



A Observational Analytical Study on Serum Magnesium Level Between Healthy and Type II Diabetic Patients at Medical College, Ujjain (M.P.)

KEYWORDS

Type II DM, serum magnesium level, HbA1c.

Poorvi Gupta

Demonstrator, Department of Biochemistry,
Government medical college, Jalaun, Orai (U.P.)
* Corresponding author

Afreena Nasir

.Assistant professor, Department of Biochemistry,
Government medical college, Jalaun, Orai (U.P)

ABSTRACT Diabetes Mellitus is a chronic metabolic disorder affecting carbohydrate, lipid and protein metabolism. It is heterogeneous group of disorder characterized by hyperglycemia due to impaired glucose utilization, resulting from defects in insulin secretion, insulin action, or both this study was conducted to estimate Hypomagnesaemia in Type II Diabetics. The study included 50 patients of type II DM, with no factors significantly altering the serum magnesium levels. Investigated parameters included in the study were FBG, serum magnesium (By Vitros 250 dry chemistry analyzer). Identified the Diabetic patients by FBG and PPG. And fasting serum Mg levels were estimated. HbA1c is done for differentiate the controlled and uncontrolled diabetic patients. Mg+2 level was significantly lower ($p < 0.05$) in controlled (1.62 ± 0.34 mg/dl) and uncontrolled (1.70 ± 0.19 mg/dl) Type II DM groups compares to healthy subjects (2.208 ± 0.63)

Introduction-

Diabetes Mellitus is a chronic metabolic disorder affecting carbohydrate, lipid and protein metabolism. It is heterogeneous group of disorder characterized by hyperglycemia due to impaired glucose utilization, resulting from defects in insulin secretion, insulin action, or both (Reaven, 1988)(1). Type 2 diabetes is characterized by cellular and extracellular Mg ion depletion. Epidemiologic studies showed a high prevalence of hypomagnesaemia and lower intracellular Mg concentrations in diabetic subjects. Insulin and glucose are important regulators of Mg metabolism. Intracellular Mg ion play a key role in regulating insulin action, insulin-mediated glucose uptake and vascular tone. Reduced intracellular Mg ion concentration result in a defective tyrosine-kinase activity, post-receptorial impairment in insulin action, and worsening of insulin resistance in diabetic patient. Mg ion deficit has been proposed as a possible underlying common mechanism of the "insulin resistance" of different metabolic conditions. Low dietary Mg ion supplementation on metabolic profile in diabetic subjects have been found in most, but not all clinical studies, and large prospective studies are needed to support the potential role of dietary Mg ion supplementation as a possible public health strategy in diabetes risk. Magnesium is a cofactor in phosphorylation of glucose, and it helps in carbohydrate metabolism. Fasting and postprandial blood glucose levels were monitored using an auto analyzer. Some trace elements act as antioxidants and prevent membrane per oxidation while others act directly on glucose metabolism. It is generally agreed that disturbed concentration of Zn, Cr and Mg ion in the body are often found in patients of diabetes mellitus. In the studied population, Mg ion levels were found significantly low ($P < 0.05$) as compared to healthy controls though serum Mg may not accurately reflect the level of total body Mg stores; persistent glycosuria with osmotic diuresis leads to Mg wasting and likely contributes to high frequency of hypomagnesaemia in poorly controlled diabetics. HbA1c glycosylated hemoglobin, is formed by the glycosylation of hemoglobin. Its value represents the glycaemic status of a person over the last two to three months.(1) It is measured in diabetics as well as in those with impaired glucose tolerance to assess the glycaemic status over the last two to three months. According to the American Diabetes Association (ADA) Guidelines 2007, the value of HbA1c should be kept below 7% in all diabetics.(2) According

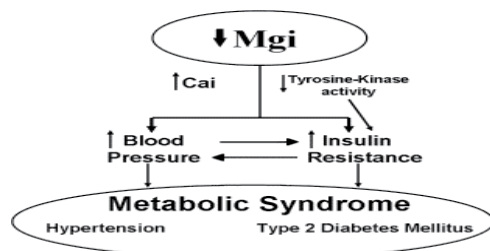
to the same guidelines, HbA1c is now referred to as A1c. Values greater than 7% indicate an increased chance of progression to diabetic complications, especially micro vascular ones. Glycosylated hemoglobin does not include HbA1c alone. It includes other hemoglobin as well and together, these constitute the HbA1 fraction of adult hemoglobin HbA.(1) Among the various glycosylated hemoglobin, HbA1c is the predominant fraction.

