

MAGNESIUM SUPPLEMENTATION: IS THIS A MIRACLE DRUG TO CONTROL DIABETES-INDUCED ABNORMAL LIPID PROFILE

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ABSTRACT

BACKGROUND

Reduced levels of magnesium levels have been observed in adults who have diabetes mellitus. It was also observed in children who were supposed to have good nutritional status but were diagnosed diabetic. Low levels of serum magnesium have been linked to a number of complications that is observed in diabetes mellitus. Reduced tyrosine kinase activity has been observed. This may result in reduced insulin sensitivity. The low levels of serum magnesium may be due to glycosuria-related hypermagnesiuria, nutritional factors or hyperinsulinaemia.

Diabetic patients often have disturbances of their lipid profile. Magnesium supplementation is known to have a beneficial effect on the lipid profile. The aim of the study is to find whether magnesium supplementation improves the lipid profile of the diabetic patients or not.

METHOD

The study is a cross-sectional study and the study is multi-staged.

The age criteria was not taken into consideration since all the patients belonged to the age group of 40 to 60 years.

Inclusion Criteria

1. The patients were atleast known diabetics since one year.
2. Patients were aged between 40 to 60 years.
3. Patients who were ready to be a part of this study and would come back for followup.

Exclusion Criteria

1. Patients who were known to have diabetic renal complications.
2. Patients who were on dialysis.
3. Patients who were on diuretics.
4. Patients who took magnesium antacids.

RESULT

The principle finding of this study is that the serum magnesium level is inversely related to the HbA1c, serum cholesterol, LDL and triglycerides. It is directly proportional to the HDL levels. Magnesium is known to play an important role in carbohydrate metabolism, and its imbalance has been implicated in diabetes mellitus both as a cause and a consequence.

CONCLUSION

There is a lot of scope for this study since it is slowly being understood that diabetes is not a single disease but a plethora of diseases whose dimensions are slowly being uprooted. Indeed magnesium supplementation improved the lipid profile and in the coming days it would be called a miracle drug with vast potentials.

KEYWORDS

Serum Magnesium, Diabetes Mellitus, HbA1c, Lipid Profile.

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INTRODUCTION: The fourth largest content of cation in the human body and second most found intracellular cation is magnesium¹. This particular cation is seen in intracellular

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fluid. Total body magnesium is about 25 g. About sixty to sixty five percent is complexed with calcium in bone.² It is also found in skeletal muscles.³ This is exchangeable with serum. About 0.4 g of magnesium is needed for a fully grown adult. Green leafy vegetables, cereals, beans, fish are the major providers of this cation.

Normal serum value is 1.8 to 2.2 mg/dL. It has a lot of functions. It acts as an activator to many enzymes which require ATP like cAMP dependent kinases, adenylyl cyclase. Insulin-dependent uptake of glucose is reduced in

magnesium deficiency. Magnesium supplements is also known to improve glucose tolerance.¹

Reduced levels of magnesium levels have been observed in adults who have diabetes mellitus. It was also observed in children who were supposed to have good nutritional status but were diagnosed diabetic.^{4,5,6,7} Low levels of serum magnesium have been linked to a number of complications that is observed in diabetes mellitus. Reduced tyrosine kinase activity has been observed. This may result in reduced insulin sensitivity.^{8,9} The low levels of serum magnesium may be due to glycosuria-related hypermagnesiuria, nutritional factors or hyperinsulinaemia.

Diabetic patients often have disturbances of their lipid profile. Magnesium supplementation is known to have a beneficial effect on the lipid profile.^{10,11,12}

This study is dedicated to find the correlation of serum magnesium with the abnormal lipid profile secondary to diabetes mellitus. The study also helps us to understand the role of magnesium supplementation in controlling the abnormal lipid profile seen often in diabetes mellitus.

AIMS AND OBJECTIVES:

1. To check the levels of serum magnesium in known cases of diabetes mellitus.
2. To check the HbA1c, serum lipid profile, albumin, total protein, creatinine levels in diabetic patients.
3. To correlate the serum magnesium level with that of other metabolic complications.

MATERIALS AND METHODS: This study was conducted in the Department of Medicine, Deccan College of Medical Sciences.

The study was conducted from Jan 2014 To Jan 2015.

Two hundred known diabetics who visited the General Medicine Department were used as a sample size.

The study is a cross-sectional study and the study is multi-staged.

The age criteria was not taken into consideration since all the patients belonged to the age group of 40 to 60 years.

Inclusion criteria:

1. The patients were atleast known diabetics since one year.
2. Patients were aged between 40 to 60 years.
3. Patients who were ready to be a part of this study and would come back for followup.

Exclusion Criteria:

1. Patients who were known to have diabetic renal complications.
2. Patients who were on dialysis.
3. Patients who were on diuretics.
4. Patients who took magnesium antacids.

Stage 1: Patients were asked to fast after their night meals and were asked to give the blood for testing in the morning. The blood was drawn after taking aseptic precautions and were tested for serum magnesium, HbA1c, lipid profile.

