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Association Of Serum Magnesium Level with and Without Retinopathy in Type-2 Diabetes Mellitus

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ABSTRACT

Background: Diabetes mellitus (DM) is a metabolic disorder which occurs due to a complex interaction between environmental, genetic and lifestyle factors. Hyperglycemia due to DM leads to microvascular and macrovascular complications. Diabetic retinopathy (DR) is an important cause of vision impairment and blindness among the working adult population. Vascular proliferation and maculopathy observed in this disease may be controlled by adequate glycemic management and prompt ocular intervention.

Magnesium is known to play an essential role in both insulin release and cellular glucose metabolism. Hypomagnesemia is seen in diabetics due to increased urinary loss and decreased dietary intake and absorption. Insulin causes shift of magnesium from extracellular to intracellular

Materials And Methods: Cross sectional study

- Study Design: Cross-sectional observational study
- Study period: 3 months
- Sample size: 60
- Study area: R. L. Jalappa Hospital
- Study population: patients >40 years age with type 2 DM, serum creatinine ⩽1.2 mg/dL and without microalbuminuria

Results

1. The age of the study population varied between 40-68 years.
2. Male patients were 68% and female patients were 32% of the study population.
3. Of the 60 patients studied most of them have diabetic retinopathy changes.
4. Majority of the patients with retinopathy had NPDR changes rather than PDR.
5. Serum magnesium levels in patients with retinopathy was lower compared to those without retinopathy.
6. Serum magnesium levels are inversely proportional to severity of retinopathy in patients with retinopathy

Conclusion

- Serum magnesium levels were low in patients with diabetic retinopathy.
- Patients with Sight threatening diabetic retinopathy (STDR) had relatively lower serum magnesium levels compared to those without STDR.

Keywords: *Magnesium, type 2 diabetes mellitus, diabetic retinopathy.*

1. INTRODUCTION

The term diabetes mellitus (DM) refers to abnormal carbohydrate metabolism that is characterized by hyperglycemia associated with impairment in insulin secretion and peripheral resistance to the action of insulin. Type 2 DM is the most common type of diabetes in adults (>90%) and is characterized by hyperglycemia due to progressive loss of insulin secretion from the beta cell superimposed on a background of insulin resistance, resulting in relative insulin deficiency. The majority of patients are asymptomatic on presentation, with hyperglycemia noted on routine laboratory investigations. The classic symptoms of hyperglycemia are polyuria, polydipsia, nocturia, blurred vision, and weight loss. Diabetic retinopathy (DR) is one of the most important causes of vision loss and impaired vision worldwide between 25-74 years of age. Visual loss from DR may be secondary to microaneurysms, retinal hemorrhages, retinal detachment, iris neovascularization. DR is often asymptomatic until late stages.

Objectives

- To determine the association between serum magnesium levels and retinopathy in type 2 diabetic patients with normal renal function and to correlate it with severity of retinopathy.

2. MATERIALS AND METHODS:

Cross sectional study

- **Study Design:** Cross-sectional observational study
- **Study period:** 3 months
- **Sample size:** 60
- **Reference article:** Shivakumar K, Rajalakshmi AR, Jha KN, Nagarajan S, Srinivasan AR, Lokesh Maran A. Serum magnesium in diabetic retinopathy: the association needs investigation. Therapeutic Advances in Ophthalmology. 2021 Dec;13:25158414211056385.
- **Study area:** R. L. Jalappa Hospital
- **Study population:** patients >40 years age with type 2 DM, serum creatinine ⩽1.2 mg/dL and without microalbuminuria

Statistical Analysis Methods: Data will be entered into Microsoft excel data sheet and will be analyzed using SPSS 22 version software. Categorical data will represented in the form of Frequencies and proportions. Chi-square will be the test of significance. Continuous data will be represented as mean and standard deviation. Independent t test will be the test of significance to identify the mean difference between two groups. P value <0.05 was considered as statistically significant.

