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A study of association of serum magnesium and zinc levels in pre-diabetics

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Abstract
Background: Decreased serum magnesium levels and increased urinary magnesium losses have been recognized in both type 1 and type 2 DM. Decreased dietary magnesium intake has been associated with increased incidence of T2DM. Hypomagnesaemia and hypermagnesuria was reported to be associated with diabetes complications. Thus, magnesium has drawn considerable attention for its potential role in improving insulin sensitivity and preventing DM. Zinc, another important trace element, acting as a cofactor for several biochemical processes has a major role in health status. There is substantiating evidence indicating the importance of zinc in DM. Impaired zinc metabolism, decreased plasma zinc and hyperzincuria has been reported as a consequential effect of glucose absorption. But limited studies have been conducted in pre-diabetics. This study puts in an effort to find the answers.
Aims and Objectives: To study the association of serum magnesium and zinc levels in pre-diabetics.
Materials and Methods: This study was done in the Department of General Medicine at Kanachur Institute of Medical Sciences, Mangalore. This study was done from Jan 2017 to Dec 2018 Ninety and an equal age and sex matched control were used for the study.
Results: There is a strong association between the serum magnesium and zinc levels in diabetics when compared to normal individuals.
Conclusion: More number of studies have to come up in different geographical locations so as to be helpful to the practicing physicians.

Keywords: Magnesium, zinc, serum, association, pre-diabetics

Introduction

Diabetes mellitus (DM) is a complex metabolic disease causing death of 1 in 20 individuals. [1] The prevalence of DM is predicted to globally hit 366 million in 2030 with a maximum increase in developing countries like India [2]. Type 2 DM (T2DM), most commonly prevalent ~90–95% is usually associated with predominant insulin resistance, relative insulin deficiency, and a poor insulin secretion [3]. In past decades, it has become apparent that deficiencies of trace elements are commonly associated with T2DM [4–6]. Magnesium, a divalent cation is one among the common micro mineral deficiency established in DM [7, 8]. Decreased serum magnesium levels and increased urinary magnesium losses have been recognized in both type 1 and type 2 DM. Decreased dietary magnesium intake has been associated with increased incidence of T2DM [9]. Hypomagnesaemia and hypermagnesuria was reported to be associated with diabetes complications [7, 10, 11]. Thus, magnesium has drawn considerable attention for its potential role in improving insulin sensitivity and preventing DM. Zinc, another important trace element, acting as a cofactor for several biochemical processes has a major role in health status [12]. There is substantiating evidence indicating the importance of zinc in DM. Impaired zinc metabolism, decreased plasma zinc and hyperzincuria has been reported as a consequential effect of glucose absorption [13, 14]. But limited studies have been conducted in pre-diabetics. This study puts in an effort to find the answers.

Aims and Objectives

To study the association of serum magnesium and zinc levels in pre-diabetics when compared to the normal individuals.

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Materials and Methods

This study was done in the Department of General Medicine at Kanachur Institute of Medical Sciences, Mangalore. This study was done from Jan 2017 to Dec 2018. Ninety and an equal age and sex matched control were used for the study.

Inclusion criteria

- Random blood sugar level of 140mg/dl to 199mg/dl were included in the study as pre-diabetics
- Age and sex matched

Exclusion criteria

- None of the patients were on treatment and were known diabetics
- Subjects who were known type 1

Blood was collected under aseptic precautions and was sent to the Department of Biochemistry of estimation of the serum zinc and magnesium levels. Their levels were estimated and was compared in the two groups.

Statistical analysis

All the statistical analysis was done using the latest R software.

