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Original Research Paper

Biochemistry

ASSOCIATION OF SERUM MAGNESIUM WITH DYSLIPIDEMIA IN TYPE 2 DIABETES MELLITUS

Choudhary Sweta	M.Sc. Student, Department of Biochemistry, S.P. Medical College, Bikaner, Rajasthan, India.
Soni Yogita	Sr. Professor, Department of Biochemistry, S.P. Medical College, Bikaner, Rajasthan, India.
Verma Anita	Professor & Head, Department of Biochemistry, S.P. Medical College, Bikaner, Rajasthan, India.
Soni N.R.*	Department of Biochemistry, J.L.N. Medical College, Ajmer, Rajasthan, India. *Corresponding Author

ABSTRACT

Background: Magnesium (Mg) deficiency is a common problem in diabetic patients. Deficiency of Mg may increase the incidence of diabetes mellitus (DM) and occurrence of diabetic complications. This study was designed to find out the serum magnesium levels and its influence on serum lipids in type 2 diabetics and how it is associated with the duration & complication of the disease. **Methodology:** The case control study was conducted in Department of Biochemistry and collaboration with Medicine Department at S.P. Medical College & Associated group of PBM Hospitals, Bikaner. The fasting serum glucose (FSG), total cholesterol (TC), triglycerides (TG) and serum magnesium were estimated by a fully automated Beckman coulter analyzer. **Results:** The mean serum levels of FSG, TC and TG were significantly higher while serum mg was significantly lower in type 2 diabetes mellitus (T2DM) patients as compared with control subjects. **Conclusion:** Hypomagnesaemia and altered lipid profile is common among the patients of T2DM. Regular monitoring of serum Mg & lipid profile along with Mg supplementation in T2DM may prevent its progression to diabetic and cardiovascular complications.

KEYWORDS : Type 2 Diabetes Mellitus, FSG, Dyslipidemia, Magnesium.

INTRODUCTION:

T2DM is a non-autoimmune complex, heterogenous and polygenic metabolic disease in which body fails to produce enough insulin, characterized by abnormal glucose homeostasis [1]. The prevalence of T2DM is rising much rapidly because of increasing obesity and reduced activity levels as countries become more industrialized. The chronic complications of DM affect many organ systems and are responsible for the majority of morbidity and mortality associated with the disease[2]. Identifying the risk factors for the development of type 2 diabetes is essential for primary prevention[3]. Dyslipidemia is one of the major risk factor for cardiovascular disease in DM. The characteristic features of diabetic dyslipidemia are a high plasma triglyceride concentration, low HDL cholesterol concentration and increased concentration of small dense LDL-cholesterol particles. The lipid changes associated with DM are attributed to increased free fatty acid flux secondary to insulin resistance[4]. Mg deficiency also has a role in the perturbation of lipid metabolism in the non-uremic population, especially in diabetic patients[5-6].

An important characteristic of hyperlipidemia associated with Mg deficiency is accumulation of triglyceride rich lipoproteins and a decrease in the concentration of HDL[7]. Mg is the fourth abundant mineral in our body and most abundant intracellular cation[8]. Mg is involved in many carbohydrate oxidation, enzymatic reactions, glucose transport mechanism, insulin secretion and in binding activity [9]. Mg plays an important role in carbohydrate metabolism. It may influence the release and activity of insulin, the hormone that helps to control blood glucose levels[10]. Low blood levels of Mg are frequently seen in individuals with T2DM. Hypomagnesaemia may worsen insulin resistance. The kidneys possibly lose their ability to retain Mg during periods of severe hyperglycemia (significantly elevated blood glucose). The increased loss of Mg in urine may then result in lower blood levels of Mg[11]. Mg play a role in the release of insulin and so Mg depletion has atherogenic potential. Mg supplementation may result in beneficial effect on the lipid profile of diabetic patients[6]. Objectives of the study were to estimate serum magnesium and lipid profile in type 2 diabetes mellitus patients.

