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A CASE CONTROL STUDY TO SHOW THE CORRELATION OF MICRONUTRIENTS BETWEEN DIABETIC AND NON DIABETIC

General Medicine

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ABSTRACT

Introduction:-Diabetic Mellitus refers to a group of Common metabolic disorders that share the phenotype of hyperglycemia. Due to high level of oxidative stress, Mitochondrial dysfunction & inflammation of blood vessels there may be a greater need for micronutrients where a diabetic disorder exists. Purpose of study was to estimate serum Zinc, Magnesium, Copper, Vit B-12 Level in diabetic and to compare with that of healthy individuals.

Materials & Method :- A case control study was crried out in department of medicine LLRM Medical College (Meerut) 130 randomly selected cases of confirmed type to DM & another 130 healthy controls were included in this study. Serum Copper, Zinc, Magnesium and Vit B-12 Levels were estimated calorimetrically using commercially available Kit.

Results :- The copper value was found to be high among diabetics (P-value 0.00006) whereas zinc (P-value 0.00001), Magnesium (P-value 0.00001) & Vit B-12 (P-value 0.00003) were found lower in diabetics.

Conclusion :- Altered level of trace elements copper, zinc, Magnesium & Vit B-12 are found to be important factors for diabetic Patients.

KEYWORDS

Diabetic mellitus, zinc, copper, magnesium & Vit B-12.

INTRODUCTION

Diabetes mellitus (DM) refers to a group of common metabolic disorders that share the phenotype of hyperglycemia. Several distinct types of DM are caused by a complex interaction of genetics and environmental factors. Depending on the etiology of the DM, factors contributing to hyperglycemia include reduced insulin secretion, decreased glucose utilization, and increased glucose production. The metabolic dysregulation associated with DM causes secondary pathophysiologic changes in multiple organ systems that impose a tremendous burden on the individual with diabetes and on the health care system.

Micronutrients and diabetes

The metabolic status of diabetes sufferers is characterized by permanent oxidative stress due to impaired carbohydrate and lipid metabolism. Early and sustained sufficient intake of antioxidant micronutrients that regulate carbohydrate metabolism is therefore particularly important in the prevention of diabetes.

Due to the high level of oxidative stress, mitochondrial dysfunction and inflammation of the blood vessels, there may be a greater need for micronutrients where a diabetic disorderexists. A deficient supply of nutrients can exacerbate the condition. Targeted consumption of micronutrients can help improve metabolic control, optimize treatment and reduce the risk of developing diabetic complications. Key to this is an adequate intake of B vitamins, which protect the nerve cells, vitamins C and E, which can help prevent vascular damage, and magnesium, which promotes normal glucose metabolism. Further, the lipid -lowering and antithrombotic properties of omega-3 fatty acids and trace elements that improve insulin sensitivity can all be beneficial in primary and secondary prevention.

AIMS AND OBJECTIVES

The study was conducted at LLRM Medical College and Associated SVBP hospital Meerut with the following objectives :

1. To study the circulatory level of micro nutrients in diabetic patients & Non diabetic controls

MATERIALAND METHODS

The study was conducted at Department of Medicine at LLRM Medical College and SVBP Hospital, Meerut U.P. in 2019-2020. The study is case control study includes patients of diabetic and non diabetic controls admitted in Medicine ward and attending medicine OPD.

METHOD OF COLLECTION OF DATA:

Study included diagnosed diabetic patients and non diabetic controls of both sex.

INCLUSION CRITERIA FOR CASE

1. Patient is diagnosed case of diabetes mellitus.
2. Age 18-65 years
3. Patients consenting to take part in study.

INCLUSION CRITERIA FOR CONTROL

1. Patient is not a diagnosed case of diabetes mellitus.
2. Age 18-65 years
3. Patients consenting to take part in study.

EXCLUSION CRITERIA

Taking Vitamin, mineral supplement, thyroid hormones estrogens, progesterone, diuretics.

