



A STUDY OF SERUM MAGNESIUM LEVELS IN DIABETES MELLITUS TYPE II

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ABSTRACT

Introduction: Diabetes Mellitus is a common endocrine disorder. Glycemic control in Diabetes Mellitus is very important. Our aim in this study was to prove that Magnesium levels can be used a marker for the glycemic control in Diabetes Mellitus. **Methods:** A total of 118 patients who were diagnosed with Diabetes Mellitus Type II by HbA1c were enrolled in this study. Detailed history, physical examination and relevant systemic examination were done. HbA1c levels, fasting blood glucose, post-prandial blood glucose levels and Mg levels were obtained from the patients. **Results:** The mean age of the patients was 47.96±6.89 years and the median age was 52 for males. Patients were divided in 2 groups as Mg levels <1.38mg/dl and >1.38mg/dl. We found that in patients with low levels of Mg(<1.38mg/dl), HbA1c was 9.45±1.28 and in patients with Mg levels of >1.38mg/dl, HbA1c was 7.01±0.95 (p value <0.001). FBS was 145.78±12.47mg/dl in patients with Mg levels <1.38 and 120.19±11.60mg/dl in patients with Mg levels >1.38(p value <0.001). PPS was 191.07±20.94mg/dl in patients with Mg levels <1.38 and 158.04±15.35mg/dl in patients with Mg levels >1.38(p value <0.001). **Conclusion:** Serum magnesium levels are inversely co-related with the glycemic control in type II Diabetes Mellitus. Poor glycemic control was seen with patients with low levels of Magnesium.

INTRODUCTION

Diabetes Mellitus is a metabolic disease in which there are high blood sugar levels for a prolonged time period.^[1] Symptoms of diabetes include polyuria, polyphagia and polydipsia.^[2] Diabetes can lead to complications like diabetic ketoacidosis, nonketotic hyperosmolar coma, heart disease, stroke, chronic kidney disease, foot ulcers, eye damage or death.^[3] There are two main types of Diabetes Type 1 DM due to failure of pancreas to produce enough insulin, also referred as insulin dependent diabetes mellitus or juvenile diabetes. Type 1 Diabetes Mellitus is due to loss of insulin producing beta cells of the islets of Langerhans. This can be idiopathic or immune mediated. Approximately 10% of diabetes cases in North America and Europe are due to autoimmune causes. In this, T cells attack the beta cells and destroy the beta cells. Sensitivity to insulin is normal in this type of diabetes. It affects mostly children and young adults and sometimes is also referred to as juvenile diabetes. Type 1 Diabetes is partly inherited and HLA genes are considered to be responsible for this.

Some viruses and some environmental factors are considered to trigger diabetes in genetically susceptible individuals. The other type of Diabetes is Type 2 DM in which there is resistance to the action of insulin and with the disease progression, there is a decrease in secretion of Insulin also. This is called non insulin dependent diabetes mellitus or adult onset diabetes. This type is the most common type of diabetes. In this type of diabetes, there is a defect in the responsiveness of the body tissues to insulin. Type 2 Diabetes is commonly due to a combination of lifestyle factors like obesity, poor diet, urbanization and increased stress. Some other factors like increased consumption of sugary items, consumption of saturated fatty acids and trans fatty acids, white rice and lack of exercise are also considered to be important for the development of diabetes mellitus. One more type of diabetes is gestational diabetes mellitus. It is due to a combination of inadequate insulin secretion and inadequate response to the insulin. About 2-10% of pregnancies have gestational diabetes. Only 5-10% of these women end up having diabetes mellitus.

