ORIGINAL RESEARCH

A Study of Serum Magnesium Level in Patients with type 2 Diabetes Mellitus

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ABSTRACT

Background: Studies have shown that patients with type 2 diabetes mellitus(T2DM) often have lower serum magnesium levels compared to healthy individuals. Magnesium is an essential mineral that plays a key role in several metabolic processes, including glucose metabolism, insulin secretion and insulin action. **Aim and objectives:** To compare the level of serum magnesium in type 2 diabetes patients and non diabetic healthy controls.

Materials and Methods: A Case-Control study was conducted in 50 diabetic patients and 50 non- diabetic healthy controls who attended General Medicine OPD at Chalmeda Anand Rao Institute of Medical Sciences, after following inclusion and exclusion criteria and also after approval of institutional ethical committee**.**

Results: Total 100 patients divided in to each 50 cases and controls, demographic profile of the study population. Showed that there was not statistically significant difference between age and gender in cases and controls. Mean magnesium level was statistically highly significant between cases and controls and its observed less among cases compared to controls. (P-value<0.001).

Conclusion: Serum magnesium levels were lower in type 2 diabetes patients when compared to healthy non-diabetic controls**.**

Keywords: Type 2 diabetes mellitus (T2DM), Glucose Metabolism, Magnesium Level.

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INTRODUCTION

Diabetes mellitus is a syndrome of impaired carbohydrate, protein and fat metabolism due to lack of secretion of insulin. Although diabetic patients have a normal lifestyle, its late complications will result in reduced life expectancy and major health cost. These include macrovascular diseases which leads to increase in prevalence of peripheral vascular disease, coronary artery disease, stroke and
microvascular damage which leads to nephropathy, retinopathy and neuropathy.

Magnesium is present in higher concentration within the cell and it is the second most abundant cation next to potassium. It plays an important role in manipulating important biological pyrophosphate compounds. The disturbance in magnesium level i.e., hypomagnesemia has been reported to be occur in diabetic patients.

Although diabetes can induce hypomagnesemia, magnesium deficiency has also been proposed as a risk factor for diabetes. Animal studies have shown that magnesium deficiency has a negative effect on post receptor signalling of insulin. Some short term metabolic studies suggested that magnesium supplementation has a beneficial effect on insulin action and glucose metabolism.

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Persistent hypomagnesemia leads to raised glucose level, insulin resistance and the degree of magnesium depletion positively correlates with serum glucose concentration and degree of glycosuria.

The cause of hypomagnesemia was attributed to.[1] Osmotic renal loss from glycosuria.[2] Decreased intestinal absorption of magnesium. Recently a specific tubular magnesium defect in patients with diabetes has been postulated. Hypermagnesuria results specifically from reduction in tubular absorption of magnesium. In this study we are going to compare the level of serum magnesium in type 2 diabetes patients and non diabetic healthy controls.

MATERIALS & METHODS

A Case-Control study was conducted in 50 diabetic patients and 50 non- diabetic healthy controls who attended General Medicine OPD at Chalmeda Anand Rao Institute of Medical Sciences, after following inclusion and exclusion criteria and also after approval of institutional ethical committee

Inclusion Criteria

- Age 30 to 70 years
- Positive History of diabetes

Exclusion Criteria

- Hypertension
- Gastrointestinal disorders
- Impaired renal function
- Alcoholic pancreatitis
- Therapy with diuretics, aminoglycosides
- Endocrine disorders
- Heart disease
- Not willing to give consent

Method

A detailed history with detailed clinical examination was done. Blood pressure was recorded. Cardiovascular disease was ruled out by history and ECG. Urine was examined for proteinuria. FBS values were assessed after 8 hours of fasting. PPBS values, Blood urea and serum creatinine values were measured.

Serum magnesium was determined by using photometric method. Calmagite – a metallochromatic indicator when binds with magnesium in alkaline medium, it forms red colour complex and it is measured at 530 to 550 nm. To prevent interference by calcium, specific calcium chelating agent EGTA was added. To avoid the heavy metal complex formation, KCN is added. Polyvinylpyrrolidone and surfactant were also included to reduce the interference from lipemia and protein. Intensity of colour formed was directly proportion to the amount of magnesium present in the sample.

