ASSESSMENT OF SERUM CERULOPLASMIN LEVELS IN TYPE II DIABETES MELLITUS PATIENTS

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ABSTRACT

Background: Diabetes Mellitus (DM) is a metabolic disorder with disturbances of carbohydrate, fat and protein metabolism which occurs due to defect in insulin secretion and/or insulin action, which results in hyperglycemia. Hyperglycemia in long run causes toxic effects on macro as well as microvascular structure and affects proper functioning of organs. Ceruloplasmin, as an acute phase protein, its level reflects acute and chronic inflammation. The purpose of this study was to evaluate oxidative stress and to understand relation of serum Ceruloplasmin levels in type II diabetes mellitus patients. **Objective:** To estimate the levels of serum Ceruloplasmin and to determine the effect of oxidative stress in patients of Type II Diabetes Mellitus patients. Its comparison with that of healthy individuals. **Materials and Method:** A cross-sectional study was conducted in 100 individuals (50Type II diabetes cases and 50 normal controls). Fasting blood Glucose level, 2-hour post prandial plasma glucose level, serum ceruloplasmin levels were estimated on fully automated chemistry analyser. **Results:** Serum ceruloplasmin is increased in cases as compared to controls (42.79 ± 11.56 mg/dL, 37.45 ± 10.36 mg/dL respectively). **Conclusion:** Ceruloplasmin have an anti-oxidant effect and its levels rise due to oxidative stress in the body, detection of serum Ceruloplasmin, in addition to other biochemical variables in the early stage of diabetes will help patients to prevent complication and reduce their morbidity rate.

Keywords: Diabetes mellitus- type II, Serum Ceruloplasmin, anti-oxidant.

INTRODUCTION:

Diabetes Mellitus (DM) is a metabolic disorder resulting from a defect in insulin secretion and/or insulin action, the chronic hyperglycemia associated with disturbances of carbohydrate, fat and protein metabolism. Type II Diabetes Mellitus accounts for approximately 90% of all cases of diabetes. Most patients acquire the disease after age 40, but it may occur in younger people. India shelters the most number of people with diabetes mellitus worldwide. From 31 million in the year 2000, the number of persons with diabetes mellitus in India would register a 2.5 fold increase over the next 30 years so as to reach an alarming level of estimated 80 million by the year 2030. **(1)** Ceruloplasmin is an α2-globulin that contains about 95% of serum copper. Each molecule of Ceruloplasmin contains 6 to 8 copper atoms, most of which are tightly bound. Ceruloplasmin is synthesize mainly by hepatic parenchymal cells, with small amounts from macrophages and lymphocytes. The peptide chain is formed first, and then copper is added from an intracellular ATPase. Copper appears to be essential for the normal folding of

Ceruloplasmin and possibly for normal oligosaccharide attachment. The normal half-life of Ceruloplasmin is 4 to 5 days. Ceruloplasmin oxidizes Fe2+to Fe3+which is important for allowing binding of iron to transferrin. In the presence of superoxide, Ceruloplasmin promotes LDL oxidation, which may contribute to atherosclerosis. **(2)** Hyperglycemia impairs glucose metabolic pathways and increases auto-oxidative glycosylation and free radical production.Hyperglycemia in long run causes toxic effects on macro as well as microvascular structure and affects proper functioning of organs. In conditions of elevated oxidative stress, it may act as a pro-oxi¬dant by donating free copper ions, which induces reactive oxygen species (ROS) formation and low density lipoprotein (LDL) oxidation. The ceruloplasmin level reflects acute and chronic inflammation, incresed serum ceruloplasmin levels seen in both type I and type II diabetes. **(3)**

MATERIALS AND METHOD

In this study 50 cases of Type II Diabetes Mellitus and 50 healthy controls of 35-64 years age group were studied. Age and sex were matched between cases and controls. The study was carried out during the time span of June-2017 to December-2018. Cases were primarily diagnosed by clinical examination and further evaluated by Biochemical tests. In the control group subjects were selected from healthy subjects with no clinical evidence of any disease.

Inclusion criteria for selection of cases are: Fasting Blood Sugar ≥126 mg/dL (≥7.0 mmol/L), Post Prandial Blood Sugar ≥200 mg/dL (≥11.1 mmol/L), and HbA1C ≥6.5%

Exclusion criteria for selection cases are: Overt thyroid dysfunction, chronic kidney disease,chronic liver disease, on corticosteroid therapy.

Ethical Consideration: Informed oral consent was obtained from each of the individuals. Due permission was taken from the concerned authority of the institution.

