



E-ISSN: 2706-9575
P-ISSN: 2706-9567
IJARM 2019; 1(1): 42-44
Received: 02-11-2018
Accepted: 13-12-2018

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

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DOI: <https://doi.org/10.22271/27069567.2019.v1.i1a.326>

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

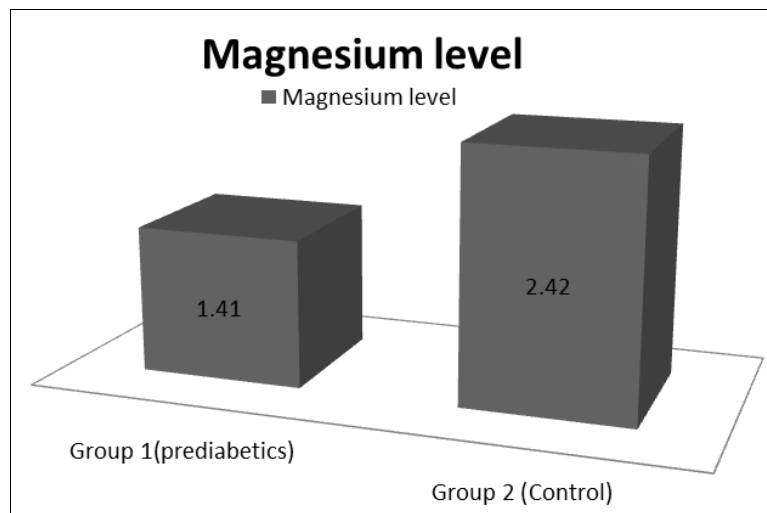
| | Total | Male | Female |
|-------------------------|-------|------|--------|
| Group 1 (pre-diabetics) | 90 | 61 | 29 |
| Group 2 (Control) | 90 | 61 | 29 |

Table 3: Serum Magnesium level

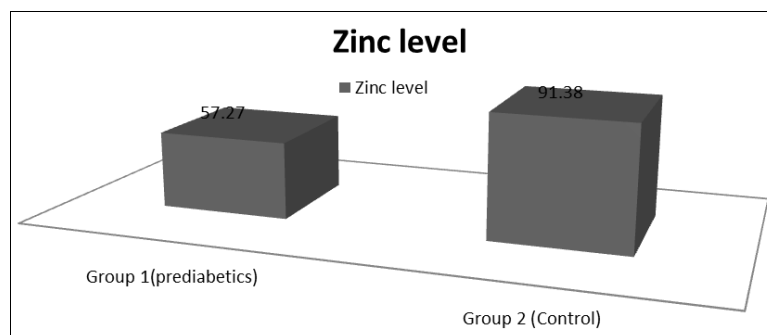
| Group 1 (pre-diabetics) | Group 2 (Control) | p-value |
|-------------------------|-------------------|---------|
| 1.41 ± 0.78 | 2.42 ± 0.56 | <0.001 |

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]. According 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 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.