Objectives:

1. To compares levels of serum magnesium in patients with type II diabetes mellitus and healthy subjects.
2. To study levels of serum Magnesium in control or uncontrolled diabetics.

Methods & Methodology:

It was a hospital based case control study conducted for a period for 6 months duration from June 2014 to November 2014. The study population comprises of 50 patients of Type 2 Diabetes mellitus, and 75 Healthy persons were selected randomly without any bias for age, sex occupation, socio-economic status and duration of disease. Study was done in the Department of Biochemistry, at C.R.Gardi Hospital, R.D. Gardi Medical College, Surasa, Ujjain. Patients were selected from OPD and ward of Medicine Department of C.R. Gardi Hospital, Surasa, Ujjain. A detailed history was recorded with particular emphasis on symptoms at onset of diabetes, diet, compliance of drug, family history of diabetes, Complication of diabetes, abortion, infertility, impotence. As per investigation reports 25 patients each in controlled and uncontrolled diabetics were selected after observing there blood sugar levels of last 3 months.



Criteria for diagnosis of Diabetes Mellitus is based on- Fasting blood glucose > 126 Mg/dl

(Fasting in designed as no caloric intake for at least 12 hours)

In post meal glucose > 200 mg/dl

Classic symptoms of DM including Polyuria and unexplained weight loss

HbA1c- For differentiate the controlled AND uncontrolled diabetic patients.

Samples were collected; 5 ml of venous blood aseptically collected from antecubital vein and the whole blood was put in a vial with no anticoagulant and allowed to stand for some time so that serum was separated for estimation of magnesium (Mg) levels. The estimation of serum Glucose, serum Mg was done by The VOTROS 250 Dry Chemistry Autoanalyser, and estimation of HbA1c was done by Bio Rad D10. After the estimation of serum magnesium levels individuals are classified into three groups according to magnesium levels. Group A includes 8 study participants, while group B and group C includes 35 and 7 participants respectively. The Ethical Committee members of the hospital were briefed about the rationale of the study, nature of the procedures, and the benefits that could be availed. There being neither any ethical considerations nor conflicts of interest, the ethical committee clearance was obtained.

Statistical analysis-

Collected data were consolidated on Excel sheets and further analyzed in Epi-info software. The results are presented in mean (\pm SD). Unpaired student t-test was applied for statistical analysis. The p-value <0.05 was considered as significant.

Results-

Table 1- Serum magnesium levels of healthy and diabetic subjects.

Serum Mg levels	Healthy subjects (N=75)	Diabetic subjects (N=50)	* t-test, df, p- value
Range (min-max)	1.50-2.60	1.54- 3.24	5.56, 123, 0.001
Mean \pm SD	2.208 \pm 0.63	1.62 \pm 0.47	

*unpaired student t-test, df= degrees of freedom

P-value <0.05 is considered statistically significant.

The mean \pm SD value of serum Mg was found to be 2.208 \pm 0.63 mg/dl in healthy subjects and in diabetics was found to be 1.62 \pm 0.47. Magnesium was significantly lower (p<0.05) in healthy as compared to diabetic patients.

Table 2- Serum magnesium levels of controlled and uncontrolled diabetic subjects.

Serum Mg levels	Controlled diabetics (N=25)	Uncontrolled diabetics (N=25)	* t-test, df, p- value
Range (min-max)	1.20-2.50	1.00-1.60	5.4, 48, 0.001
Mean \pm SD	1.72 \pm 0.34	1.30 \pm 0.19	

*unpaired student t-test, df= degrees of freedom

P-value <0.05 is considered statistically significant.

The mean \pm SD value of serum Mg was 1.72 \pm 0.34 mg/dl in controlled diabetes patients and the mean \pm SD value of serum Mg was 1.30 \pm 0.19 mg/dl in uncontrolled diabetes patients. Magnesium was significantly lower (p<0.05) in uncontrolled as compared controlled Type II DM groups.

