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A DESCRIPTIVE STUDY ON HYPOMAGNESEMIA IN PATIENTS OF TYPE-II DIABETES MELLITUS

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Abstract:
Objective: *To assess the frequency of hypomagnesemia in patients of type-II diabetes mellitus.*
Material and methods:
This cross sectional study was conducted at Department of Medicine, Central Park Medical College Lahore from August 2019 to February 2020. Total 350 type-II diabetics, having age range 30-60 years, either male or female with duration of diabetes ≥ 3 years were selected. Hypomagnesemia was assessed in selected.
Results: *Total 350 type-II diabetics were selected and hypomagnesemia was asseseed. Mean age of the patients 45.34 ± 8.55 years with age range from 30-60 years and mean duration of diabetes was 6.54 ± 2.43 years. Out of 350 type-II diabetics, hypomagnesemia was found in 122 (35%) patients. Total 169 (48.29%) patients belonged to age group 30-45 years and 181 (51.71%) patients belonged to age group 46-60 years. Hypomagnesemia was found in 60 (35.50%) patients and 62 (34.25%) patients respectively in age group 30-45 years and age group 46-60 years. Statistically insignificant association of hypomagnesemia with age group was detected with p value 0.8232. Male diabetics were 197 (56.29%) and female diabetics were 153 (43.71%) and hypomagnesemia was noted in 72 (36.55%) male patients and in 50 (32.68%) female patients. Association of hypomagnesemia with gender was statistically insignificant with p value 0.4980*
Conclusion: *Results of present showed a higher percentage of hypomagnesemia in cases of type-II diabetes mellitus. A higher proportion of male gender was reported as compered to female gender and there is no association of hypomagnesemia with gender. Duration of diabetes, age and obesity were insignificantly associated with hypomagnesemia.*
Key words: *Diabetes mellitus, endocrine, magnesium, enzyme activator*

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INTRODUCTION:

The number of people with diabetes is increasing due to population growth, aging, urbanization and increasing prevalence of obesity and physical inactivity.[1] Quantifying the prevalence of diabetes and the number of people affected by diabetes, now and in the future, is important to allow rational planning and allocation of resources.[2] There are an estimated 23.6 million people in the U.S. (7.8% of the population) with diabetes and 17.9 million being diagnosed, 90% of whom are type 2.[3] With prevalence rates doubling between 1990 and 2005, CDC has characterized the increase as an epidemic.[4] Pakistan is estimated to have 7 million people with diabetes.[5] Currently it is 8th in the world according to WHO estimation of prevalence of diabetes and by the year 2025 is expected to be 4th with 15 million people with diabetes, representing a 2 fold increase in caseload.[6] It is also one of the most common chronic diseases affecting children with about 200 children world-wide develop type 1 diabetes every day.[7]

Globally, over 300 million people suffer from type 2 diabetes mellitus (T2DM), and the prevalence is predicted to rise to over 600 million over the next decades.[8] T2DM is characterized by a combination of insulin deficiency and insulin resistance. The general pathophysiological concept is that hyperglycemia emerges when endogenous insulin secretion can no longer match the increased demand owing to insulin resistance.[9]

Magnesium is the fourth most abundant cation in the human body and the second most abundant intracellular cation.[10] It plays an important role in the carbohydrate metabolism. It serves as a cofactor for all enzymatic reactions that require kinases.[11] It is also an essential enzyme activator for neuromuscular excitability and cell permeability, a regulator of ion channels and mitochondrial function, a critical element in cellular proliferation and apoptosis, and an important factor in both cellular and humoral functions.[12]

The disturbance in serum magnesium level i.e. hypomagnesemia has been reported to occur among patients of diabetes mellitus.[13] The persistent hypomagnesemia leads to raised serum glucose level, insulin resistance and the degree of magnesium depletion correlates positively with serum glucose concentration and the degree of glucosuria.[14]

Present study was conducted to evaluate the hypomagnesemia in cases of type-II diabetics. Results of this study may help us to reduce the morbidity related to it by early screening of hypomagnesemia in type-II diabetics.

MATERIAL AND METHODS:

This cross-sectional study was conducted at Department of Medicine, Central Park Medical College Lahore from August 2019 to February 2020. Total 350 type-II diabetics, having age range 30-60 years, either male or female with duration of diabetes ≥ 3 years were selected. Patients with type-I diabetes mellitus, secondary causes of diabetes mellitus (like haemochromatosis, Cushing's disease, acromegaly), chronic diarrhea, hypo-proteinemic states (like chronic liver disease). Patients with acute or chronic diarrheal/ malabsorption states, with thyroid or adrenal dysfunction, history of alcohol intake, history of vitamin or mineral supplements in the recent past, recent metabolic acidosis, pregnancy, lactation, with serum creatinine> 1.5 mg/dl, and on drugs known to affect magnesium levels, were excluded from the study.