History of myocardial infarction, hepatic disease and psychiatric disorders, alcoholic. Pregnant and lactating female

Study Design : Case control study

OBSERVATIONS AND RESULTS

Table 1 :Distribution of copper level in diabetic cases and non diabetic controls

Cu LEVEL	DM Cases		Non Diabetic Controls		Total Number	x^2	P Value
	Number	Percentage	Number	Percentage			
Low (<70 mg/dl)	8	6.15	3	2.3	11	19.2415	0.00 0066
Normal (70-155 mg/dl)	50	38.46	85	65.38	135		
High (>155 mg/dl)	72	55.38	42	32.3	114		
Total	130		130		260		

Table 1 shows that out of 130, 72 (55.38%) cases are having high Cu level while 42 (32.3%) control are having high Cu level. 8 (6.15%) case & 3 (2.3%) control are having Low and 50 (38.46%) case and 85

(65.38%) control are having normal copper value. The copper level was found to be high among diabetics and this association was highly significant (P-value 0.00006).

Table 2 :Distribution of Zinc level in diabetic cases and non diabetic controls

Zn LEVEL	DM Cases		Non Diabetic Controls		Total Number	x^2	P Value
	Number	Percentage	Number	Percentage			
Low (<63.8 mg/dl)	62	47.69	13	10	75	52.1713	0.00001
Normal (63.8-114mg/dl)	58	44.61	109	83.84	167		
High (>114mg/dl)	10	7.69	8	6.15	18		
Total	130		130		260		

Table 2 shows that out of 130, 62 (47.69%) cases are having low Zn level and 13 (10%) control are having Low Zn level. 58 (44.61%) case & 109 (83.84%) control are having Normal and 10 (7.69%) case and 8 (6.15%) control are having High zinc level. Zn level was low among diabetics as compare to non diabetics and this association was highly significant (P-value=0.00001).

Table 3: Distribution of Magnesium level in diabetic cases and non diabetic controls

Mg LEVEL	DM Cases		Non Diabetic Controls		Total Number	x^2	P Value
	Number	Percentage	Number	Percentage			
Low (<1.3 meq/l)	57	43.84	19	14.61	76	26.9775	0.00001
Normal (1.3-2.1 meq/l)	62	47.69	92	70.76	154		
High (>2.1 meq/l)	11	8.46	19	14.61	30		
Total	130		130		260		

Table 3 shows that out of 130, 62 (47.69%) cases are having normal Mg level and 92 (70.76%) control are having normal Mg level. 57 (43.84%) case & 19 (14.61%) control are having Low Magnesium value whereas 11 (8.46%) case and 19 (14.61%) control are having High magnesium value. Magnesium level was found to be low among diabetics & this association was highly significant (P-value=0.00001).

Table 4: Distribution of Vitamin B12 level in diabetic cases and non diabetic controls.

Vit B12 LEVEL	DM Cases		Non Diabetic Controls		Total Number	x^2	P Value
	Number	Percentage	Number	Percentage			
Low (<160 pg/dl)	41	31.53	15	11.53	56	20.4048	0.000037
Normal (160-970 pg/dl)	80	61.53	112	86.15	192		
High (>970 pg/dl)	9	6.92	3	2.3	12		
Total	130		130		260		

Table 4 shows that out of 130, 80 (61.53%) cases are having normal Vit B12 level and 112 (86.15%) control are having normal Vit B12 level.41 (31.53%) case & 15 (11.53%) control are having Low vitamin B12 value whereas 9 (6.92%) case and 3 (2.3%) control are having High vitamin B12 value. Vit B-12 level was found to be low among diabetics & this associate was highly significant (P-value 0.00003).

Table 5:Association between level of Vitamin B12 in Vegetarian case and control.

Vit B12 Value	Vegetarian case	Percentage	Vegetarian control	Percentage	Total	x^2	P Value
Low (<160pg/dl)	46	52.87	22	28.20	68	20.92	0.000029
Normal (160-970pg/dl)	35	40.22	30	38.46	65		
High (>970pg/dl)	6	6.89	26	25.61	32		
Total	**87**		**78**		**165**		

Table 5 shows that out of 87, 46 (52.87%) vegetarian cases are having Low Vitamin B12 Value, 35 (40.22%) Normal & 6 (6.89%) having High Value whereas in vegetarian control out of 78, 22 (28.20%) low, 30 (38.46%) normal and 26 (25.61%) having High value. Incidence of vegetarian cases was found to be inversely associated with Vit-B12 level.

DISCUSSION

In this study, zinc levels in diabetics –Were lower than the control group. This finding was in agreement with the findings of Schlienger JL et al and Pai LH, but this finding was contradictory with the findings of Osman E et al, D'Ocon C et al and Mateo MC et al.

In the mammalian pancreas, Zinc is essential for the correct processing, storage, secretion, and action of insulin in beta (β)-cells.