Biochemical Analysis: After explaining to the patients and with proper consent samples were collected with taking all necessary aseptic precautions as per guidelines. Fasting blood Sugar, Post Prandial blood Sugar and Serum Ceruloplasmin were analysed on fully auto analyzerERBA XL – 640 and at Hi-Tech Biochemistry Laboratory Civil, Hospital, Ahmedabad.

Data Analysis: Data was analyzed by appropriate statistical test using statistical software. The differences of various parameters within groups were evaluated on the basis of p value.

RESULTS

Age wise distribution of cases and control

As per table 1, in the present study 38% of cases and 36% of controls were in the age group 55-64 years. Both the cases and controls were age matched. Mean age (± SD) in cases was 49.98±8.63years and in controls were 49.50±8.65 years.

Comparison of FBS levels between case & control group

Table 2 shows that serum FBS is increased in cases as compared to controls (175.44±59.52 mg/dL, 99.74±13.77 mg/dL respectively). There is highly significant difference observed in between group 1 and group 2 of serum FBS. (p value is <0.001)

Comparison of PPBS levels between case & control group

Table 3 shows that serum PPBS is increased in cases as compared to controls (271.17±86.48 mg/dL, 130.23±19.85 mg/dL respectively). There is highly significant difference observed in between case and control of PPBS. (p-value is <0.001)

Comparison of Ceruloplasmin levels between case & control group

Table 4 shows that serum ceruloplasmin is increased in cases as compared to controls (42.79±11.56 mg/dL, 37.45±10.36 mg/dL respectively). There is significant difference observed in between case and control of serum ceruloplasmin. (p-value is <0.05)

DISCUSSION

Diabetes mellitus is a multifactorial disease, indulging severe insulin dysfunction in with gross abnormalities in glucose homeostasis, lipid and protein metabolism. It contributes for macrovascular and microvascular complications in diabetes.

In this study, Ceruloplasmin levels were significantly increased in cases of Type II DM (42.79±11.56) as compared to controls (37.45±10.36). Our finding matching well with other studies whichalso observed significant increase in Ceruloplasmin levels in type II DM. **(4, 5, 6, 7)**

Ceruloplasmin may act as a pro-oxidant under condi¬tions of increased oxidative stress, such as in type II diabetes mellitus. Ceruloplasmin possesses antioxidant properties due to its ferroxidase activity which decreases the availability of the iron in free radical generating reactions. Increased genera¬tion of ROS disrupts the binding of copper from ceruloplas¬min which further induces ROS formation and LDL oxidation. Ceruloplasmin lead to vascular injury by generating free radicals, such as hydrogen peroxide, in the course of oxidation of serum homocysteine. Considering that eleveted oxidative stress and oxidized LDL are known to be associated with progression of diabetic complication. **(7, 8)**

CONCLUSION

It can be concluded as per this study that serum Ceruloplasmin elevated in persons having Type II Diabetes as compared to normal control persons. Since Ceruloplasmin have an anti-oxidant effect its levels incresed due to oxidative stress in the body, detection of serum Ceruloplasmin, in addition to other biochemical variables in the early stage of diabetes will help patients to prevent complication and reduce their morbidity rate.

This basic test can be utilized to monitor the effects of oxidative stress on type II diabetes patients and can be an aid to other tests done in diabetic cases. Serum Ceruloplasmin can be used for evaluating the overall glycemic and cardiovascular status in patients with type II diabetesmellitus.

TABLES

Age groups (Years)	Cases (N= 50)		Controls (N= 50)	
	Frequency	**Percentage**	**Frequency**	**Percentage**
35-44	15	30.0	14	28.0
45-54	16	32.0	18	36.0
55-64	19	38.0	18	36.0
Total	50	100.0	50	100.0
Mean±SD	49.98±8.63		49.50±8.65	

Table-2: Comparison of FBS levels between case & control group:

Group	Case	Control
Sample Size	50	50
Mean	175.44	99.74
Standard Deviation (SD)	59.52	13.77
Significance	t = 11.23, df = 98, p =0.0001	

Table 3: Comparison of PPBS levels between case & control group:

Group	Case	Control
Sample Size	50	50
Mean	271.17	130.23
Standard Deviation (SD)	86.48	19.85
	t = 8.76, df = 98, p =0.0001	

Table 4: Comparison of Ceruloplasmin levels between case & control group:

Group	Case	Control
Sample Size	50	50
Mean	42.79	37.45
Standard Deviation (SD)	11.56	10.36
Significance	t = 2.43, df = 98, p =0.017	

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