The HbA1c was checked to find out whether the patient is a chronic diabetic or not.

The serum magnesium levels were compared with the other profiles.

Stage 2: The patients were given oral supplements of 0.4-0.6 mg/day of magnesium and were asked to return after three months. All the tests were repeated and the conclusion was drawn.

RESULTS:

Stage 1:

HbA1c	Number of patients	Mean magnesium value
<6	32	2.41 ±0.16
6-8	121	2.11±0.31
>8	47	1.88±0.45

Table 1: Comparison of HbA1c with Mean Magnesium Value

Total number of patients	Mean cholesterol level	Mean magnesium level
44	>300	1.76±0.66
124	200-300	1.89±0.44
32	<200	2.11±0.27

Table 2: Comparison of Cholesterol Level with Mean Magnesium Levels

Total number of patients	Mean HDL level	Mean magnesium level
54	<30	1.86±0.53
109	30-50	1.91±0.71
47	>50	2.27±0.52

Table 3: Comparison of HDL Levels with Mean Magnesium Levels

Total number of patients	Mean LDL level	Mean magnesium level
71	>180	1.69±0.91
88	130-180	1.79±0.31
41	<130	2.25±0.74

Table 4: Comparison of LDL Levels with Mean Magnesium Levels

Total number of patients	Mean Triglycerides level	Mean magnesium level
145	>250	2.22±0.62
34	150-250	2.13±0.23
21	<150	2.09±0.43

Table 5: Comparison of Triglycerides with Mean Magnesium levels

Stage 2: The patients were given 600 mg of magnesium and asked for followup after 3 months.

The following observations were made when the same tests were conducted after three months.

HbA1c	Number of patients	Mean Magnesium value
<6	98	2.44 ±0.19
6-8	71	2.31±0.44
>8	21	2.01±0.27

Table 6: Comparison of HbA1c with Mean Magnesium Value

Total number of patients	Mean cholesterol level	Mean magnesium level
23	>300	1.85±0.71
44	200-300	1.97±0.68
133	<200	2.61±0.66

Table 7: Comparison of Cholesterol Level with Mean Magnesium Levels

Total number of patients	Mean HDL level	Mean magnesium level
09	<30	1.95±0.72
21	30-50	1.99±0.4
120	>50	2.59±0.52

Table 8: Comparison of HDL levels with Mean Magnesium Levels

Total number of patients	Mean LDL level	Mean magnesium level
33	>180	1.89±0.75
112	130-180	2.29±0.39
55	<130	2.75±0.7

Table 9: Comparison of LDL levels with Mean Magnesium Levels

Total number of patients	Mean Triglyceride level	Mean magnesium level
20	>250	2.46±0.62
135	150-250	2.42±0.23
45	<150	1.79±0.43

Table 10: Comparison of Triglycerides with Mean Magnesium Levels

DISCUSSION: The principle finding of this study is that the serum magnesium level is inversely related to the HbA1c, serum cholesterol, LDL and triglycerides. It is directly proportional to the HDL levels. Magnesium is known to play an important role in carbohydrate metabolism, and its imbalance has been implicated in diabetes mellitus both as a cause and a consequence.^{13,14,15}

1. No matter what kind of diabetes it is, the risk of low levels of magnesium levels in the serum and the associated complications will be there. Simple lack of magnesium in the dietary products will not cause the serum level of magnesium to be lowered, but the risk

of diabetes always has a risk. Magnesium may also play a role in the release of insulin and magnesium depletion has an atherogenic potential.^{16,17,18}

Recent studies in rats have shown that magnesium deficiency produces hypertriglyceridaemia, hypercholesterolemia, increased low-density lipoproteins (LDL), and reduced high-density lipoprotein (HDL) through reduced triglyceride clearance, diminished activity of lecithin cholesterol acetyltransferase (LCAT) and lipoprotein lipase, and increased activity of HMG-CoA reductase. The association between hypomagnesaemia and hypertriglyceridaemia has been confirmed in studies of pigs. While the association between lipid abnormalities and hypomagnesaemia has not been fully understood in human studies.

In the second part of the study when the magnesium supplementation was given the lipid profile was better when compared to the lipid profile in stage 1. There was a significant difference (p<0.005) between stage 1 study and stage 2 study in almost all the values. But it is not very clear that whether lipid profile damage is caused by the low magnesium or it causes hyperglycaemia and this in turn causes the damage.

CONCLUSION: The study successfully shows the correlation of abnormal lipid profile and serum magnesium levels.

The principle finding of this study is that the serum magnesium level is inversely related to the HbA1c, Serum cholesterol, LDL and triglycerides. It is directly proportional to the HDL levels. Magnesium is known to play an important role in carbohydrate metabolism, and its imbalance has been implicated in diabetes mellitus both as a cause and a consequence. There is a lot of scope for this study since it is slowly being understood that diabetes is not a single disease but a plethora of diseases whose dimensions are slowly being uprooted. Indeed magnesium supplementation improved the lipid profile and in the coming days it would be called a miracle drug with vast potentials.

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