 (Sig)	

**Table 2: Correlation of Serum Magnesium level with glycemic profile**

Variable	r- value	p- value
FBS	-0.775	0.0004 (Sig)
HbA1c	-0.458	0.0001 (Sig)

**Table 3: Prevalence of Hypomagnesemia**

Hypomagnesemia	Number of present	Percentage
Present	18	36
Absent	32	64
Total	50	100

## DISCUSSION

Magnesium (Mg) has a critical role in the actions of important enzymes and is the fourth most abundant cation in the human body. It is claimed that there is an inverse relationship between Mg intake and incidence of diabetes mellitus (DM). Mg deficiency is common in diabetic patients. The incidence of hypomagnesemia varies between 11 and 47.7%. Compared with the control group, incidence of hypomagnesemia in newly diagnosed diabetes is 10.5-fold and in patients with previously diagnosed diabetes is 8.5-fold more common.<sup>7-10</sup>

Mean age of the patients of diabetic subjects and control group was 49.5 years and 45.8 years respectively. Majority proportion of subjects of both study group and control group were males. Mean serum magnesium levels among subjects of diabetic group and control group was 1.95 mg/dL and 2.39 mg/dL respectively (p-value < 0.00.) Significant results were obtained while correlating serum magnesium levels with glycemic profile. Hypomagnesemia was seen in 36 percent of the subjects. Prabhu G et al estimated serum magnesium level of patients with diabetes mellitus and correlated between serum magnesium levels and glycemic control, duration of diabetes and its complications. 132 Type 2 DM patients included in the study was estimated with serum magnesium level and compared with the age matched control group. The mean serum magnesium was 1.74+ 0.32mg/dl. Of the patients, 33(25%) had low serum magnesium levels (less than or equal to 1.5mg/dl). They observed that serum magnesium levels were lower in patients with increasing duration of diabetes. Out of the 19 patients who had hypomagnesaemia, 18 patients had HbA1c > 7 %. This correlates between hypomagnesaemia and poor

glycemic control. Serum magnesium level was low in Type 2 DM; serum magnesium was low in patient with poor glycemic control.<sup>11</sup>Batar PK et al, in another study, estimated level of serum magnesium in the development and progression of DM Type 2 and its complications. 50.4% of the patients were males and 49.6% were females. Overall, mean age of the study population was 48± 18 years. The mean BMI of the study population was 26.43 + 5.11 kg/m<sup>2</sup>. In their study majority of the patients with hypomagnesemia Mg < 1.7mg/ dl were having diabetic complication, mainly microvascular complications. Patient with hypomagnesemia were showing significant association with nephropathy (p < 0.001, r= -0.48), neuropathy (p < 0.009), retinopathy (p < 0.007) and cardiovascular disease (p < 0.001). Their study did not show significant correlation with hypertension and cerebrovascular events. Measurement of serum magnesium should be considered in patients whose blood sugar is uncontrolled with anti diabetic drugs or insulin, as hypomagnesemia may be a cause for micro vascular complications of diabetes.<sup>12</sup>Guerrero – Romero F et al suggested that hypomagnesaemia by a etiopathogenic pathway independent of glycemic status may be involved in the reduction of HDL – cholesterol.<sup>13</sup> Lipinski B, Lipinski L et al studied the effect of magnesium on fibrin formation from low molecular weight fibrinogen and they found that the circulating fibrinogen in human blood is comprised of high molecular weight (HMW) and lower molecular weight fractions (LMW). LMW fraction of fibrinogen was significantly increased in diabetic patients.<sup>14</sup>

## CONCLUSION

A significant decrease in the serum magnesium levels in patients with Type 2 DM was seen; hence it is

important to insist magnesium supplementation on uncontrolled Type 2 diabetes.

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