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**ORIGINAL ARTICLE**

# Estimation of Serum Magnesium Level in Patients of Type-II Diabetes Mellitus and Diabetic Nephropathy

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## ABSTRACT

**Aims & Objective**: This study was conducted to estimate the serum magnesium level in patients of type-II diabetes mellitus and diabetic nephropathy.

**Methodology**: This case control study was conducted at LUMHS Jamshoro Sindh Pakistan. Total 120 subjects were selected for this research divided in to three groups, control and two case study groups for the period of six months July 2020 to December 2020. FBS, HbA1%, serum creatinine, serum magnesium levels were estimated from all subjects. The statistical analysis was done by SPSS version 21 by applied ANOVA test to compare the parameters in different groups.

**Results**: Serum Magnesium level was significantly ($p<0.05$) decline in group C patients of diabetic nephropathy with poor glycemic control as compared to control or diabetic patients without complications.

**Conclusion:** Estimation of serum magnesium level in the diabetic patients can be use for the early predictor tool to know the expansion of diabetic complications.

**Keywords:** Type-2 Diabetes Mellitus, Diabetic Nephropathy, Serum Magnesium

## INTRODUCTION

The poor glycemic control of diabetes mellitus can lead chronic loss of kidney function leading to diabetic nephropathy.[1]More than 30% patients of type-I & II diabetes mellitus are affected with nephropathy.[2] The chronic kidney disease and end stage renal disease (ESRD) are also caused by diabetic nephropathy.[3,4] More than one third diabetic population all over the world also suffered from ESRD due to diabetic nephropathy.[5] The earliest pathology in diabetic nephropathy is constriction of efferent arterioles and dilation of afferent arterioles, which can lead to hypertension and hyperfiltration of glomeruli capillaries.[6] Urine albumin and serum creatinine are the main biochemical parameters for assessment of renal function in diabetic nephropathy.[7] When micro albuminuria (UAE > 20 g/min and 199 g/min) and macro albuminuria (UAE > 200 g/min) occur, diabetic nephropathy should be investigated.[8]Increasing prevalence rate of type-II diabetes mellitus all over the world can lead to increase the incidence of end stage renal disease.[5] Magnesium is one of the important intracellular cation and main cofactor in different metabolic ATPase dependent reactions of carbohydrate metabolism.[9,10] Magnesium plays important role in release of insulin.[11] Depletion of magnesium can affect insulin sensitivity.[11] Hyperglycemia causes increased magnesium loss in the kidneys, resulting in hypomagnesaemia in diabetics.[12] Depletion of magnesium also take part in development of diabetic complications like nephropathy, retinopathy. [13] The goal of this study is to evaluate the status of serum magnesium levels in diabetics without nephropathy, diabetics with nephropathy and in control patients.

## METHODOLOGY

This case control study was conduced for period of six months from July to December 2020 at Liaquat University of Medical & Health Sciences Jamshoro, Sindh. Diabetic patients were recruited from diabetic OPD and diabetic nephropathy patients collected from diabetic OPD and nephrology unit. Total 120 subjects were selected with their own consent and permission and divided in to three groups, group A contained 40 normal subjects selected as control, group B 40 diabetic patients without diabetic complications and group C 40 diabetic patients with diabetic nephropathy.The patients with both genders of type-II diabetes mellitus with history of diabetes from last five years with age 40 to 60 years were included while patients of type-I diabetes and type-II diabetes below age 40 or above 60 years, patients of hypertension, retinopathy, liver disorders, patients having history of usage of diuretic drugs, alcohol were excluded from this study. The overnight fasting sample was taken from each subject under aseptic measurements 5ml of blood sample collected 1ml separated in fluoride containing gel tube while remaining sample in plain test tube and sample was centrifuged at 4000rpm for 5 to 10 min. Urine sample was collected in sterile urine bottles. Fasting Blood glucose level was measured by Glucose Oxidase Method while HbA1c% measured on Cobbas auto analyzer, serum magnesium estimated by Kit Method while Urine albumin level measured by Immunoturbidimetric method.[14]The data was statistical analyzed by SPSS version 21 by applied ANOVA test to compare parameters with in three groups.

## RESULTS

The results of this study shows there is statistically significance raised fasting blood sugar levels, HbA1c%, serum creatinine, albumin in urine in diabetic as well diabetic with nephropathy group. Serum magnesium levels statistically significant decline ($p< 0.05$) in diabetic nephropathy group.

Table 1: Mean & S,D with Significant Values of all Parameters under Study

| Parameters | GroupA | Group B | Group C |
|---|---|---|---|
| FBS (mg/dl) | 77 ±11 | 134 ± 14 * | 199 ± 26** |
| HbA1c% | 5.2 ± 0.3 | 7.7 ± 1.3 * | 11.5 ± 2.1** |
| S.Creatinine (mg/dl) | 0.6 ± 0.2 | 1.1 ± 0.3 | 3.4 ± 1.6* |
| Micro albumin (Urine) | 21.8± 4.99 | 51.7 ± 15.3 | 87.13 ± 25.37* |
| $S.Mg^{++}$ (mg/dl) | 1.9 ± 0.1 | 1.2 ± 0.3* | 0.8 ± 0.7 * |

(* = p < 0.05 / ** =p< 0.001)