Statistical Analysis

Collected data were entered in the Microsoft excel 2016 for further statistical analysis. Categorical data were expressed in terms of frequency and proportion and quantitative data were expressed in terms of mean and standard deviation. Association between categorical variables was asses with the help of chi-square test and mean difference in quantitative variable were assessed using t-test and ANOVA. P-value<0.05 were considered as statistically significant. Statistical analysis were done by using statistical package SPSS version 25.

RESULTS

In the study we have total 100 patients divided in to each 50 cases and controls, demographic profile of the study population given in table 1. Showed that there was not statistically significant difference between age and gender in cases and controls.

Table 1: Age and Gender distribution between cases and controls

Parameter	Cases(n=50)	Controls (n=50)	chi-square/t-value	P-value
Age				
Mean ± SD	50.39±9.76	50.01±10.15	0.1456	0.8845
Gender				
Male	35	35	0	1
Female	15	15		

There was statistically significant difference in mean fasting blood sugar and post prandial blood sugar was observed between cases and controls.

Table 2: Blood sugar level distribution between cases and controls

Parameter	Cases(n=50)	Controls (n=50)	chi-square/t-value	P-value
FBS (Mg/dl)				
Mean ± SD	104.15 ± 10.14	93.45 ± 5.28	6.61**	<0.001
PPBS (Mg/dl)				
Mean ± SD	184.84±27.49	128.43±6.54	14.11**	<0.001

**P-value<0.05, statistically highly significant at 5% level of significance

Table 3: Mean magnesium level distribution between cases and controls

Serum Magnesium(mEq/L)				
Group	Mean	SD	t-value	P-value
Cases	1.35	0.35	9.69**	<0.001
Controls	1.86	0.22		

**P-value<0.05, statistically highly significant at 5% level of significance

We have observed mean magnesium level was statistically highly significant between cases and controls and its observed less among cases compared to controls.

DISCUSSION

Diabetes mellitus is the most common disorder among endocrine disorders that are associated with hypomagnesemia. So far many studies have shown that Mg levels are lower in diabetic patients.[1,2,3] According to CARDIA Study (Coronary Artery Risk Development in young Adults) there was an inverse relationship between Mg intake and the incidence of diabetes.[1] Mg depletion may cause an insulin-resistant state,[4,5] poor glycemic control[6,7,8] and disordered lipid metabolism in diabetic patients.[9] Furthermore, poor glycemic control in diabetic patients is a well-known risk factor for Mg depletion.[8] Significant negative correlation between Mg and fasting plasma glucose, HbA1c. Marhalle et al[10] have found that diabetes, dyslipidemia, and hypertension were inversely related with serum Mg levels.

In present study we have included, each 50 patients in cases and controls, the minimum age was 31 years and maximum age was 70 years. Maximum number of patients are in the age

group of 41 to 50 i.e., 42% and there was not statistical significant difference in mean age between cases and controls. In the study done by Shrabani Mohanty et al in Bangalore (2013),[11] the mean age of cases and controls were 54.36±11.25 and 51.81±10.25 respectively and the total numbers of study subjects were 100. In the study we have found, 70% were males and 30% were females. In the study conducted by Maula MG et al[12] in 2013, among 50 cases, 58% were males and 42% were females. In the study conducted by Shrabani Mohanty et al in Bangalore (2013), among 100 cases 70% were males and 30% were females.

In this study, the mean magnesium level in cases and controls were 1.35 ± 0.35 and 1.86 ± 0.22 and it is found to be significant ($p<0.001$). The study conducted by Shrabani Mohanty et al in Bangalore has shown that serum magnesium in diabetics (1.58±0.28) is significantly lower ($p<0.001$) when compared to controls(1.91±0.22). Another study conducted by Nadler JL et al[13], the mean magnesium level in cases and controls were 1.94±0.05 and 2.31±0.12 respectively. This study shows that intracellular magnesium concentration in diabetics were significantly reduced when compared to controls and oral magnesium supplementation for 8 weeks restored RBC magnesium concentration to normal.

CONCLUSION

From overall observation and discussion with other studies we can conclude that, Serum magnesium levels were lower in type 2 diabetes patients when compared to healthy non-diabetic controls.

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