



## A STUDY OF MAGNESIUM SUPPLEMENTATION ON FASTING BLOOD GLUCOSE IN PATIENTS OF DIABETES MELLITUS TYPE-2



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### Abstract

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The study was done in 60 diabetic patients. These patients were divided into two groups, Group I (n=30) receiving Magnesium and Metformin therapy for a period of 16 weeks and Group II (n=30) receiving only Metformin therapy. The blood samples were collected and analyzed for Serum Magnesium and fasting blood glucose at 0, 4, 8, 16 weeks respectively. In GROUP I Mean Baseline value for S. Magnesium is  $1.79 \pm 0.032$  and after treatment values at 16 weeks  $1.92 \pm 0.034$ . In this group we observed that S. Magnesium values before and after 16 weeks of magnesium supplementation was highly significant. In GROUP II Mean Baseline value for S. Magnesium is  $1.79 \pm 0.031$  and after treatment values at 16 weeks is  $1.82 \pm 0.030$ . In this group there was no significant difference in S. Magnesium between before and after 16 weeks of treatment. In our study values for Mean fasting blood glucose level in group I before treatment (i.e. first visit) was  $146.33 \pm 1.60$  mg/dl as compared to  $127.07 \pm 0.96$  mg/dl values of after treatment. This difference was considered highly Significant between before and after treatment values for fasting blood glucose levels ( $p < 0.001$ ) In group II values for mean fasting blood glucose level before treatment (i.e. first visit) was  $145.5 \pm 1.81$  mg/dl as compared to  $136.53 \pm 1.31$  mg/dl values of fasting blood glucose after treatment. This Difference was also considered Significant.

## **INTRODUCTION:**

Magnesium is the fourth most abundant mineral in the body and is essential to good health. Approximately 50% of its total in the body is found in bone. The other half is found predominantly inside cells of body tissues and organs. Only 1% of it is found in blood, but the body works very hard to keep blood levels at its constant. It is needed for more than 300 biochemical reactions in the body. It helps maintain normal muscle and nerve function, keeps heart rhythm steady, supports a healthy immune system, and keeps bones strong. It also helps regulate blood sugar levels, promotes normal blood pressure, and is known to be involved in energy metabolism and protein synthesis. There is an increased interest in its role in preventing and managing disorders such as hypertension, cardiovascular disease, and diabetes.

Magnesium plays an important role in carbohydrate metabolism. It may influence the release and activity of insulin. Individuals with poorly-controlled diabetes may benefit from its supplements because of increased loss of magnesium in urine associated with hyperglycemia. Low serum

and intracellular magnesium concentrations are associated with insulin resistance, impaired glucose tolerance, and decreased insulin secretion <sup>[1]</sup>. There is a strong relationship between magnesium and insulin action and it is important for the effectiveness of insulin. Magnesium deficiency is the most evident disturbance of metal metabolism in diabetes mellitus. Hypomagnesaemia has been linked both to the acute metabolic and late chronic complication of diabetes <sup>[2]</sup>. Without insulin magnesium doesn't get transported from our blood into our cells where it is most needed. A study observed that the plasma magnesium level has been shown to be inversely related to insulin sensitivity <sup>[3]</sup>. Insulin-mediated glucose disposal is decreased in normal subjects with relatively low plasma magnesium concentrations <sup>[4]</sup>. Oral magnesium supplementation improves both insulin sensitivity and metabolic control in type 2 diabetic subjects with decreased serum magnesium levels <sup>[5]</sup>. Higher intake of magnesium has been shown to improve glucose and also insulin homeostasis <sup>[6]</sup>. So it would be prudent for physicians who treat diabetic patients to consider magnesium deficiency as a

contributing factor in many diabetic complications and as a main factor in exacerbation of the disease itself [7]. We observed that role of magnesium is crucial in treatment and prevention of diabetes mellitus and a few studies [8] emphasize the role of magnesium in diabetes but not much work has been done in India. So we conducted this study to strengthen the role of magnesium supplementation in diabetes mellitus.

