



CORRELATION OF SERUM MG²⁺ LEVELS WITH DURATION OF T2DM

Dr. Shweta

MD Department Of Physiology Bhaskar Medical College & Hospital, Yenkapally, Moinabad,rr,Hyd,ts-500075

Dr. A. Santa Kumari*

M.D Department Of Physiology Osmania Medical college,Koti, Hyderabad Telangana *Corresponding Author

Dr. Abrar Hassan

MD Department Of Physiology Bhaskar Medical College & Hospital, Yenkapally, Moinabad,rr,Hyd,ts-500075

ABSTRACT

INTRODUCTION: Diabetes is the most common serious metabolic disease. The hallmark of Diabetes is elevated blood glucose concentration, just one of many biochemical & physiological alterations that occur in the disease. In Diabetics there is a **DIRECT** association between serum magnesium levels & cellular glucose disposal independent of insulin secretion. This change in glucose disposal is found to be associated with **INCREASED SENSITIVITY** of the tissues to insulin in the presence of sufficient magnesium levels. Magnesium deficiency has been found to be related with **DIABETIC MICROVASCULAR DISEASE**. Hypomagnesaemia has been reported to occur in 25-38% patients with T2DM without metabolic control. Hence the present study is conducted to find any correlation with **DURATION** of T2DM & Serum Magnesium¹

KEYWORDS : T2DM, Serum Mg²⁺, T2DM Duration

MATERIALS & METHODS :

INCLUSION: T2DM 50 Subject

EXCLUSION: T2DM On Insulin, T2DM with Hypothyroid, Hypertension, Nephropathy, Neuropathy, Retinopathy, CHF & Renal diseases.

CONTROL: 50 Healthy subjects

Fasting /Postprandial blood glucose measured :Automated calorimeter Serum Magnesium levels measured : Calmagnite dye method, Normal=1.8-2.5mg/dl

STATISTICAL ANALYSIS: Student t test

RESULTS:

Table no:1 Showing serum Mg²⁺ levels compared with that of duration of T2DM, as longer the duration the less is the serum Mg²⁺ levels in study group compared with that of control group ie 1.46mg/dl compared to 2.51mg/dl in control group.

DURATION OF STUDY GROUP	SERUM Mg ²⁺ LEVELS (mg/dl)	CONTROL GROUP SERUM Mg ²⁺ levels (mg/dl)
2-5 YEARS	2.26mg/dl	2.51mg/dl
10-15 YEARS	2.16mg/dl	2.51mg/dl
_ 20 years	1.46mg/dl; p Value significant <0.0001	2.51mg/dl

Table no:2 Showing the comparison of fasting along with postprandial blood glucose compared with that of duration.

The longer the duration ie more than 20years the FBG- 232.41±17.02 and PPBG- 269.38± 14.12

DURATION T2DM	FASTING BLOOD GLUCOSE mg/dl	POSTPRANDIAL BLOOD GLUCOSE mg/dl
2-5YEARS	101±14.0mg/dl	130.22±8.2mg/dl
10-15YEARS	162±12.05mg/dl	200±12.01 mg/dl
_ 20YEARS	232.41±17.02 mg/dl	269.38±14.12mg/dl

American Diabetes Association Criteria: Normal FBS: >126mg/dl, PPBG: >200mg/dl 2 (9 recheck ADA criteria of blood glucose levels)

Table no.3 Comparison of Serum Mg²⁺ with duration & blood glucose levels

DURATION OF T2DM	FASTING BLOOD GLUCOSE mg/dl	POSTPAND RIAL BLOOD GLUCOSE mg/dl	SERUM Mg ²⁺ mg/dl	p Value
2-5years	101±14.0	130.22 ±8.2	2.26mg/dl	0.38
10-15years	162±12.05	200± 12.01	2.16mg/dl	0.25
	232.41± 17.02	269.38±14.1 2	1.46mg/dl	<0.0001

DISCUSSION.

1. Diabetes- a potential epidemic in India with 62 billion currently. According to WILD 2 et al prevalence of diabetes estimated to double globally from 171 million to 366 MILLION BY 2030 with MAXIMUM rise in India.
2. Magnesium --4th most abundant cation in human body 2nd most abundant intracellular cation An important COFACTOR for many enzymatic reactions especially phosphate transfer along with regulation of glucose metabolism
3. Present study exhibit longer the duration along with raise FBG & PPBG had a low serum Mg²⁺ correspondingly A.G.Kulkarni et al concluded serum Mg²⁺ levels was lower in T2DM. Mohamed Murtuza Kause et al showed serum Mg²⁺ levels lower in T2DM.
4. Similarly Sharma A et al study concluded poor glycemic control was ASSOCIATED with hypomagnesaemia.
5. Mg²⁺ in insulin sensitivity: hypomagnesemia is associated with increased insulin resistance in T2DM 5-7
6. The crystal structure of insulin receptor tyrosine kinase shows two Mg²⁺ ions bind to tyrosine kinase domain as shown in Fig No.1 8 Mg²⁺ being ESSENTIAL autophosphorylation of β-subunit of insulin receptor.
7. Depending on target tissue, direct substrate of insulin receptor may recruit the receptor. Insulin receptor substrate phosphorylate downstream signalling pathway which are (PIP3,PKC,Grb2)13 resulting in glucose uptake, glycogenesis, lipid synthesis, cell growth and cell differentiation.
8. Alternatively , insulin receptor act independently via Src-homology 2domain called MAP13 resulting in cell signalling and regulation of cell proliferation9-12 as shown in Fig No.1

