# Role of Serum Calcium and Serum Magnesium in Diabetic Nephropathy

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**Abstract**

**Background:** Diabetic Nephropathy (DN) is the main cause of end-stage kidney disease (ESKD) in developed countries. Diabetes mellitus has an important impact on serum $Ca^{2+}$ levels. There is a strong negative link between glycemic management (as measured by a high HbA1c percentage) and a decrease in serum $Ca^{2+}$ levels, which is usually unaffected by gender or duration of DM. There are reports on the link between serum $Ca^{2+}$ level and decline in the kidney function.[2]

**Aim:** To determine the role of Serum Magnesium and Serum Calcium levels in Patients with Diabetic Nephropathy.

**Objectives:** The specific objectives of the studies were as follows:

1) To evaluate Serum Magnesium and Serum Calcium in all patients ad study the patient characterisitics with respect to nutritional status Diabetes and nephropathy..
2) To determine the association between Serum Magnesium and Serum Calcium with Hypoproteinemia, Anemia, BMI, estimated glomerular filteration rate, HbA1c in diabetic and non diabetic patients.

**Methodology:** This observational retrospective study was carried out at the Medicine Department of Rohilkhand Medical College and Hospital in Bareilly, Uttar Pradesh.Records of all patients who had hypocalcemia and hypomagnesemia were taken an studies for age, gender, BMI, Hemoglobin, Serum protein and Albumin level, S.creatinine,Hb A1C .The GFR was estimated by cockcroft and Gault formula. Then patient characteristics of diabetic and nondiabetic group were studied and statistically analysed. All patient of anemia and hypoalbunemia were excluded from the study. Correlation of eGFR with calcium and magnesium levels were statistically analysed.and vit D levels were done wherever possible. Results In this study, the gender distributed as male patient is (n=59) and female (n=46). Hence, also distributed further in relation with hypomagnesemia and hypocalcemia. Hypomagnesemia (defined as fasting serum magnesium concentration <1.7) was found in 4 male patients and 7 females. No patient had hypermagnesemia. Hypocalcemia (defined as a fasting serum calcium concentration <8.5) was found in 55 male patient and 39 in females. Hence, the correlation with gender was not significant with p-value >0.05.
The difference in prevalence rates of hypomagnesemia in patients with nephropathy and without nephropathy had no statistical significance with p value 0.80. Also, the difference in prevalence rates of hypocalcemia in patients with nephropathy and without nephropathy had no statistical significance with p value 0.40.

**Conclusion**: The was no significant correlation found in the serum calcium levels and serum magnesium when they were determined acoording to the varying duration of diabetes mllitus, the p-vaue was found to be 0.426 and 0.373 respectively which is statistically insignificant.

**Keywords**: **serum calcium, serum magnesium, diabetic nephropathy**

**Introduction:** According to the World Health Organization (WHO), noncommunicable diseases (NCDs) accounted for 74% of global deaths in 2019, with diabetes contributing to 1.6 million deaths, making it the ninth most common cause of death worldwide. By 2035, it is proposed that about 592 million patients suffering from diabetes will die. Diabetic Nephropathy(DN) is the main cause of end-stage kidney disease (ESKD) in developed countries. Diabetes mellitus has an important impact on serum $Ca^{2+}$ levels, and there is a strong negative link between glycemic management, as measured by a high HbA1c percentage, and a decrease in serum $Ca^{2+}$ levels, which is usually unaffected by gender or duration of DM. There are reports on the link between serum $Ca^{2+}$ level and decline in the kidney function.
Chronic renal failure (CRF) also called chronic renal insufficiency is a slowly progressive loss of renal function over a period of months or year and defined as an abnormally low glomerular filtration rates (GFR)[2]. CRF that leads to severe illness and requires some form of renal replacement therapy such as dialysis is called end-stage renal disease. CRF occurs in 1.0 of every 5000 people, usually in middle-aged and older people, although children and pregnant women are also susceptible. CRF may be irreversible, and eventually leads to total kidney failure.Many people are unaware of the problem until more than 70% of kidney function has been lost. CRF produces a number of abnormalities of calcium and phosphorus metabolism.

**Materials And Methods:**
**Place Of Study:** This Study Was Conducted In Patients Attending OPD And IPD In Department Of Medicine, Rohilkhand Medical College And Hospital, Bareilly Uttar Pradesh.
**Type Of Study**: An Observational Study.
**Duration Of Study**: The proposed study will be conducted from the 1st November 2022 to 31st October 2023.
**Sample Size**: In our study a total of 100 patients were taken, which was statically calculated by using the software Power and sample size program.[11]
Alpha - 0.05(5%)
Power -0.8(80%)
Delta-19(mean)
Sigma-24(standard deviation)
Calculated sample size - 35 in each group

**Inclusion Criteria**
- Age > 18 years
- Patients with diabetes suffering from diabetic nephropathy or not.

**Exclusion Criteria**
- Chronic Smoker and Alcohol
- Pregnant
- Cardiovascular disease and Thyroid disease
- Anasarca, CLD
- Autoimmune diseases, Active infection and Neoplasm
- Non Diabetic CKD Patients
- Malabsorption or Chronic diarrhoea
- Patients on Magnesium Supplements
- Patients on Calcium Supplements

**Methodology**:
**Ethics Committee Approval:** Approval was obtained from Institutional Ethics Committee.
**Consent**: Informed consent was obtained from all the participants and their relatives wherever necessary.

