ISSN: 0975-833X

Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 7, Issue, 08, pp.19613-19615, August, 2015

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

RESEARCH ARTICLE

COMPARISON OF SERUM MAGNESIUM AND HbA_{1c} LEVELS IN PATIENTS WITH TYPE-2 DIABETES MELLITUS

***,[1]Dr. Gayatri, A., [2]Dr. Senthil Kumari, K. R. and [3]Dr. Rasheeda, A.**

[1]Department of Physiology, KAPV Govt Medical College, Trichy
[2]Department of Physiology, Govt. Thiruvarur Medical College, Thiruvarur
[3]Department of Physiology, Kilpauk Medical College

ARTICLE INFO

Article History:
Received 03rd May, 2015
Received in revised form
10th June, 2015
Accepted 29th July, 2015
Published online 31st August, 2015

Key words:

Diabetes Mellitus,
Chronic hyperglycaemia,
Serum magnesium,
HbA1C.

ABSTRACT

Introduction: Diabetes mellitus comprises a group of common metabolic disorders that share the phenotype of hyperglycemia. The metabolic dysregulation associated with DM causes secondary pathophysiologic changes in multiple organ systems that impose a tremendous burden on the individual. Amongst the electrolytes, magnesium merits special attention. Micronutrients have been investigated as potential, preventive and therapeutic agents for type 2 diabetes mellitus and their complications. The aim of the study is to evaluate serum magnesium and HbA_{1c} levels in type-2 diabetes.

Materials and Methods: This case control study was carried out in the Department of Diabetology, Kilpauk Medical College, for a period of 1 year for 60 type 2 diabetic patients without complications. For comparison, 30 age and sex matched apparently healthy non diabetic subjects were also studied. Serum magnesium estimation was done by Colorimetric method with Chlorophosphonazo III and HbA_{1c} was done by high performance liquid chromatography in a standard laboratory.

Results: Serum magnesium levels were lower in patients with diabetics when compared with controls with significant p value. On comparing HbA_{1c} levels with serum magnesium it is inferred that as the HbA_{1c} level increases, serum magnesium decreases.

Conclusion: Magnesium depletion has a negative impact on glucose homeostasis and insulin sensitivity in diabetic patients as well as may increase risk of secondary complications. So it is prudent to monitor magnesium routinely in this patient population and treat the condition whenever possible, it is frequently over looked and undertreated.

Citation: Gayatri A., Senthil Kumari, K. R. and Rasheeda, A. 2015. "Comparison of serum magnesium and HbA_{1c} levels in patients with type-2 diabetes mellitus", *International Journal of Current Research*, 7, (8), 19613-19615.

INTRODUCTION

Diabetes mellitus (DM) is considered as the most common non communicable disease. Globally, the number of people with diabetes is expected to rise from the current estimate of 220 million in 2010 to 300 million in 2025. Type 2 diabetes mellitus is the predominant form of diabetes worldwide, accounting for 90% of cases globally (Henry M. Kronenberg, 2008). DM leads to many complications and one of them is electrolyte imbalance which has been an ignored subject. In particular, diabetes has shown to be associated with abnormalities in the metabolism of zinc, chromium, copper, magnesium and manganese. Out of these magnesium is a clinically significant electrolyte, for a long term global policy to lower the burden of diabetes mellitus.

Corresponding author: Gayatri, A.
Department of Physiology, KAPV Govt Medical College, Trichy

Magnesium is the second most abundant intracellular cation after potassium. Magnesium is essential for Insulin secretion, Insulin receptor interaction, Post receptor events and normal carbohydrate utilization (by Mg dependent enzymes).Hence hypomagnesaemia will lead to insulin resistance (Ashima Badyal *et al*., 2011). Diabetes Mellitus is an endocrine disease with high oxidative and metabolic stress. An important risk factor for development of microangiopathy in diabetic is elevated levels of HbA1c (Sabanayagam & Liew, *et al*., 2009). HbA1c has special affinity for oxygen there by causes tissue anoxia and plays a role in causation of micro and macroangiopathy. Glycosylated hemoglobin have been postulated as a biochemical model for the pathogenesis of diabetic sequelae through the glycosylation reaction The gold standard method for assessing glucose homeostasis is HbA1c which is an integration of both postprandial and fasting blood glucose variations over a 12 weeks period.