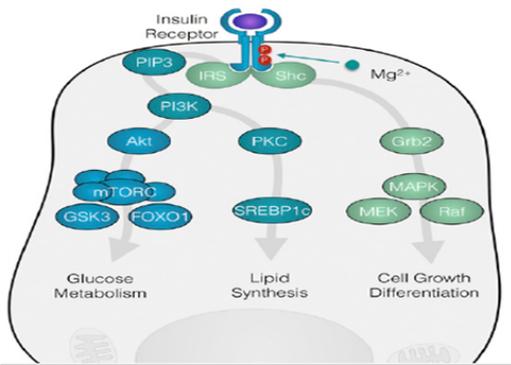


Fig.no: 1 Mg²⁺ regulates insulin signalling pathway.

11. Barbagallo M, Dominguez LJ, Galito A, et al. Role of magnesium in insulin action, diabetes and cardiac-metabolic syndrome X. *Mol Aspects Med* 2003;24:39-52
12. Guyton AC, Hall JE, Textbook of medical physiology. 11th edition. Philadelphia, Saunders, 2006
13. MAP- Mitogenic activated protein, PKC-protein kinase c, Grb2- growth factor receptor bound-2 an adaptor protein for cell communication, PIP3-phosphatidylinositol 3,4,5-triphosphate
14. Dr. Shweta MD, Asst. prof Department of Physiology, Bhaskar Medical College Yenkapally Moinabad Hyd, T.S
15. Dr. A. Santa Kumari MD, Prof Department of Physiology, Osmania Medical College, Koti, Hyd, T.S
16. Dr. Abrar Hassan MD, HOD & Prof, Department of Physiology, Bhaskar Medical College, Yenkapally, Moinabad, Hyd, T.S

CONCLUSION:

1. Serum Mg²⁺ levels decreased with increased duration T2DM.
2. Mg²⁺ deficiency usually presents as chronic latent Mg²⁺ deficit rather than clinical hypomagnesemia³
3. HYPOMAGNESEMIA CAUSES **INSULIN RESISTANCE** WHICH FURTHER REDUCES **SERUM Mg²⁺ LEVELS** IN **T2DM** CREATING A **VICIOUS CYCLE**⁴
4. Accurate measurement of intracellular and extracellular Mg²⁺ levels- **A TOOL TO TRANSLATE KNOWLEDGE** of magnesium and glucose in insulin metabolism INTO **CLINICAL PRACTICE**
5. However the picture is far from complete and more research would be enforced to distinguish the complex yet dynamic role of Mg²⁺ in T2DM



Mg²⁺ deficiency is a CAUSE or EFFECT OF T2DM..?

Acknowledgement:

Im thankful to all my subjects for they patience & co-operation in the study & my guide for her continues motivation.

REFERENCE:

1. De Lorges, Lima M, Cruz T et al. The effect of magnesium supplementation in increasing doses on the control of Type 2 DM. *Diabetes care*. 1998 May; 21(5):682-6
2. ADA, Standard of medical care in Diabetes. *Diabetes care*. 2016; 31:S1-S106. ADA- www.diabetes.org
3. Joshi SR et al. *API*. 2007; 55:323-4, Kumar A et al. *Australas Med J* 2013; 6(10):524-31. Pubmed, Wild S et al. *global prevalence diabetes* 2004; 27(3):1047-53. Pubmed
4. Paolisso G et al. *Am J hypertension* 1997; 10:346-335, Reinhart et al. *Mg metabolism* 148, 2415-2420, Sharret et al. *circulation* 63, 247a-250a
5. Lisanne M.M et al. volume 65, jan 2016 *Hypomagnesemia in Type 2 Diabetes: A Vicious cycle* *Diabetes journals.org*
6. Pham PC, Pham PM, Pham SV et al. *hypomagnesemia in patients with T2DM*. *Clin J Am Soc Nephrol* 2007; 2:366-373
7. Humphries S, Kushner H et al. *Low dietary Mg²⁺ with insulin resistance in a sample of young non-diabetic black Americans*. *Am J Hypertens* 1999; 12:747-756
8. Lima mdel, cruz t et al. *serum & intracellular Mg²⁺ deficiency in patients with metabolic syndrome-evidences for its relation to insulin resistance*. *Diabetes res clin pract* 2009; 8:257-262
9. Hubbard SR. *Crystal structure of activated insulin receptor tyrosine kinase complex with peptide substrate and ATP analog*. *EMBO* 197; 16:5572-5581
10. Gunther T. *The biochemical function of Mg²⁺ in insulin secretion, insulin signal transduction and insulin resistance*. *Magnes Res* 2010; 23:5-18
11. Takaya J, Higashino H, Kobayashi Y. *Intracellular magnesium and insulin resistance*. *Magnes Res* 2004; 17:126-136