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RESEARCH ARTICLE

ESTIMATION OF SERUM ZINC LEVEL IN NEWLY DIAGNOSED TYPE 2 DIABETES MELLITUS PATIENTS

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Abstract

Background: There is an important role of zinc in the synthesis, storage and secretion of insulin and thus an important role in energy production. Zinc has antioxidant effect and is also component of many antioxidants. It inhibits formation of free radicals and damage by lipid peroxidation. Whereas oxidative stress plays an important role in the development of diabetic complications.

Objective: Thus this study is designed to estimate serum zinc level and its correlation with HbA1c in newly diagnosed type 2 diabetes mellitus patients from north eastern population.

Materials And Methods: In this hospital based observational study done in department of General Medicine , Assam Medical College and Hospital 82 newly diagnosed type 2 diabetes mellitus patients were selected and detailed history, physical examination and blood investigation including serum zinc estimation of all the subjects was done and the results were analysed.

Results of zinc study: The mean serum zinc level of newly diagnosed type 2 diabetes mellitus patients with HbA1C level <8% was 59.82+/-13.12 microgram/dl , those with HbA1C level of 8-10% were having mean serum zinc level of 48.19+/-17.98 microgram/dl and those with HbA1C level >10% were having mean serum zinc level of 39.38+/-14.95 microgram/dl . There was a statistically significant negative correlation (r - value = -0.38 and p value = 0.0004) observed between HbA1C level and serum zinc levels in newly diagnosed type 2 diabetes mellitus patients.

Conclusion: In this cross-sectional observational study done in the North-East population of India, we found that there was a reduction of serum zinc level in newly diagnosed Type 2 Diabetes Mellitus and there was also a statistically significant negative correlation between HbA1C and serum zinc level in newly diagnosed Type 2 Diabetes Mellitus patients. Therefore, earlier detection of zinc deficiency in newly diagnosed Type 2 Diabetes Mellitus patients helps in controlling glycemic status and also helps in preventing complications.

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Introduction:-

Diabetes comprises of a number of metabolic diseases which are characterised by hyperglycaemia which is the result of defects in either insulin secretion or insulin action or both[1] .

The people living with diabetes is estimated to rise from 463 million in 2019 to 700.2 million by 2045 according to data published by the International Diabetes Federation in their 9th edition of Diabetes Atlas[2] .Diabetes is associated with many complications which may result in blindness, amputations, kidney disease, anemia, cardiovascular and neurological complications which result in decreased functional capacity, autonomy and individual quality of life.

There is an important role of zinc in the synthesis, storage and secretion of insulin and thus an important role in energy production. The structural integrity of insulin is also maintained by zinc[3,4]. The ability of islet cells of pancreas to produce and secrete insulin is affected by decreased zinc concentration in blood and may lead to development of insulin resistance responsible for type 2 diabetes[5] . Oxidative stress plays an important role in the development of diabetic complications. Zinc has antioxidant effect and is also component of many antioxidants. It inhibits formation of free radicals and damage by lipid peroxidation[6] .

Glycated hemoglobin percentage is an index of glycemic control. It's measurement helps in identifying the risk of having diabetic complications[7] .

Thus this study is designed to estimate serum zinc level and its correlation with HbA1c in newly diagnosed type 2 diabetes mellitus patients from north eastern population. It is enticipated that this study will shed light on the role of zinc in the pathogenesis of type 2 diabetes mellitus and its complications. Also it may be integrated in clinical practice to guide management decisions in newly diagnosed type 2 diabetes mellitus patients.

Materials And Methods:-

In this hospital based observational study done in department of General Medicine , Assam Medical College and Hospital 82 newly diagnosed type 2 diabetes mellitus patients were selected and detailed history of all the subjects regarding diagnosis and complications of Diabetes mellitus as well as the type of anti-diabetic treatment received was taken and Standardized Physical examination was done.Anthropometric measurements (weight and height) and calculation of body mass index of all participants was measured.Under strict aseptic conditions blood and Urine samples were collected from all the patients and the serum was investigated for serum zinc , HbA1c, cholesterol, triglycerides and fasting blood glucose ,post breakfast (2hrs after breakfast) blood glucose and Urine was investigated for Routine Urine examination and Microalbuminuria. The outcome parameter serum zinc in newly diagnosed type 2 diabetes mellitus and correlation of serum zinc with HbA1C in newly diagnosed type 2 diabetes mellitus patients were analysed.