Management during pregnancy needs dietary changes, blood glucose monitoring and in some cases, insulin is required. Some studies have been done that have showed the effects of Magnesium levels on Diabetes Mellitus.^[4,5] Some studies also showed that Magnesium depletion may have a negative impact on glucose homeostasis and Insulin sensitivity. The cause of low levels of magnesium in diabetes can be osmotic renal losses from glycosuria and decreased absorption of magnesium from intestines. Magnesium is important in insulin secretion, binding and activity on various levels. Low levels of magnesium can cause alteration in sodium potassium-adenosine triphosphatase which maintains the gradients of sodium and potassium in glucose transport.^[6] According to one study, irrespective of insulin secretion, there is a direct relationship between serum magnesium level and cellular glucose levels.^[7] This is due to the fact that there is increased sensitivity of the tissues for insulin when the magnesium levels are adequate. Low levels of magnesium are associated with diabetic retinopathy, arrhythmogenesis and vasospasm.^[8]

METHODS

In our study, total of 118 patients were taken who were diagnosed with Diabetes Mellitus Type II by HbA1c test. Detailed history, physical examination and systemic examination were done. Valid consent was obtained from all the patients in the study. Inclusion criteria were patients who were diagnosed with Diabetes Mellitus type II with age >40 and BMI 17-30. Patients who were having alcohol abuse, chronic NSAIDs abuse, angina or myocardial infarction, chronic kidney disease, liver failure, inflammatory bowel diseases and patients taking magnesium supplements.

RESULTS

In table 1, the baseline characteristics of the patients were noted. The mean age in males was 46.78 years and in females was 49.22 years. There were 61 males and 57 females. 52.05% males had hypertension while 47.56% females had hypertension. 1.1% of males had liver disease and 0.8% of females had liver disease. 28.98% males and 9.87% females were smokers. 45.59% males and 36.41% females had dyslipidemia. 26.35% males and 14.73% females had chronic pulmonary disease.

The mean levels of Magnesium are showed in table 2, 3 and 4. Patients were divided in 2 groups as Mg levels <1.38mg/dl and >1.38mg/dl. We found that in patients with low levels of Mg(<1.38mg/dl), HbA1c was 9.45±1.28 and in patients with Mg levels of >1.38mg/dl, HbA1c was 7.01±0.95 (p value <0.001). FBS was 145.78±12.47mg/dl in patients with Mg levels <1.38 and 120.19±11.60mg/dl in patients with Mg levels >1.38(p value <0.001). PPS was 191.07±20.94mg/dl in patients with Mg levels <1.38 and 158.04±15.35mg/dl in patients with Mg levels >1.38(p value <0.001).

DISCUSSION

In this study, we took total of 52 patients. HbA1c >8 was considered as poor control and HbA1c <8 was considered good control. In our study, it was found out that low serum levels of Magnesium were associated with high HbA1c, high FBS and high PPS. This shows that low serum magnesium levels were associated with a poor glycemic control of diabetes mellitus. Similar kind of research was done by Schlienger et al and it showed that low levels of Magnesium were associated with poor control of Diabetes.^[9] The study by Nadler et al showed that in non-diabetic patients, after induction of magnesium deficiency, insulin sensitivity decreases. In some elderly patients, it was found out that glucose tolerance was better after they received magnesium supplements.^[10] Yajnick reported that in male sex and with an increase in age, the plasma levels of magnesium levels would increase.^[11] The decline in renal failure was considered to be the cause of the increase in magnesium levels. In our study, there were no differences in the levels of magnesium between males and females. And in our study, patients with renal failure were excluded.

Hence, from the above study and other studies, it can be strongly said that low levels of Magnesium are associated with poor glycemic control. The limitations of the study are that the patient population was small. Complications of diabetes mellitus in association with the levels of magnesium were not studied. Also, effects about magnesium supplementation and glycemic control and metabolic control was not done in this study.

CONCLUSION

Serum Magnesium levels have an inverse co-relation with the glycemic control in type II Diabetes Mellitus. In our study, patients with low Mg levels (<1.38mg/dl), HbA1c, FBS, PPBS were significantly higher than that in patients with Mg levels >1.38mg/dl. This shows a poor glycemic control with low levels of Magnesium.

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