#### **MATERIAL AND METHODS**

This study was carried out in the Department of Physiology and Department of Neurology, S.N. Medical College and Associated Hospitals Agra, over a period of 18 months in diabetic patients attending the Diabetic clinic from February 2009 to August 2010. The study patients (n=60) were divided into 2 groups. Group I consists of 30 Diabetic patients receiving Magnesium Supplementation and Metformin therapy for a period of 16 weeks. Group II consists of 30 diabetic patients of comparable age and sex receiving only Metformin therapy.

All Patients were subjected to a Detailed History and thorough Clinical Examination.

They were thoroughly examined and investigated for Fasting Blood Sugar, S. Magnesium, at first visit (0 weeks) and subsequently these tests were repeated at 4, 8, 16 weeks respectively. For evaluating the level of improvements in fasting blood glucose levels, the type II Diabetic patients who were attending O.P.D of diabetic clinic S.N Medical College, Agra were divided into two groups:

**Group-I:** was given Magnesium supplementation (Magnesium chloride sustained release tablets) in the doses of 300 mg/d along with Metformin drug for a period of 16 weeks.

**Group-II:** was given only Metformin for a period of 16 weeks. They were not given any Magnesium supplementation. Group II patients were of comparable ages were of normal weight for height, on usual diet with no drug taken at the time of examination. Renal and liver function test were normal.

Average dose of Metformin was 1 g/day.

#### **INCLUSION CRITERIA:**

1. A known case of diabetes mellitus.

2. Patient showing evidences of diabetes mellitus after being investigated for blood sugar.

#### **EXCLUSION CRITERIA:**

1. Patients of diabetes mellitus with altered sensorium or disturbed mental state.
2. Patients of diabetes mellitus having any other complication of diabetes like coma.
3. Patients with diabetes mellitus having very high blood sugar level and is on insulin therapy.
4. Patients showing abnormal levels of blood urea, S. Creatinine, Abnormal liver function- tests.

#### **OBSERVATION**

**Table No. 1:** Depicts the Before treatment values (Baseline) of S. Magnesium (mg/dl) and after treatment values for Group I and GROUP II at 4 weeks, 8 weeks, 16 weeks respectively.

In GROUP I; Mean Baseline value for S. Magnesium is  $1.79 \pm 0.032$  and after treatment values at 4 weeks is  $1.82 \pm 0.031$ , 8 weeks  $1.86 \pm 0.033$ , at 16 weeks  $1.92 \pm 0.034$  respectively. In this group we observed that S. Magnesium values before and after 16

weeks of magnesium supplementation was significant.

In GROUP II; Mean Baseline value for S. Magnesium is  $1.79 \pm 0.031$  and after treatment values at 4 weeks is  $1.79 \pm 0.030$ , 8 weeks  $1.81 \pm 0.030$ , at 16 weeks  $1.82 \pm 0.030$  respectively. In this group there was no significant difference in S. Magnesium between before and after 16 weeks of treatment.

Table No 2: Depicts the baseline values (before treatment) of fasting blood glucose (in mg/dl) and after treatment values for Group I and GROUP II at 4 weeks, 8 weeks, 16 weeks respectively.

In GROUP I; Mean Baseline value for fasting blood glucose is  $146.33 \pm 1.60$  and after treatment values at 4 weeks is  $140.63 \pm 1.47$ , 8 weeks  $134.40 \pm 1.25$ , at 16 weeks  $127.07 \pm 0.96$  respectively. This difference between before and after treatment was considered highly significant.

In GROUP II; Mean Baseline value for fasting blood glucose is  $145.5 \pm 1.81$  and after treatment values at 4 weeks is  $142.23 \pm 1.44$ , 8 weeks  $139.91 \pm 1.45$ , at 16 weeks  $136.53 \pm 1.31$  respectively. This difference was also significant.

**DISCUSSION:**

In present study mean serum magnesium level in group I before treatment was  $1.79 \pm 0.032$  mg/dl as compared to after treatment values  $1.92 \pm 0.034$  mg/dl in group I Patients. This difference was considered statistically significant ( $p < 0.05$ ).