References

1. Kumar A, Goel MK, Jain RB, Khanna P, Chaudhary V. India towards diabetes control: Key issues. *Australas Med J.* 2013 Oct 31;6:524-31.
2. Wild S, Roglic G, Green A, Sicree R, King H. Global prevalence of diabetes: estimates for the year 2000 and projections for 2030. *Diabetes Care.* 2004 May;27[5]:1047-53.
3. American Diabetes Association. Diagnosis and classification of diabetes mellitus [published correction appears in *Diabetes Care.* 2010 Apr;33[4]:e57]. *Diabetes Care.* 2010;33 Suppl 1[Suppl 1]:S62-S69.
4. Walter RM, Uriu-Hare JY, Olin KL, Oster MH, Anawalt BD, Critchfield JW, *et al.* Copper, zinc, manganese, and magnesium status and complications of diabetes mellitus. *Diabetes Care.* 1991;14:1050-1056.
5. Kazi TG, Afridi HI, Kazi N, Jamali MK, Arain MB, Jalbani N. Copper, chromium, manganese, iron, nickel, and zinc levels in biological samples of diabetes mellitus patients. *Biol Trace Elem Res.* 2008 Apr;122[1]:1-18.
6. Khan AR, Awan FR. Metals in the pathogenesis of type 2 diabetes. *J Diabetes Metab Disord.* 2014 Jan 8;13:16.
7. de Valk HW. Magnesium in diabetes mellitus. *Neth J Med.* 1999;54:139-146.
8. Chaudhary DP, Sharma R, Bansal DD. Implications of Magnesium Deficiency in Type 2 Diabetes: A Review. *Biol Trace Elem Res.* 2010 May;134:119-29.
9. Barbagallo M, Dominguez LJ. Magnesium and type 2 diabetes. *World J Diabetes.* 2015 Aug 25;6:1152-7.
10. Sales CH, Pedrosa Lde F. Magnesium and diabetes mellitus: their relation. *Clin Nutr.* 2006 Aug;25[4]:554-62.
11. Arpacı D, Tocoglu AG, Ergenc H, Korkmaz S, Ucar A, Tamer A. Associations of serum Magnesium levels with diabetes mellitus and diabetic complications. *Hippokratia.* 2015;19:153-7.
12. Roohani N, Hurrell R, Kelishadi R, Schulin R. Zinc and its importance for human health: An integrative review. *J Res Med Sci Off J Isfahan Univ Med Sci.* 2013;18:144.
13. Kinlaw WB, Levine AS, Morley JE, Silvis SE, McClain CJ. Abnormal zinc metabolism in type II diabetes mellitus. *Am J Med.* 1983 Aug;75[2]:273-7.
14. Mateo MC, Bustamante JB, Quiros JF, Manchado OO. A study of the metabolism of zinc its metalloenzymes in diabetes mellitus. *Biomedicine.* 1975 Apr 30;23[4]:134-6.
15. Chasapis CT, Loutsidou AC, Spiliopoulou CA, Stefanidou ME. Zinc and human health: an update. *Arch Toxicol.* 2012 Apr 1;86:521-34.
16. Romani AM. Magnesium in health and disease. *Met Ions Life Sci.* 2013;13:49-79.
17. Ranasinghe P, Piger S, Galappathy P, Katulanda P, Constantine GR. Zinc and diabetes mellitus: understanding molecular mechanisms and clinical implications. *Daru.* 2015;23[1]:44.
18. Sharma A, Dabla S, Agrawal RP, Barjatya H, Kochar DK, Kothari RP. Serum magnesium: an early predictor of course and complications of diabetes mellitus. *J Indian Med Assoc.* 2007 Jan;105[1]:16, 18, 20.
19. Walter RM Jr, Uriu-Hare JY, Olin KL, Oster MH, Anawalt BD, Critchfield JW, Keen CL. Copper, zinc, manganese, and magnesium status and complications of diabetes mellitus. *Diabetes Care.* 1991 Nov;14[11]:1050-6. doi: 10.2337/diacare.14.11.1050.
20. Durak R, Gülen Y, Kurudirek M, Kaçal M, Capoğlu I. Determination of trace element levels in human blood serum from patients with type II diabetes using WDXRF technique: a comparative study. *J Xray Sci Technol.* 2010;18[2]:111-20.
21. Kundu D, Osta M, Mandal T, Bandyopadhyay U, Ray D, Gautam D. Serum magnesium levels in patients with diabetic retinopathy. *J Nat Sci Biol Med.* 2013 Jan;4[1]:113-6.
22. Dasarathan R, Kumar S, Ganesh V, Chenthil KS. Study of serum Zinc status among type 2 diabetes mellitus patients. *IJAM.* 2017;4:1344-1347.
23. McNair P, Kiilerich S, Christiansen C, Christensen MS, Madsbad S, Transbol I. Hyperzincuria in insulin treated diabetes mellitus--its relation to glucose homeostasis and insulin administration. *Clin Chim Acta.* 1981 May;112[3]:343-8.
24. Farooq DM, Alamri AF, Alwhahabi BK, Metwally AM, Kareem KA. The status of zinc in type 2 diabetic patients and its association with glycemic control. *J Family Community Med.* 2020;27[1]:29-36.