Insulin is stored inside secretory vesicles or granules, where two Zn++ ions coordinate six insulin monomers to form the hexameric structure on which maturated insulin crystals are based.

It is also known that like, most other chronic disorders, diabetes increases the excretion of minerals.

Hyperglycemia in diabetes is usually associated with hyperzincuria and increased urinary loss of Zn++, which is responsible for decreases in total body Zn++.Zinc has antioxidant properties; thus it can stabilize macromolecules against radical induced oxidation.

Zinc is a component of the important antioxidant enzyme superoxide dismutase (Cu-ZnSOD). Thus the protection of this antioxidant against free radicals generated in the disease will be diminished.

It is also very important to note that Zn concentration regulates the metabolism of other very important members of the antioxidant defence system. Vitamin A(an antioxidant) is dependent on adequate zinc level for its release from the storage site in the liver and metabolism.

Similarly the potent antioxidant, vitamin E and zinc have a number of functions in common, including membrane stabilization, antioxidant functions and modulation of prostaglandin metabolism.

Furthermore, zinc deficiency produces high vulnerability to lipoprotein oxidation in experimental models. Hyperglycemia and hyperinsulinemia increases the production of free radicals and there is evidence that lipid peroxidation is increased in type 2 diabetes mellitus patients.

Although some investigators suggest that decreased serum Zn levels can be prevented by oral Zn replacements, later researches indicated that different representations of serum Zn level are independent of diet. Present study has shown increased Cu levels in diabetic patients- than the controls. Similar finding has been observed by other studies as Di-Silvestro RA et al and Zagar AH et al.

Urinary excretion of copper has been found to be affected by diabetes mellitus.Previous studies proved involvement of copper to cause oxidative stress. Majority of plasma copper is transported bound to ceruloplasmin (>95%); rest is bound to albumin, transcuprein and copper-amino acid complexes.

Ceruloplasmin is an acute phase reactant, has ferro-O2-oxidoreductase (pro-oxidant) activity directed towards ferrousion stimulated lipid peroxidation and formation of hydroxyl radical in Fenton reaction.

Copper is toxic in its unbound form, causes redox imbalance due to it's highly redox active nature, which leads to activation of stress sensitive intracellular signaling pathways through Haber-Weiss reaction.

The increase in Cu ion levels in patients with diabetes mellitus may be attributed to hyperglycaemia that may stimulate glycation and release

of copper ions and this accelerates the oxidative stress, so that, Advanced Glycation End products are formed, that are involved in the pathogenesis of diabetic complications.

Transition metal like copper has affinity to bind with proteins that have been glycated. Copper in its free form is a potent cytotoxic element because of its redox chemistry it readily participates in Fenton and Heiber-Weiss reactions to generate Reactive Oxygen Species (ROS).

Ceruloplasmin and serum albumin are the main Cu binding proteins in plasma and there is some evidence that chronic hyperglycemia can damage the Cu binding properties of both.

Considering all of the findings together it was implied that the ratio of Cu/Zn levels, instead of serum Zn levels alone provides more useful information. In present study there exist antagonistic relationship in the levels of Cu and Zn in diabetes.

In this study magnesium levels in diabetics were lower than control group.

According to CARDIA study (coronary artery risk development in young adults) there was a inverse relationship between Mg in take & incidence of diabetes. Marhalle et al have found that diabetes dyslipidemia & hypertension were inversely related with serum Mg level serum Mg depletion have been reported in diabetic patient who had advanced retinopathy & poor glycemic control.

Present study has shown that Vit B-12 level were lower than control group.

Vitamin B12 deficiency among patients with type 2 diabetes mellitus and the general population: a comparative review Several cross sectional studies and case reports have documented an increased frequency of vitamin B12 deficiency among type 2 DM (T2DM) patients.

CONCLUSION

Altered levels of trace elements Zn, Mg ,Vit B12 and Cu are found to be important for diabetic patients.

From present study ,it may be concluded that altered level of trace elements like Zn, Mg ,Vit B12 and Cu were found in diabetic patients.

The decreased blood levels of Zn ,Mg and Vit B12 and increased blood levels of Cu as have been found in present study can be utilized for management of diabetes Mellitus.

However these observations requires further study

Because of important role of trace elements in Diabetes Mellitus, it is suggested that an adequate supply of these substances in the diet of diabetic patients can be beneficial in the long term management of diabetic patients and further study in this field are recommended.

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