Results of zinc study:-

Majority of the subjects belong to 51-60 years of age.(40.24%) . The next majority of subjects were in 41-50years age group.(30.49%). 13.41% of subjects were in 61-70years age group. 4.88% subjects were in 19-30years age group. 1.22% of subjects were in >70years age group. The mean age of the study was 50.39+/- 10.81 years. The percentage of males in the study was 63.41% and the percentage of females in the study was 36.59%.

The majority of the subjects lies in the normal BMI level group (79.27%) and the remaining subjects lies in the obese group (20.73%). The mean BMI for the study was 24.27+/-1.52kg/m2. The percentage of newly diagnosed diabetes mellitus patients without chronic complications was 53.66% whereas the percentage of patients with chronic complications was 46.34%.

The majority percentage of serum zinc level was found to be <60 microgram/dl (74.39%) and 25.61% of study subjects lies in 60-120 microgram/ dl level. There was no study subject having a serum zinc level >120 microgram/ dl. The mean serum zinc level among the study subjects was 52.57+/-16.96 microgram/dl.

For majority of the study subjects HbA1C level was<8%(48.78%) and the next majority of the study subjects HbA1C level lies between 8 - 10% (36.59%) and the rest of the study subjects lies >10%(14.63%). The mean HbA1C level among the study subjects was 8.66+/-2.15%.

The mean serum zinc level of newly diagnosed type 2 diabetes mellitus patients with HbA1C level <8% was

59.82+/-13.12 microgram/dl , those with HbA1C level of 8-10% were having mean serum zinc level of 48.19+/-17.98 microgram/dl and those with HbA1C level >10% were having mean serum zinc level of 39.38+/-14.95 microgram/dl . There was a statistically significant negative correlation (r - value = -0.38 and p value = 0.0004) observed between HbA1C level and serum zinc levels in newly diagnosed type 2 diabetes mellitus patients. There was also significant negative correlation (r value = -0.39 and p value = 0.00034) observed between fasting plasma glucose and serum zinc level. There was also a significant negative correlation (r value = -0.24 and p value = 0.03058) observed between serum triglyceride and serum zinc level and another significant negative correlation (r value = -0.28 and p value = 0.01208) observed between serum total cholesterol and serum zinc level.
The mean serum zinc level of newly diagnosed type 2 diabetes mellitus patients without the chronic complications was 55.61+/-13.51microgram/dl whereas in patients with chronic complications was 49.06+/-19.85. The comparison between the two groups was found to be statistically significant (p value = 0.0905)

Discussion:-

The mean age for our study was 50.39+/- 10.81 years.
Saharia et al[8] study included 50 newly diagnosed type 2 diabetes mellitus patients in which the maximum number of cases belong to 41-60years age group which is comparable to our study.

In our study it was seen that the percentage of males in the study was 63.41% and the percentage of females was 36.59%. The male: female ratio was 1.73:1.

In Saharia et al[8] study the male: female ratio was 2.33:1 where the male proportion was more than female which was comparable to our study.

In our study it was seen that the mean age group among males was 49.38+/-11.37years and females was 52.13+/-9.70years.

In the Ha et al[9] study the mean age group among males was 54.3+/-11.9years and females was 58.8+/-11.2years which was relatively comparable to our study.

In our study the majority percentage of serum zinc level was <60microgram/dl(74.39%) and 25.61% of study subject lies in 60-120microgram/dl level. The mean serum zinc level was low in newly diagnosed type 2 diabetes mellitus patients.