In group II before treatment values of Mean Serum magnesium level was  $1.79 \pm 0.031$  mg/dl as compared to after treatment  $1.82 \pm 0.030$  mg/dl values of Serum Magnesium. This difference was statistically insignificant. Thus from our study it can be said that hypomagnesaemia occurs in patients with type 2 diabetes and in such patients if magnesium is supplemented then normal values for S. magnesium are restored. Similar results were obtained by the following studies: serum magnesium was decreased in Diabetes mellitus type 2 patients. <sup>[9]</sup> A study concluded that oral magnesium supplementation improves both insulin sensitivity and metabolic control in type 2 diabetic subjects with decreased serum magnesium levels. <sup>[10]</sup>

In present study values for Mean fasting blood glucose level in group I before treatment (i.e. first visit) was  $146.33 \pm 1.60$

mg/dl as compared to  $127.07 \pm 0.96$  mg/dl values of after treatment. This difference was considered highly significant ( $p < 0.001$ ).

In group II values for mean fasting blood glucose level before treatment (i.e. first visit) was  $145.5 \pm 1.81$  mg/dl as compared to  $136.53 \pm 1.31$  mg/dl values of fasting blood glucose after treatment. This Difference was considered significant ( $p < 0.05$ ). Thus from these observations it can be said that magnesium supplementation is effective in reducing fasting blood glucose levels.

Almost similar results were obtained by the following studies:

Oral magnesium supplementation for 4-16 weeks may be effective in reducing plasma fasting glucose levels in patients with Type 2 Diabetes. <sup>[11]</sup> A Study documented that daily oral magnesium supplementation substantially improved insulin sensitivity by 10% and reduced blood sugar by 37% <sup>[12]</sup>. Another Study suggested that young adults with higher magnesium intake have lower risk of development of metabolic syndrome. <sup>[13]</sup> A Study documented that chronic magnesium deficiency has been associated with the development of insulin resistance. <sup>[14]</sup>

Thus it can be concluded from the present study that Magnesium supplementation along with regular anti-diabetic therapy improves S. Magnesium and Fasting blood glucose levels in type 2 diabetes mellitus

patients. A major limitation of our study was relatively small sample size with diabetic patients. So further study involving large number of diabetic patients should be done.

**Fasting Blood Glucose (mg/dl) - Diagnostic criteria for diabetes mellitus laid by American Diabetes Association 2004:**

Normoglycemia	Impaired fasting glucose or Impaired glucose tolerance	Diabetes mellitus (DM)
Fasting blood glucose < 110 mg/ dl	Fasting glucose mg/dl blood 110 – 125 mg/dl	Fasting blood glucose > 126 mg/dl
2 hrs. postprandial blood glucose < 140mg/dl	Postprandial blood glucose =140-199 mg/dl	Postprandial blood glucose level > 200mg/dl ± sign/symptoms suggestive of DM

**TABLE NO. 1: S.MAGNESIUM (mg/dl) BEFORE AND AFTER TREATMENT**

	GROUP I (n=30)				GROUP II (n=30)			
	Before treatment	After Treatment			Before T/t	After Treatment		
		4 weeks	8 weeks	16 weeks		4 wk	8 wk	16 wk
Mean	1.79	1.82	1.86	1.92	1.79	1.79	1.81	1.82
S.D	0.18	0.17	0.18	0.19	0.17	0.17	0.16	0.16
S.E.M	0.032	0.031	0.033	0.034	0.031	0.030	0.030	0.030
% Change Over Baseline				7.3%				1.7%
p Value				p<0.05				p>0.05

**TABLE NO 2: FASTING BLOOD GLUCOSE (mg/dl) BEFORE AND AFTER TREATMENT**

	GROUP I (n=30)				GROUP II (n=30)			
	BeforeT/t	After T/t			BeforeT/t	After T/t		
		4 wks	8 wks	16wks		4 wks	8 wks	16 wks
Mean	146.33	140.63	134.40	127.07	145.5	142.23	139.9	136.53
S.D	8.79	8.06	6.86	5.24	9.91	7.91	7.95	7.14
S.E.M	1.60	1.47	1.25	0.96	1.81	1.44	1.45	1.31
% Change Over Baseline				13.2%				6.2%
p Value				P<0.001				P<0.05

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