Five ml blood sample was drawn from every patient and send to laboratory for Magnesium levels. The normal serum magnesium level considered was 1.8 - 2.5 mg /dl so the value < 1.8 mg /dl was labeled as hypomagnesaemia. Findings of the lab test were noted on pre-designed performa along with demographic profile of the patients.

Type 2 diabetes mellitus was diagnosed as per criteria of American diabetic's association:

1. Fasting plasma glucose level higher than 126 mg/dl or
2. Plasma Glucose level exceeding 200 mg/dl at 2 hours in the 75 g oral glucose tolerance test or
3. Symptoms of Diabetes and Random Plasma Glucose > 200mg/dl or
4. HbA1C > 6.5%.

All the collected data was entered in SPSS version 18 and analyzed. Mean and SD was calculated for numerical data and frequencies and percentages were calculated for categorical data.

RESULTS:

Total 350 type-II diabetics were selected and hypomagnesemia was asseseed. Mean age of the patients 45.34 ± 8.55 years with age range from 30-60 years and mean duration of diabetes was 6.54 ± 2.43 years. Out of 350 type-II diabetics, hypomagnesemia was found in 122 (35%) patients. (Fig. 1) Selected patients were divided into two age groups i.e. age group 30-45 years and age group 46-60 years. Total 169 (48.29%) patients belonged to age group 30-45 years and 181 (51.71%) patients belonged to age group 46-60 years. Hypomagnesemia was found in 60 (35.50%) patients and 62 (34.25%) patients respectively in age group 30-45 years and age group 46-60 years. Statistically insignificant association of hypomagnesemia with age group was detected with p value 0.8232. (Table 1)

Male diabetics were 197 (56.29%) and female diabetics were 153 (43.71%) and hypomagnesemia was noted in 72 (36.55%) male patients and in 50 (32.68%) female patients. Association of hypomagnesemia with gender was statistically insignificant with p value 0.4980 (Table 2)

Minimum duration of diabetes was 3 years and maximum duration of diabetes was 10 years. Two equal groups was made according to duration of diabetes i.e. 3-7 years group and 8-10 years group. Total 210 (60%) patients belonged to 3-7 years group and hypomagnesemia was noted in 77 (36.67%) patients. Out of 140 (40%) patients of 8-10 years group, hypomagnesemia was seen in 45 (32.14%) patients. Insignificant association between hypomagnesemia and duration of diabetes mellitus was seen with p value 0.4236. (Table 3) Obese were 140 (40%) and non-obese were 210 (60). Hypomagnesemia was found in 45 (32.14%) patients and 77 (36.67%) patients respectively in obese and non-obese patients. Insignificant association between obesity and hypomagnesemia was seen with p value 0.4236 (Table 4)

Fig. 1: Frequency of hypomagnesemia

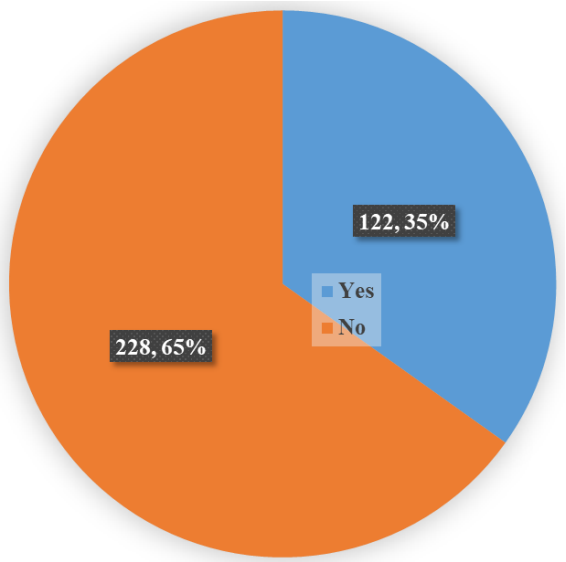

Table 1: Association of hypomagnesemia with age

Age Group	Hypomagnesemia		Total	P value
	Yes	No		
30-45	60 (35.50)	109 (64.50)	169 (48.29)	0.8232
46-60	62 (34.25)	119 (65.75)	181 (51.71)	
Total	122 (35)	228 (65)	350	

Table 2: Association of hypomagnesemia with gender

Gender	Hypomagnesemia		Total	P value
	Yes	No		
Male	72 (36.55)	125 (63.45)	197 (56.29)	0.4980
Female	50 (32.68)	103 (67.32)	153 (43.71)	
Total	122 (35)	228 (65)	350	

Table 3: Association of hypomagnesemia with duration of diabetes

Duration of diabetes	Hypomagnesemia		Total	P value
	Yes	No		
3-7	77 (36.67)	133 (63.33)	210 (60)	0.4236
8-10	45 (32.14)	95 (67.86)	140 (40)	
Total	122 (35)	228 (65)	350	