Results

Table 1: Age

Total	Mean Age (Group 1)	Mean Age (Group 2)	p-value
60	44.56 ± 4.38	42.48 ± 4.93	>0.001 (Not sig)

Table 2: Sex Distribution

	Total	Male	Female
Group 1 (pre-diabetics)	90	61	29
Group 2 (Control)	90	61	29

Table 3: Serum Magnesium level

Group 1 (pre-diabetics)	Group 2 (Control)	p-value
1.41 ± 0.78	2.42 ± 0.56	<0.001

Table 4: Serum Zinc Level

Group 1 (pre-diabetics)	Group 2 (Control)	p-value
57.27 ± 8.38	91.38 ± 6.27	<0.001
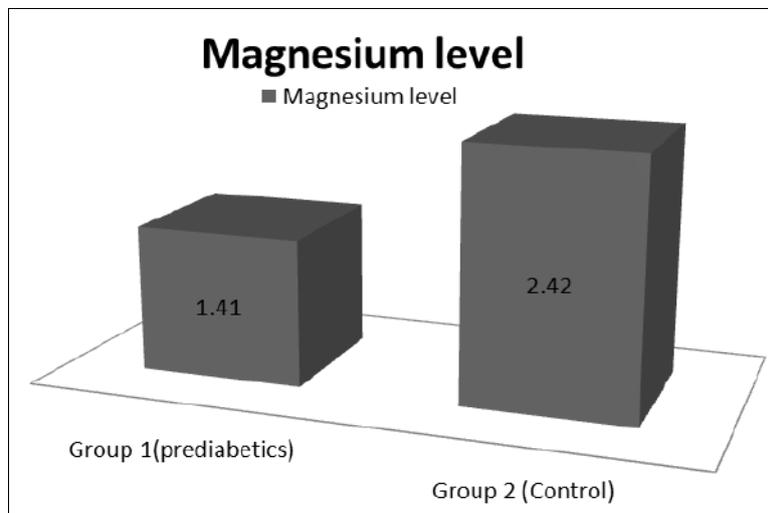
Graph 1: Serum Magnesium level
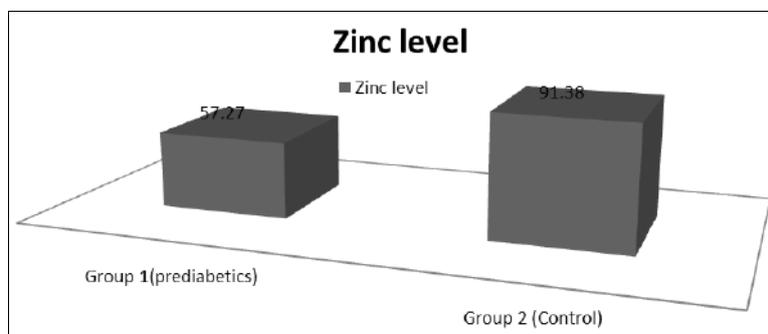
Graph 2: Serum Zinc Level

Discussion

Zinc and magnesium are important trace elements that play vital roles in several biochemical functions [15, 16]. In diabetes, these minerals attract importance due to its association with insulin sensitivity, insulin secretion and blood glucose regulation [17]. Diabetics had lower serum magnesium in our study than controls which is in association with Arpaci et al. study where hypomagnesemia was closely associated with poor glycemic status along with microalbuminuria and other complications [11]. Sharma et al. showed hypomagnesemia could be an early predictor for poor glycemic status and its associated complications [18]. Hypomagnesemia due to increased urinary loss of magnesium [19] is caused by reduced tubular reabsorption of magnesium [20]. With respect to serum magnesium levels, Kundu et al. showed a significant association of

hypomagnesemia with diabetic retinopathy patients which suggests hypomagnesemia could be a probable risk factor in the development and progression of diabetic complications [21]. SP *et al.* study also observed a significant decrease in mean serum zinc and magnesium concentration in all diabetics than controls. Few studies showed the association of glycemic status with zinc levels as our study. Dasarathan *et al.* showed a significant inverse relationship (r = -0.54) of zinc concentration with HbA1c which is parallel to our study (r = -0.56). [22] McNair *et al.* and Farooq *et al.* reported that serum zinc levels were inversely related to glycemic status [23, 24]. Acoording a study conducted by Hypomagnesium serum levels was significantly associated with development of pre-diabetes and impaired glucose tolerance conditions. Surprisingly no impaired fasting glucose serum levels were detected. This indicates magnesium levels helps to prevent the progression of the disease. It's a known fact that its associated with diabetes but is is associated with prediabetics is the question. This study successfully links the relation.

Conclusion
This study successfully links the relation between the serum zinc and magnesium levels in the pre-diabetics.

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