MATERIALS & METHODS:

The case control observational study was conducted on 117 normal healthy subjects and 117 type 2 diabetic mellitus of either sex and of varying age (30-70 years) groups of participants attending the Medicine Department of S.P. Medical College & Hospitals, Bikaner. All the anthropometric measurements were performed. Blood sample collection was done by aseptic technique and subjected to biochemical estimations. The FSG, TC, TG and serum Mg were estimated by a fully automated Beckman coulter analyzer. The p-values <0.05 were considered significant.

RESULTS:

Table: 1: Comparison of Biochemical parameters in both study groups.

S.NO.	Parameters (mg/dl)	Normal Healthy Controls (117) (Mean ± S.D.)	Cases (117) (Mean ± S.D.)	P-Value
1.	FSG	93.17 ±09.29	182.94 ± 12.72	P<0.001
2.	TC	190.0±23.22	217.68±19.12	
3.	TG	133.18±06.26	196.21±09.41	
4.	Serum Magnesium	2.10 ±1.86	1.71± 0.16	P<0.05

Note: $p < 0.001$ = Highly significant (HS), $p < 0.05$ = Significant

The mean raised levels of FSG, TC and TG were found to be highly significant ($p < 0.001$) and significantly decreased level of serum magnesium was observed in patients with T2DM as compared to normal healthy control subjects (Table:1).

DISCUSSION:

Magnesium is a cofactor for several enzymes involved in carbohydrate metabolism. There is a strong relationship between magnesium and insulin action.

The hypomagnesaemia in diabetic nephropathy due to Poor dietary intake, impaired absorption of magnesium, increased urinary loss due to hyperglycemia, osmotic diuresis, defective Mg reabsorption from renal tubules and loss of plasma protein bound Mg. Magnesium depletion is said to reduce the insulin sensitivity, thereby increasing the risk of secondary complications. Hyperglycemia leads to decreased cellular Mg levels. Hypomagnesaemia leads to collagen and ADP-induced platelet agreeability and also decreased function of Mg dependent enzymes, kinases and oxidative stress[12]. Magnesium deficiency also has a role in the perturbation of lipid metabolism of diabetic patients. Hypomagnesaemia inhibits prostacyclin receptor function, producing an imbalance between prostacyclin and thromboxane effects. Hypomagnesaemia can increase platelet reactivity, increase vascular and adrenal responses to angiotensin II, enhance thromboxane A2 (TXA2) release, and lead to organ damage from free radicals[5].

Hypomagnesaemia causes dyslipidaemia by decreasing activity of lipoprotein lipase, LCAT (Lecithin Cholesterol Acyl Transferase) and increasing HMG COA reductase enzyme. The lipid changes are attributed to increased Free Fatty Acids flux secondary to insulin resistance[13].

Other studies were done by M. M. Yassin et al[14], Dayanand C D et al[15], R D Ankush et al[16] and Lal et al[17] had reported that Mean serum magnesium at baseline in the diabetic patients was significantly lower than that in controls. A significant fall in serum total cholesterol, LDL cholesterol and triglycerides and a rise in HDL cholesterol levels were observed 48 weeks after initiation of magnesium supplementation and continued till the end of the study i.e. 12 weeks and concluded that Mg supplementation resulted in a beneficial effect on the lipid profile of these patients[5]. Cristianae Hermes et al observed that inadequate metabolic control can affect the corporal concentration of Mg, developing hypomagnesemia which directly related with micro and macrovascular complications based on Cristiana's study, the supplementation of Mg has been suggested in patients with diabetes who have proven hypomagnesemia and presence of its complication[18].

CONCLUSION:

Serum Mg was found to be inversely associated with the prevalence of Microalbuminuria. Hypomagnesemia was found to be associated with poor glycemic control. Hypomagnesaemia and altered lipid profile is common among the patients of T2DM. Regular monitoring of serum Mg & lipid profile along with Mg supplementation in T2DM may prevent its progression to diabetic and cardiovascular complications.

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