Table 4: Association of hypomagnesemia with obesity

Obesity	Hypomagnesemia		Total	P value
	Yes	No		
Obese	45 (32.14)	95 (67.86)	140 (40)	0.4236
Non-obese	77 (36.67)	133 (63.33)	210 (60)	
Total	122 (35)	228 (65)	350	

DISCUSSION:

Among the endocrine and metabolic disorders associated with magnesium deficiency, diabetes mellitus is the most common.[15] Many studies have shown that mean plasma levels are lower in patients with both type 1 and type 2 diabetes compared with nondiabetic control subjects. Significant negative correlations between magnesium and fasting plasma glucose, HbA1c, HOMA-IR have been shown.[16] The various causes of low magnesium in diabetics include diets low in magnesium, osmotic diuresis causing high renal excretion of magnesium, insensitivity to insulin affecting intracellular magnesium transport and thereby causing increased loss of the extracellular magnesium, rampant use of loop and thiazide diuretics promoting magnesium wasting, diabetic autonomic neuropathies and reduced tubular reabsorption due to insulin resistance.[17]

In present study, total 350 type-II diabetics were selected and hypomagnesemia was asseseed. Mean age of the patients 45.34 ± 8.55 years with age range from 30-60 years and mean duration of diabetes was 6.54 ± 2.43 years. Out of 350 type-II diabetics, hypomagnesemia was found in 122 (35%) patients. Selected patients were divided into two age groups i.e. age group 30-45 years and age group 46-60 years. Total 169 (48.29%) patients belonged to age group 30-45 years and 181 (51.71%) patients belonged to age group 46-60 years. Hypomagnesemia was found in 60 (35.50%) patients and 62 (34.25%) patients respectively in age group 30-45 years and age group 46-60 years. Statistically insignificant association of hypomagnesemia with age group was detected with p value 0.8232.

In a study by Kauser et al[18] mean age of the diabetics was 55.42 ± 12.65 years which is higher than our study. In same study 62% patients were males and 38% patients were females. In our study, male diabetics were 197 (56.29%) and female diabetics were 153 (43.71%) and hypomagnesemia was noted in 72 (36.55%) male patients and in 50 (32.68%) female patients. Association of hypomagnesemia with gender was statistically insignificant with p value 0.4980. This male to female frequency in similar with our study.

In one study by Siddiqui et al,[19] total 323 diabetics were selected and serum magnesium levels was studied and found hypomagnesemia in 34.11% patients which is comparable with findings of our study.

Prevalence of low plasma magnesium status in type-II diabetics in several studies, which ranged from 25 to 39%. Prevalence of hypomagnesemia in type-II diabetics in our study was similar to that reported by Nadler et al[20] in type-II diabetics, attending outpatient clinics in the US. Walti MK et al[21] also reported a prevalence of hypomagnesemia in type-II diabetics at 37.6% versus 10.9% in non-diabetic controls in a study conducted in Zurich, Switzerland. The reasons for the high prevalence of magnesium deficiency in diabetes are not clear, but may include increased urinary loss, lower dietary intake, or impaired absorption of magnesium compared to healthy individuals. Hyassat et al[22] reported that out of 1105 patients with type 2 diabetes, 210 patients (19%) (95% CI, 16.8%-21.4%) were hypomagnesaemic. Female gender, hypertension, statin therapy, HbA1c between 7-7.9% or ≥ 9% and patients with diabetes duration more than five years were independent risk factors for hypomagnesaemia. No association between hypomagnesaemia and age distribution was found.
A cross-sectional study conducted by Seyoum et al[23] included a total of 159 subjects (44 patients with type 1 DM, 69 patients with type 2 DM and 46 non diabetic control) to assess the prevalence of hypomagnesaemia in Ethiopian patients with type-1 and type-2 DM. The study revealed that hypomagnesaemia was present in 65% of patients with diabetes. In other studies, hypomagnesaemia has been shown to occur in 25-38% (6, 17-19) of patients with diabetes, especially in those without good metabolic control.[24-25] This wide range of difference in the prevalence between our study and other studies might be due to differences in the definition of hypomagnesaemia, techniques of magnesium measurements, and heterogeneity of the selected patient populations. Dasgupta et al,[26] hypomagnesemia (Se magnesium < 1.6 mg/dl) was documented in 17 (11.33%) patients with a female:male ratio of 9:8.

CONCLUSION:

Results of present showed a higher percentage of hypomagnesemia in cases of type-II diabetes mellitus. A higher proportion of male gender was reported as compered to female gender and there is no association of hypomagnesemia with gender.

Duration of diabetes, age and obesity were insignificantly associated with hypomagnesemia.

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