Sample Size: Was estimated by using the difference in Mean Serum magnesium between with retinopathy and with retinopathy from the study Lokendra Singh Rajpoot et. al. as 1.80 ± 0.25 and 2.03 ± 0.33. Using these values at 95% Confidence limit and 80% power sample size of 27 was obtained in each group by using the below mentioned formula and Med calc sample size software. With 10% nonresponse sample size of 27 + 2.7 ≈ 30 cases will be included in each group.

Sample Size Estimation Formula:

$N = 2\,SD^2(Z_{\alpha/2} + Z_{\beta})^2 d^2$

- Where $Z_{\alpha/2}$ is the critical value of the Normal distribution at $_{\alpha/2}$ (e.g. for a confidence level of 95%, **α** is 0.05 and the critical value is 1.96).
- Z_{β} is the critical value of the Normal distribution at β (e.g. for a power of 80%, ß is 0.2 and the critical value is 0.84),
- SD is the standard deviation from previous study population variance, and
- d is the largest difference between two mea

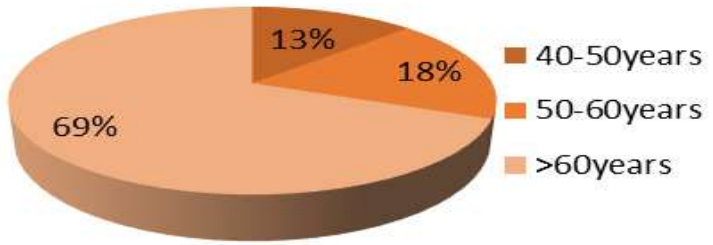
3. RESULTS

Table 1. Age distribution among the samples in the study was as follows:

Age (Years)	total	
	Number	Percentage

40-50	8	13%
50 – 60	11	18%
>60	41	69%
Total	60	100%

Figure 1. Age distribution among the samples in the study was as follows



Of the 60 patients, 35 patients have diabetic retinopathy changes and 25 patients have no retinopathy changes. Among the patients studied most of them have diabetic retinopathy changes