Discussion-

In the present study we observed that the Mg level was significantly lower (p<0.05) in both controlled and uncontrolled DM. In group serum magnesium levels, the difference between serum magnesium levels of Group A, B & C was highly significant (p<0.001). It was observed that maximum number of diabetics were in the range of 1.1 to 2.0 mg/dl and most prevalent levels of serum magnesium encountered amongst type 2 diabetics to be 1.7mg/dl. A similar finding was reported by (1,2,3). Some trace elements act as antioxidants and prevent membrane peroxidation while others act directly on glucose metabolism. It is generally agreed that disturbed concentration of Mg in the body are often found in patients of diabetes mellitus. In the study population, Mg level was found significantly low (p<0.05) as compared to healthy controlled. Serum magnesium may not accurately reflect the level of total body Mg store. Persistent glycosuria with osmotic diuresis leads to Mg wasting likely contributes to high frequency of hypomagnesaemia in poorly controlled diabetics. (4,5,6). Lower serum magnesium level in diabetics than in controls was also reported by A magnesium deficiency may also result in disorders of tyrosine kinas activity on insulin receptor. This deficiency may be related to the development of insulin resistance and decreased cellular glucose utilization. Lower basal levels of Mg would necessitate more insulin to metabolize the same glucose load, hence a decrease in insulin sensitivity. Furthermore, the link between insulin resistance and Mg deficiency has been strengthened by the observation that several medications currently prescribed to treat type II diabetes also increase Mg levels. For example, metformin has been shown to increase levels of Mg in the liver. Additionally, pioglitazone, an anti- diabetes drug that has been reported to increase insulin sensitivity, has also been shown to have positive action on magnesium metabolism. The Mg values show a significant decrease in diabetes mellitus patients compared to controls. This important lowering, to half the normal values, may be due to magnesium depletion caused by osmotic diuresis, then caused by the indirect hormone, vitamin or ionic effect. (8) Hypomagnesaemia represents a risk factor in diabetic retinopathy and tends to decrease the hypoglycemic action of insulin (7,9,10).

Conclusion-

The present study was done in department of Biochemistry, at C.R.Gardi Hospital, R.D.Gardi medical college Surasa Ujjain, M.P. Patients were selected randomly from the O.P.D. and Ward of Medicine The mean \pm SD value of serum Mg was found to be 2.208 \pm 0.63 mg/dl in healthy subjects. The mean \pm SD value of serum Mg was 1.62 \pm 0.34 mg/dl in controlled diabetes patients. The mean \pm SD value of serum Mg was 1.70 \pm 0.19 mg/dl in uncontrolled diabetes patients. Magnesium was significantly lower (p<0.05) in controlled and uncontrolled Type II DM groups compare to healthy subjects. Proper monitoring of magnesium levels in diabetic patient is of prime importance to combat the various complication which may be not serious but with prolonged time can be life threatening.

Conflict of interest- none declared

Acknowledgement- the authors are thankful to depart-

ment of medicine as well as hospital staff to co-operate with the study and the patients without whom the study was incomplete. Special thanks to Dr. S. Gupta for his support and help in statistical analysis.

REFERENCE:

1. Diwan AG, Pradhan AB, Lingojar D, Krishna KK, Singh P, Almelkar SI. Serum zinc, chromium and magnesium levels in Type 2 diabetes. *Int J Diab Dev Ctries* [serial online] 2006.
2. Young DS, Friedman RB. *Effects of disease on clinical laboratory test* 4th edition AACC press , 2001.
3. Mildred, S., Seelig, Rosanoff, A., *The Magnesium Factor* – Ed. Avery (Penguin Group) New-Work, 2003
4. Haennia, A., Zind, Z., Andersson, A., Lithell, H., 6th European Magnesium congress, Budapest. 1998, Hungary , Book of Abstracts. May 13-16, 57.
5. S.Ewis and M.S. Abdole-Rahman, *J.Appl.Toxicol.*, 1995, 15, 387-390.
6. Djurhuus MS, Klitgaard NA, Beck-Nielsen H. " Magnesium deficiency and development of late diabetic complications" *Ugeskr Laeger*, 1991 jul 22;153(30):2108-10.
7. Endoh, M., *Clin, Calcium* ,2005, feb .15(2) p 162-174.
8. Durlach ,J., *Le Magnesium en pratique Clinique*, J Bailliere, Paris, 1975.
9. Song Y, Manson JE, Buring JE, Liu S: Dietary magnesium intake in relation to plasma insulin levels and risk of type 2 diabetes in women. *Diabetes Care* 27: 59–65, 2004
10. Jose A Curiel - Garcia. Martha Rodriguez- Moran, Fernando Guerrero-Romero "Hypomagnesaemia and mortality in patients with type 2 diabetes" *Magnesium Research*. Volume 21, Numero 3, 163-6. September 2008, Short communication