In Sunthari et al[10] study the serum zinc level among newly diagnosed type 2 diabetes mellitus patients was found low when compared to non diabetic individuals (p value = 0.001) which was comparable to our study.

In Dasarathan et al[11] study, the mean serum zinc concentration ng newly diagnosed type 2 diabetic patients was 58.31+/-17.23 mcg/dl and also the serum zinc level among newly diagnosed type 2 diabetic patients was low when compared to nondiabetic individuals (p-value <0.001), which is comparable to our study.

In the Saharia et al[8] study, the serum zinc level among newly diagnosed type 2 diabetic patients was found low when compared to nondiabetic individuals (p-value <0.001), which was comparable to our study.

In the Eva et al[12] study, the serum zinc level in type-2 diabetic patients was found low when compared to nondiabetic individuals (p-value< 0.001), which was comparable to our study.

In Farooqet al[18] study, the serum zinc level in type 2 diabetic patients was found low when compared to non-diabetic individuals (p-value <0.001), which was comparable to our study.

In the Masoodet al[13] study, serum zinc level was significantly lower in type-2 diabetic patients as compared to healthy subjects p-value $\leq$ 0.001, which was comparable to our study.

In the Al-Timimiet al[14] study, serum zinc level was significantly lower in type-2 diabetic patients as compared to healthy subjects (p-value <0.01), which was comparable to our study.

Serum Zinc Level Distribution Among Male And Female Newly Diagnosed Type 2 Diabetes Mellitus Patients:
In our study, the mean serum zinc concentration among male individuals was 50.80 +/-17.46 mcg/dl and female individuals was 55,66+/-15.87mcg/dl the p-value is 0.21.

In Sahariaet al[8] study, that the mean serum zinc concentration among newly diagnosed male type 2 DM cases was 80.83+/- 13.1 mcg/dl. And that in female cases was 77.56+/- 14.2 mcg/dL. Here, the difference between male and female cases was very minimal and statistically not significant (p-value>0.05) which was comparable to our study.

Similar results were also obtained by Kinlaw et al[15] , Zalewski et al [16] and Williams et al [17] , in their study and were found no significant difference in serum zinc concentration between males and females cases (p-value >0.05), which was comparable to our study.

HbA1C Level Among Newly Diagnosed Type 2 Diabetes Mellitus Patients:
In our study, it was found out that the majority of study subject lies in HbA1c level <8% (48.78%) and the next majority of study subject lies in HbA1c level 8-10% (36.59%) and the rest of the study subject lies in HbAle level>10% (14.63%). The mean HbA1c level among the study subject was found out to be 8.66+2.15%.

In Sunthari et[10] al study, the mean HbA1c among the subjects was 8.73+/_1.52% which was comparable to our study.

In Dasarathanet a[11]study, the mean HbA1c among cases was 8.57+/-1.51% which was comparable to our study.

In the Sahariaet at[8] study, the mean HbA1C among cases was 8. 32+/-1.58%, which was comparable to our study.

In the Farooqet al[18] study, the mean HbA1C among cases was 8.09+/-1.61%, which was comparable to our study.

Relationship Between Serum Zinc And Haic Levels In Newly Diagnosed Type 2 Diabetes Mellitus Patients:
In our study, the mean serum zinc level of newly diagnosed type 2 diabetes mellitus patients with HbA1c level <8% was 59.82+/-13.12 µg/dl, those patients with HbA1c level 8-10% were having a mean serum zinc level of 48.19+/-17.98 µg/dl, and those patients with HbA1c level of >10% were having mean serum zinc level of 39.38±14.95 µg/dl.

There was a significant negative correlation (r-value= -0.38, p-value= 0.0004) observed between the HbA1c level and serum zinc concentration. And it was evident that the cases who had lower values of HbAIC had higher values of serum zinc concentration and vice versa.

In Sunthari et [10] study, the Pearson correlation coefficient value of Zinc and HbA1c in newly diagnosed type 2 DM was -0.69 which a strong negative correlation between those two parameters, which was comparable to our study.