MATERIALS AND METHODS

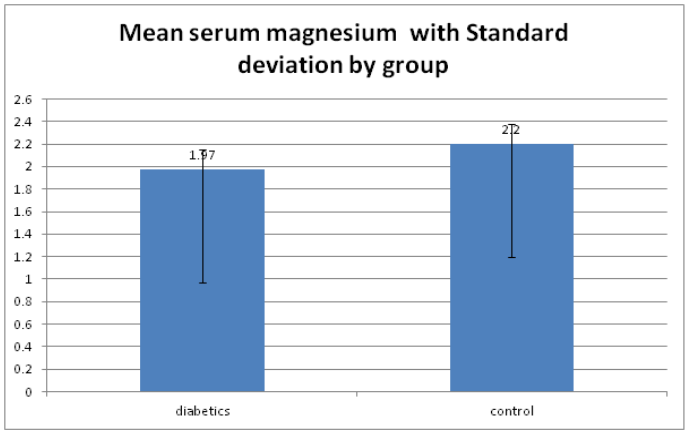
This Study is a case control study, conducted for a period of one year in 60 cases of type-2 diabetic patients without any diabetic complications. Both the sexes were included in the present study. Patients above 45 years were chosen for the study from the outpatients Department of Diabetology. Ethical clearance was obtained. The subjects were briefed about the study and a written consent was obtained from them. The control group was selected from the normal volunteers attending Master health check up in outpatient Department of Government Kilpauk Medical College Hospital .Inclusion criteria includes Type-2 diabetic patients in the age group 45-65 years without complications. Patients with Acute pancreatitis, Alcoholism, Gastrointestinal fistulas, Malabsorbtion syndromes, Liver diseases, patients with history of Diarrhoea, Vomiting and Nasogastric suction, pt on drugs which alter serum magnesium levels (Ashima Badyal *et al*., 2011) and Diabetic patients with complications, are excluded from the study. Detailed history was taken and clinical examination was done. The Lab investigations like Fasting *Blood Sugar and Urine routine* was done in the Department of Diabetology, Kilpauk M*edical College*. Serum magnesium estimation was done by Colorimetric method with Chlorophosphonazo III. HbA1c was done using Bio- Rad variant II HbA1c Kit -2 using the principle of Ion – exchange high performance liquid chromatography in Hi-tech diagnostics, Chennai.

RESULTS

In both control and cases group, participants were equally distributed with respect to age and gender. The different parameters were analysed using student t-test and pearson correlation.

Table 1. Serum magnesium in patients and controls

	No of subjects	Mean ± Standard Deviation	P value
Cases	60	1.947 ± 0.166	
Controls	30	2.20 ± 0.176	<0.01

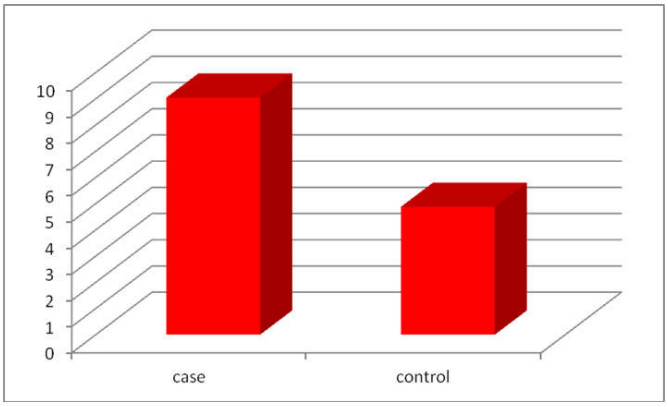


On comparing serum magnesium levels, pt with diabetes had lower serum magnesium levels than controls as shown by significant p value (p<0.001) in Table 1. The mean Serum Magnesium is 2.20 in controls whereas it is1.94 in cases.

Table 2. HbA1c in patients and controls

	No. of subjects	Mean ± Standard Deviation	P value
Cases	60	9.04 ± 2.15	<0.001
Control	30	4.87 ± 0.42	

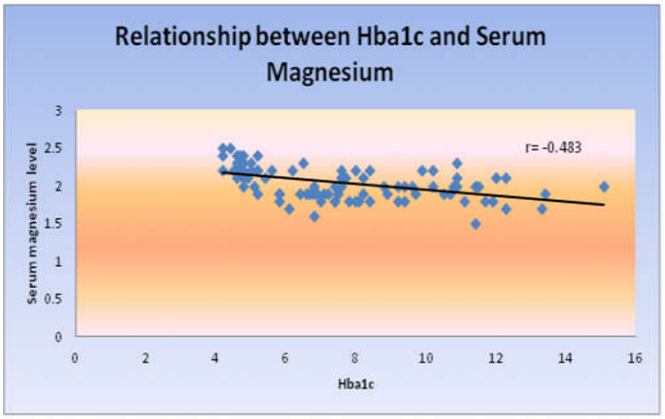
Patient with diabetes had higher levels of HbA1c levels with mean value of 9.0 compared to that of controls with mean value of 4.8 with significant p value of 0.001.



HbA1c in patients and controls

Table 3. Correlations between serum magnesium and HbA1c

			'r' value	Inference
Pearson Correlation	S Magnesium	HbA1c	-0.483	Negatively correlated



There is a significant negative Pearson correlation coefficient value (r -0.483) between serum magnesium and HbA1c levels that infers when HbA1c level increases the serum magnesium level decreases.