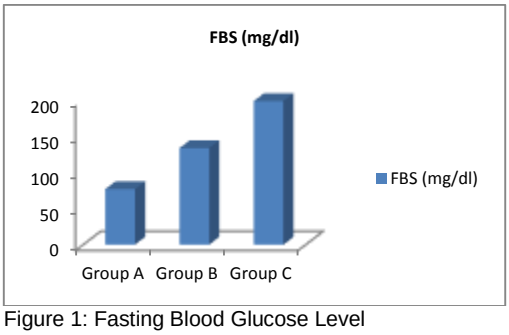


Figure 1: Fasting Blood Glucose Level

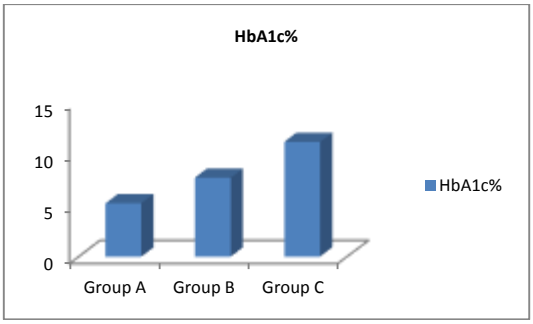


Figure 2: HbA1c%

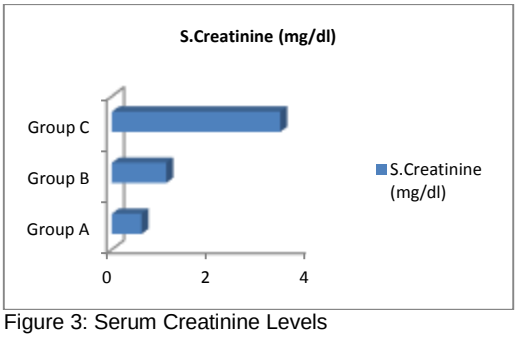


Figure 3: Serum Creatinine Levels

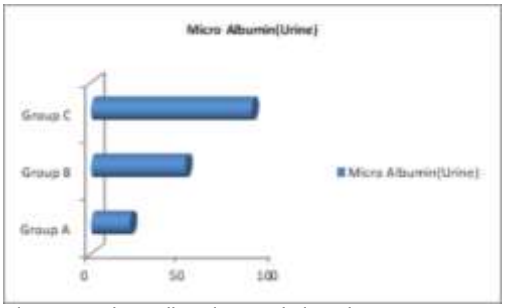


Figure 4: Micro Albumin Levels in Urine

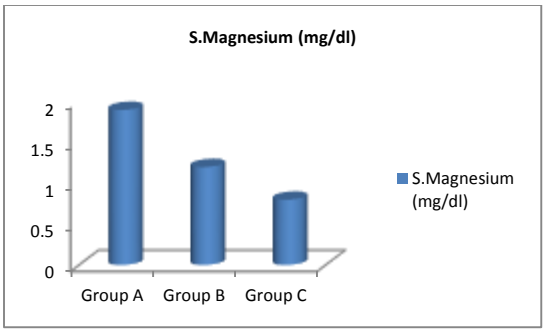


Figure 5: Serum Magnesium Levels

## DISCUSSION

Magnesium is the intracellular cation that plays vital role as cofactor to regulate the functions of different enzymes of carbohydrate metabolism which are the energy dependent or energy yielding enzymes.[15] Magnesium plays important role in the secretion and regulation of insulin from pancreas.[16] Hypomagnesaemia can lead to decrease secretion of insulin or disturb the proper actions of insulin so it leads hyperglycemia because magnesium depletion can interrupt the function of Kinases enzyme family and it may cause the development of oxidative stress and formation of free radicals.[17,18] When oxidative stress persists in diabetic population, that will lead to development of complications like, angina, myocardial infarction, nephropathy and retinopathy.[19] In diabetic nephropathy magnesium depletion more markedly observed due to impaired absorption, excessive loss in urine due to hyperglycemia, osmotic diuresis, and defective reabsorption of magnesium from renal tubules.[20,21]

Our findings are consistent with those of Matsuo S, et al (2009)[22], who found that serum magnesium levels fall in diabetics, whereas serum creatinine levels rise dramatically in diabetic nephropathy. The findings of this investigation, which were backed up by Dewitte et al (2004)[23] and Schwarz S et al (2006)[24], suggested a link between serum magnesium and diabetic nephropathy. Why the impact of hypomagnesaemia on renal outcome differed between type 2 diabetic nephropathy and nondiabetic CKD is unknown. Mg shortage has been linked to the development of diabetic problems due to disruption of cell membrane transport and consequent myo-inositol depletion within the cell.[25] Mg deficiency is, in fact, associated with various type 2 diabetes complications including albuminuria.[26]

Therefore, it is plausible that Mg deficiency has specific pathogenic significance in type 2 diabetic nephropathy; however, the exact role of Mg deficiency in type 2 diabetic nephropathy warrants further investigation.

From above discussion it is also proven that magnesium is considered as biomarker before the development of ESRD.

## CONCLUSION

This study concluded that serum magnesium level is significantly decline in poor glycemic control with diabetic complication like diabetic nephropathy. Estimation of serum magnesium level in the diabetic patients can be the early predictor tool for indication the expansion of diabetic complications.

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