In Dasarathan et al[11] study, the Pearson correlation coefficient (r vale) of Zinc and HbA1c in newly diagnosed type 2 DM was -0.54 which established a strong negative correlation and statistically significant (p-value <0.001), which was comparable to our study.

In the Sahariaet al[8] study, it was observed that the mean HbA1C level in newly diagnosed type 2 DM cases had an inverse relation with serum zinc concentration with r-value -0.80 which also established the strong negative correlation between those two parameters, which was comparable to our study.

In Farooq et al[18] study, the Pearson correlation coefficient ("r value") of Zinc and HbA1c in type 2 DM was -0.47 which established a strong negative correlation and statistically significant (p-value <0.001), which was comparable to our study.

In a study done by Tripathyet al[19] the Pearson correlation coefficient ('r-value') of Zine and HbA1c in type 2 DM was -0.41 which established a strong negative correlation between those two parameters, which was comparable to our study.

In Refaat et at[20] study, the Pearson correlation coefficient (r value) of Zine and HbA1c in the diabetic group was -0.33 which established negative correlation between those two parameters, which was comparable to our study.

Correlation Of Serum Zinc Level With Other Parameters:
In our study, it was found out that there was a significant negative correlation (r-value= -0.39) observed between fasting plasma glucose and serum zinc level with p-value= 0.00034.There was also a significant negative correlation r-value= -0.24) observed between serum triglyceride and serum zinc level with p value 0.03058 and another significant negative correlation (r-value= -0.28) observed between serum total cholesterol and serum zinc level with p value=0.01208. There was no significant correlation observed between Body Mass Index, Systolic blood pressure, diastolic blood pressure, and serum zinc levels (p Value>0.05) which was statistically insignificant.

In the Dasarathan et al[11] study, there was a significant negative correlation (r-value -0.553, p-value <0.001) observed between fasting plasma glucose and serum zinc level. There was also a significant negative correlation (r=-0.451, p-value <0.001) observed between serum triglyceride and serum zinc level and another significant negative correlation (r-value =-0.422, p-value<0.00 1) observed between serum total cholesterol and serum zinc level among diabetic patients, which was comparable to our study.

In the Wolide et al[21] study, there was a significant negative relation (r-value= -0.245, p-value <0.001) observed between serum triglyceride and serum zinc level and another significant negative correlation(r. value =-0.269, p-value <0.001) observed between serum total cholesterol and serum zinc level among diabetic patients, which was comparable to our study.

In the Farooq et al[18] , there was a significant negative corelation (r-value =-0.223, p-value =0.001) observed between fasting plasma glucose and serum zinc level among diabetic patients, which was comparable to our study.

Conclusion:-

In this cross-sectional observational study done in the North-East population of India, we found that there was a reduction of serum zinc level in newly diagnosed Type 2 Diabetes Mellitus patients and there was also a statistically significant negative correlation between HbA1C, FPG, and serum zinc level in newly diagnosed Type 2 Diabetes Mellitus patients. Thus it can be concluded that the majority of newly diagnosed Type 2 Diabetes Mellitus patients have low serum zinc levels and the lower the serum zinc value, the poorer is the glycemic status. Therefore, earlier detection of zinc deficiency in newly diagnosed Type 2 Diabetes Mellitus helps in controlling glycemic status and also helps in preventing complications.