**Procedure Of Study**: In this study,77 cases of Diabetic Nephropathy patients and 28 patients of diabetes mellitus but not suffering from Nephropathy and presenting to the OPD or emergency room of Rohilkhand Medical College and hospital, Bareilly and fulfilling the inclusion criteria.
Patients were included according to the criteria's mentioned above, after getting informed consent. Patients had been examined and with history followed by the investigations like Serum Magnesium, Serum Calcium, Serum Creatinine,Urine albumin creatinine ratio, Urine routine and microscopy, Ultrasound whole abdomen and RBS has been done. The criteria of Diabetic Nephropathy has been used to determine the Staging and prognosis. Patients are categorised accordingly.

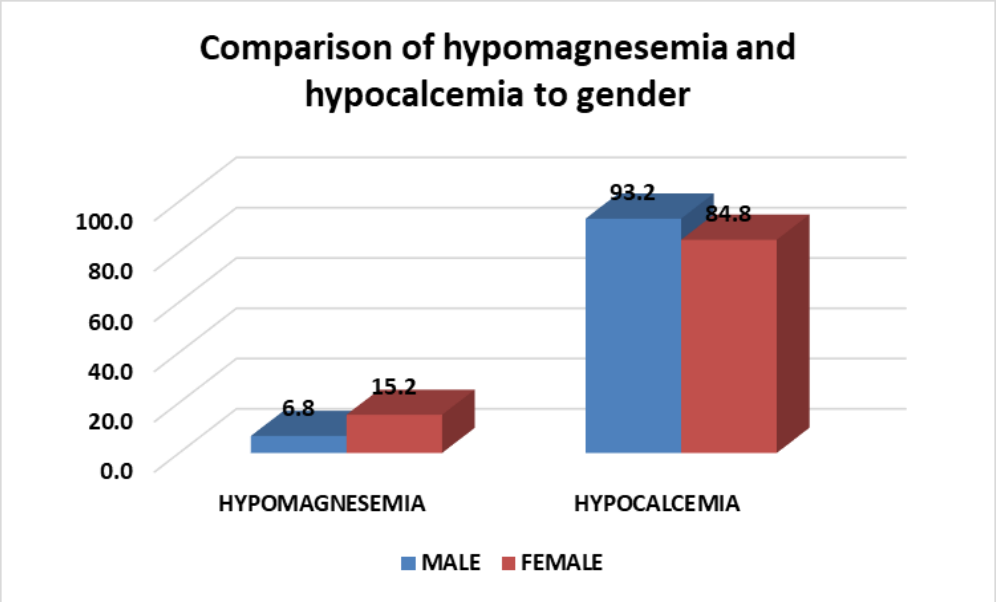
**Statistical Analysis:** The data was coded and entered; its compiling was done on a Microsoft Excel and them imported into SPSS (statistical package for social sciences) Licensed Version 23.0.
Descriptive analysis was done by calculating proportions, means and standard deviations. Appropriate statistical tests were applied depending upon the distribution and type of the data. $p<0.05$ was considered significant.
This one-year observational study was conducted in the Department of General Medicine, RMCH, Bareilly to observe the Serum Magnesium and Serum Calcium in Diabetic Nephropathy. In this study, 105 patients suffering from Diabetes Mellitus were included and closely observed for the complications of nephropathy. The data obtained from these were analysed and results were tabulated as follows. p-value <0.05 was considered statistically significant.