DISCUSSION

In our study, comparison of serum magnesium levels between diabetic patients and controls, showed a significant decrease in serum magnesium levels in diabetics. In diabetes hypomagnesaemia results from increased excretion of magnesium through kidneys. Insulin has an important role in normal renal reabsorption of magnesium. High blood glucose

and glycosuria can augment magnesium excretion, by decreasing reabsorption of magnesium through renal tubule (Lecube *et al*., 2012). Francesco corica *et al.* reported a high prevalence of hypomagnesemia in diabetic patients and its association with the other constituents of the metabolic syndrome (Francesco Corica, *et al*., 2006). This view was supported by the study done by Phuong-chi T. Pham *et al*. Factors that contribute to hypomagnesaemia are (a) Hyperglycemia which leads to decreased cellular Mg Levels, independent of insulin levels (b) Osmotic diuresis (Lecube A *et al*., 2012) leads to increased urinary Mg losses and (c) Concomitant use of diuretics and hypolipidemic agents also increase urinary Mg loss. In our study diabetic patients has higher HbA1c levels when compared to the control group participants. This finding was supported by study done by Ishrat Karrem *et al* (Ishrat Kareem, *et al*., 2004). In our study there is an inverse relationship between HbA_{1c} and serum magnesium levels. A Sharma *et al*. reported a negative correlation between serum magnesium levels and poor glycemic control and a strong association with retinopathy. He concluded that serum magnesium can be used as an early predictor of course and complications of diabetes mellitus (Sharma *et al*., 2007). Viktorinova *et al*. concluded that patients with diabetes had abnormal metabolism of Cu, Zn, and Mg; and this may be related to elevated values of HbA_{1c} and altered metabolism of these minerals may contribute to the disease progression and its complications (Viktorinova A, Toserova E *et al*., 2009). Hypomagnesmia has been reported to occur with increased frequency among patients with type-2 diabetes

Conclusion

Thus from the above study, it is evident that Serum magnesium levels is significantly decreased in diabetic patients when compared to controls. HbA1c levels are raised significantly in non insulin dependent diabetes mellitus patients, as the HbA1c level increases the serum magnesium levels decreases. Increased frequency of hypomagnesemia occurs in type-2 diabetic patients. High dietary intake of magnesium may decrease the risk of type-2 diabetes (Phuong-Chi T. Pham *et al.*, 2007). Magnesium is a critically important micronutrient and an useful therapeutic agent. Oral magnesium supplementation improves sensitivity to insulin and metabolic control in diabetic patients with hypomagnesemia by restoring serum magnesium level (Martha rodr´iguez-mor´an *et al*., 2003). It is therefore advisable to include serum magnesium in the routine electrolyte panel for the better management of diabetes.

Acknowledgement

We sincerely thank our Dean, kilpauk Medical College, Chennai for permitting us to do this work. We thank all the subjects who participated in this study.

Conflict of Interest: Nil

Source of funding: Self

Ethical Clearance: Taken

REFERENCES

Ashima Badyal, Kuldip Singh Sodhi, *et al*. July-September 2011

Francesco Corica, Andrea Corsonello, *et al*. 2006. Serum Ionized Magnesium Levels in

Henry M. Kronenberg, 2008. 11th edition-William text book of Endocrinoligy-Pages-1329

Ishrat Kareem, S.A. Jaweed, *et al*. 2004. Study of magnesium, glycosylated hemoglobin and lipid profile in diabetic retinopathy, *Indian Journal of Clinical Biochemistry*, 19 (2) 124-127.

Lecube A, Baena-Fustegueras JA, *et al*. 2012. Diabetes Is the Main Factor Accounting for Hypomagnesemia in Obese Subjects PLoS ONE 7(1): e30599. doi:10.1371/journal. pone.0030599.

Martha rodr´iguez-mor´an, Fernando guerrero-romero, *et al*. 2003. Oral Magnesium

Phuong-Chi T. Pham, Phuong-Mai T. Pham**,** *et al*. 2007. Hypomagnesemia in Patients with Type 2 Diabetes *Clin J Am Soc Nephrol.,* 2: 366–373.

Relation to Metabolic Syndrome in Type 2 Diabetic Patients *Journal of the American College of Nutrition*, Vol. 25, No. 3, 210–215.

Sabanayagam & G. Liew, *et al*. 2009, Relationship between glycated haemoglobin and microvascular complications: Is there a natural cut-off point for the diagnosis of diabetes? Diabetologia, 52:1279–1289.

Serum Magnesium Levels: A Key Issue For Diabetes Mellitus. vol.13 No.3.

Sharma A, Dabla S, Agrawal**,** *et al*. 2007. Serum magnesium: an early predictor of course and complications of diabetes mellitus. *J Indian Med Assoc*., Jan;105(1):16, 18.

Supplementation Improves Insulin Sensitivity and Metabolic Control in Type 2 Diabetic Subjects, Diabetes care, 26:1147-1152.

Viktorinova A, Toserova E *et al*. 2009. Altered metabolism of copper, zinc, and magnesium is associated with increased levels of glycated hemoglobin in patients with diabetes mellitus Oct; 58(10):1477-82. Epub 2009 Jul 9.

****