References:-

1. American Diabetes Association. Diagnosis and classification of diabetes mellitus.Diabetes Care. 2010 Jan 1; 33(Supplement-1):S62-9.
2. Saeedi P, Peterson I, Salpea P, Maranda B, Karuranga S, Unwin N, et al. Global and regional diabetes prevalence estimates for 2019 and projections for 2030 and 2045: results from the international diabetes federation Diabetes Atlas, 9th edition. Diabetes Res Clin Practice. 2019 Nov; 157: 107843
3. Beletate V, Atallah A, El Dib R. Zinc supplementation for the prevention of type 2 diabetes mellitus (Review). Cochrane database of systematic reviews (Online). 2007;24(1):CD005525.
4. Chausmer AB. Zinc, insulin and diabetes. J Am Coll Nutrition. 1998 Apr; 17(2):109-15
5. Mamza YP, Abdullahi ZB, Gail RM, Mshelia D, Genesis RY, Habu SA. Status of serum zinc and magnesium among type 2 diabetic subjects in Maiduguri. IOSR J Dent Med Sci. 2016 Jul;15(07):66-70.
6. Thomas JP, Bachowski GJ, Girotti AW. Inhibition of cell membrane lipid peroxidation by cadmium and zinc metallothioneins. Biochip BiophysActa - Gen Subj. 1986 Dec; 884(3):448-61.
7. Nathan DM, Singer DE, Hurxthal K, Goodson JD. The clinical information value of the glycosylated hemoglobin assay. N Engl J Med. 1984 Feb;310(6):341-6.
8. Saharia GK, Goswami RK, Evaluation of zinc status and glycated hemoglobin of type 2 diabetes mellitus patients in a tertiary care hospital of Assam. J Lab Physicians. 2013 Jan;5(1):30-3
9. Ha KH, Park CY, Jeong IK, Kim HJ, Kim SY, Kim WJ, et al. Clinical characteristics of people with newly diagnosed type 2 diabetes between 2015 and 2016: difference by age and body mass index. Diabetes Metab J. 2018 Apr;42(2):137-46.
10. Sunthari DK. Correlation of serum zinc and glycated hemoglobin (HbA1C) of newly diagnosed type 2

diabetes mellitus patients at a tertiary hospital of Chidambaram. J Med SCI Clin Res. 2018 Oct 15;6(10):563-9.
11. Dasarathan R, Sivasubramaniyam SK, Ganesh V, Chenthil KS. Study of serum Zinc status among type 2 diabetes mellitus patients. Int J Adv Med. 2017 Sep22;4(5):1344,
12. Eva H, Akter QS, Alam MK. Relationship of serum glycemic status with serum zinc level in type 2 diabetes mellitus. Mymensingh Med J. 2020 April ; 29(2) :357-60
13. Masood N, Baloch GH, Ghori RA, Memon IA, Memon MA, Memon MS. Serum zinc and magnesium in type-2 diabetic patients: J Coll Physicians Surg Pak. 2009 Aug:19(8):483-6.
14. Al-Timimi DJ, Sulieman DM, Hussen KR. Zinc status in type 2 diabetics relation to the progression of diabetic nephropathy. J ClinDiagn Res. 2014 Nov:8(11):CC04-8.
15. Kinlaw WB, Levine AS, Morley JE, Silvis SE. McClain Cl Abnormal zinc metabolism in type 1 diabetes mellitus. Am J Med. 1983 Aing:75(2):273-7
16. Zalewski PD, Millard SH, Forbes IJ, Kapaniris O, Slavotinek A, Betts WH, et al. Video image analysis of labile zinc in viable pancreatic islet cells using a specific fluorescent probe for zinc. J HistochemCytochem. 1994 Jul;42(7):877-84
17. Williams NR, Rajput-Williams J. West JA, Nigdikar SV, Foote JW. Howard AN. Plasma, granulocyte and mononuclear cell copper and zinc in patients with diabetes mellitus. Analyst. 1995 Mar;120(3):887-90.
18. 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.
19. Tripathy S, Sumathi S, Raj GB. Minerals nutritional status of type 2 diabetic subjects.Int J Diabetes DevCtries. 2003;24(11):27-8.
20. Al-Maroof RA. Al-Sharbami 55. Serum zinc levels in diabetic patients and effect of zinc supplementation on glycemic control of type 2 diabetes Saudi Med J 2006 Mar:27(3):344-50
21. Wolide AD, Zawdie B, Alemayehu T. Tadesse S. Association of trace metal elements with lipid profiles in type 2 diabetes mellitus patients: cross sectional study. BMC EndocrDisord. 2017 Oct 13;17(1):64.