**Result:**

**Gender based distribution of hypomagnesemia and hypocalcemia in diabetic patients**

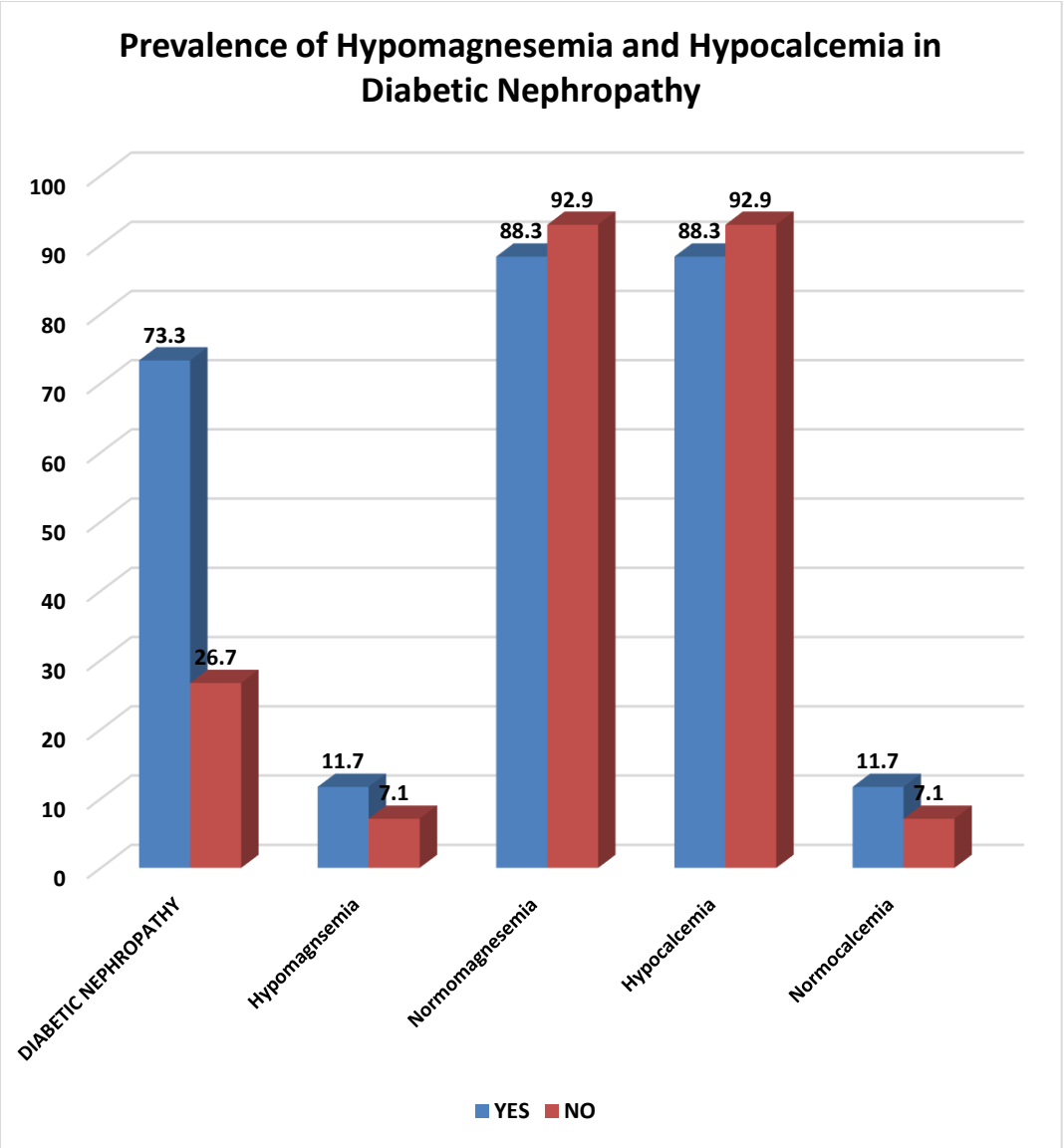
| | **HYPOMAGNESEMIA** | | **HYPOCALCEMIA** | | **TOTAL** |
|---|---|---|---|---|---|
| **GENDER** | **Number** | **%** | **Number** | **%** | |
| **MALE** | 4 | 6.8 | 55 | 93.2 | 59 |
| **FEMALE** | 7 | 15.2 | 39 | 84.8 | 46 |
| **TOTAL** | 11 | 10.5 | 94 | 89.5 | 105 |

In this study, the gender distributed as male patient is (n=59) and female (n=46). Hence, also distributed further in relation with hypomagnesemia and hypocalcemia. Hypomagnesemia (defined as fasting serum magnesium concentration <1.7) was found in 4 male patients and 7 females. No patient had hypermagnesemia. Hypocalcemia (defined as a fasting serum calcium concentration <8.5) was found in 55 male patient and 39 in females. Hence, the correlation with gender was not significant with p-value >0.05.




**Prevalence of Hypomagnesemia and Hypocalcemia in Diabetic Nephropathy**

| DIABETIC NEPHROPATHY | Diabetic Patients | | Hypo magnesemia | | Normo magnesemia | | Hypocalcemia | | Normocalcemia | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Number | Percentage% | Number | Percentage% | Number | Percentage% | Number | Percentage% | Number | Percentage% |
| **YES** | 77 | 73.3 | 9 | 11.7 | 68 | 88.3 | 68 | 88.3 | 9 | 11.7 |
| **NO** | 28 | 26.7 | 2 | 7.1 | 26 | 92.9 | 26 | 92.9 | 2 | 7.1 |
| **Total** | 105 | 100 | 11 | 10.5 | 94 | 89.5 | 94 | 89.5 | 11 | 10.5 |




**Discussion:** The difference in prevalence rates of hypomagnesemia in patients with nephropathy and without nephropathy had no statistical significance with p value 0.80. Also, the difference in prevalence rates of hypocalcemia in patients with nephropathy and without nephropathy had no statistical significance with p value 0.40.

**Conclusion**: The was no significant correlation found in the serum calcium levels and serum magnesium when they were determined acoording to the varying duration of diabetes mllitus, the p-vaue was found to be 0.426 and 0.373 respectively which is statistically insignificant.

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