Figure 2. Distribution of retinopathy changes in diabetic patients

In the study males accounted for 68% and females for 32% of the total population

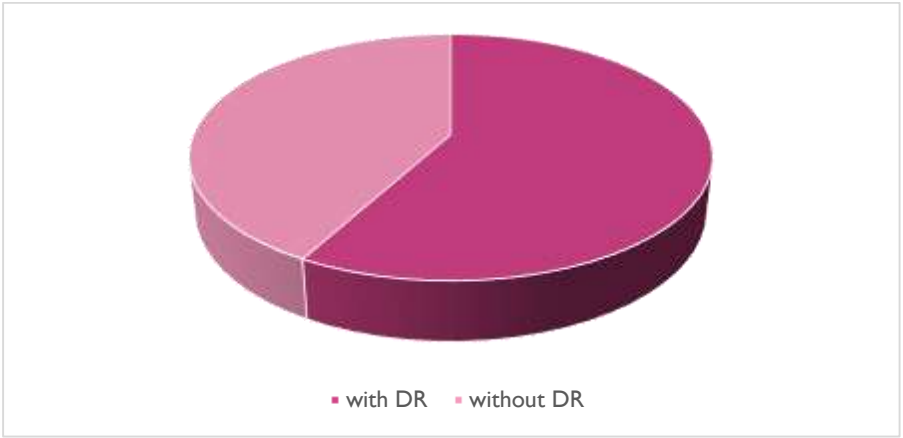


Figure 3. Gender distribution among the sample population

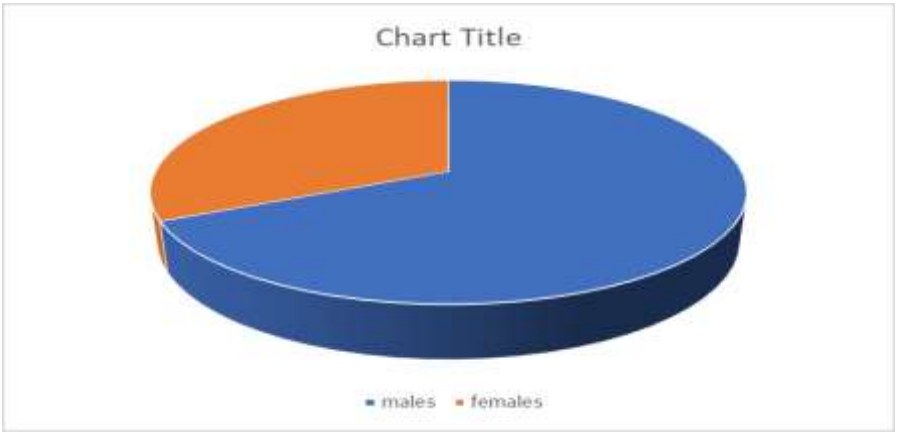
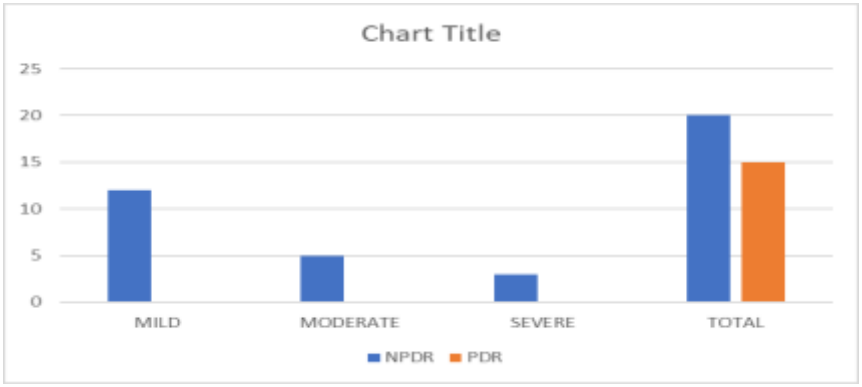


Figure 4. Analysis of stages of diabetic retinopathy



Majority of the patients with retinopathy had NPDR (n = 20, 58%). Mild, moderate, severe NPDR was seen in 12 (60%), 5 (25%) and 3 (15%) patients; with associated CSME in 1 (8%), 3 (60%), 2 (66%) patients, respectively. Among the 15 (42%) patients with PDR, 2 (13.3%) had CSME. STDR was present in 12 (34%) patients, whereas 23 (66%) had non-sight-threatening diabetic retinopathy (non-STDR)

Table 2. Analysis of stages of diabetic retinopathy.

Variants	Total No. of patients	CSME	Percentage
NPDR	20	6	30%
PDR	15	2	13%
Total	35	8	

The mean serum magnesium levels in patients with retinopathy (1.63 ± 0.30 mg/dL) were lower compared with patients without retinopathy (1.76 ± 0.22 mg/dL).In the retinopathy group, mean serum magnesium levels showed a decrease with increasing severity of retinopathy. Patients with STDR had a mean serum magnesium of 1.55 ± 0.33 mg/dL, while those with non-STDR had a mean serum magnesium of 1.68 ± 0.37 mg/dL. Patients with STDR had a significantly lower serum magnesium level compared with those with non-STDR and no retinopathy.

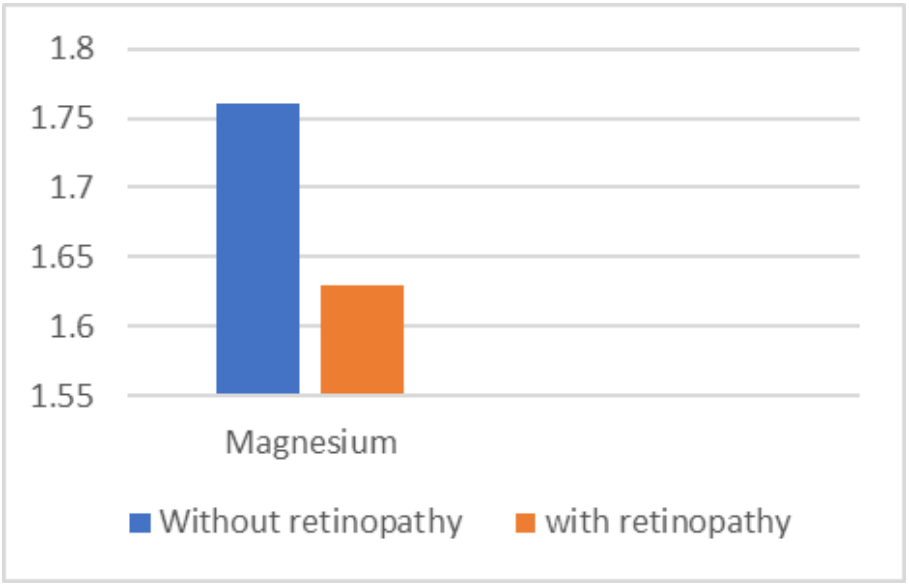


Figure 7. Analysis of serum magnesium levels with and without retinopathy.

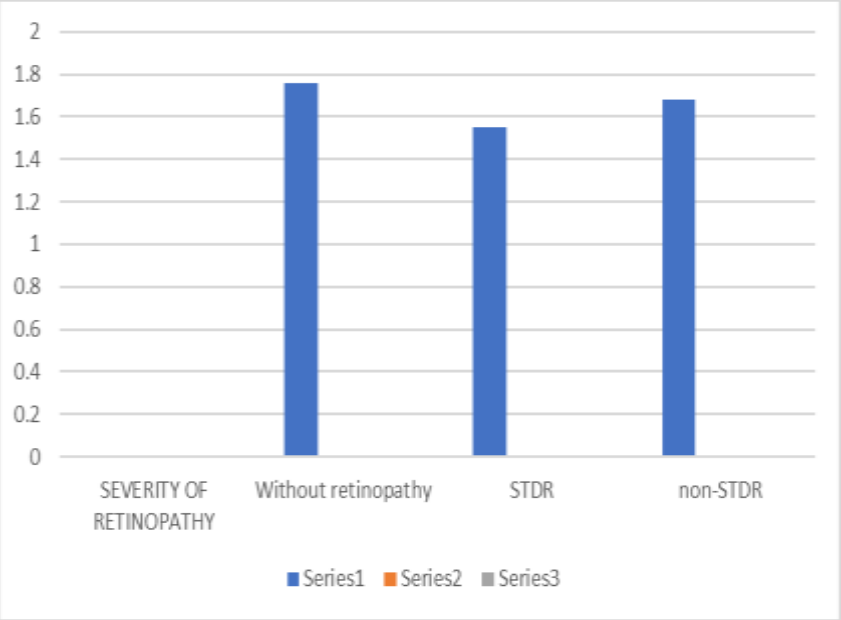


Figure 7. Analysis of serum magnesium levels with severity of retinopathy

SUMMARY

60 patients of DM admitted to Sri Devraj Urs Medical College were studied for retinopathy changes.

1. The age of the study population varied between 40-68 years.
2. Male patients were 68% and female patients were 32% of the study population.
3. Of the 60 patients studied most of them have diabetic retinopathy changes.
4. Majority of the patients with retinopathy had NPDR changes rather than PDR.
5. Serum magnesium levels in patients with retinopathy was lower compared to those without retinopathy.
6. Serum magnesium levels are inversely proportional to severity of retinopathy in patients with retinopathy

4. LIMITATIONS OF THIS STUDY

- Sample size of the study is small and requires large sample size to define the results to large population.

5. CONCLUSION

- Serum magnesium levels were low in patients with diabetic retinopathy.
- Patients with Sight threatening diabetic retinopathy (STDR) had relatively lower serum magnesium levels compared to those without STDR

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