Serum copper levels in Non-Insulin Dependent Diabetes Mellitus

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ABSTRACT

Background: The findings of previous research on the status of trace elements in diabetic patients have been controversial.

A comparative study of serum copper in diabetic patients and healthy Iraqi controls is becoming important, particularly after the dietary shortage, as sequel of 13 years of sanctions.

Objective: To study the difference of serum copper between the diabetic patients and healthy Iraqi people.

Method: This is an outpatient-based study; it was carried out in AL-Rhasid Military Teaching Hospital during a period from March 2002 till February 2003 the study included seventy – four non insulin dependent diabetic patient (NIDDM) aged (40-62) year, forty – four from which have retinopathy and twenty – four have albuminuria (>50 mg/day) other seventy normal healthy control with comparable age (38-65) year. Blood samples were drowning fasting and the blood was left at room temperature for 10 minuets. Centrifuged 3000 rpm for 10 minuets, then serum was separated and stored at –20c$^{0.}$ The urine sample taken freshly, randomly on early morning and urine albumin was measured quantitatively by Lowry method, data were analyzed and compared with previous study result

Conclusion: The clinical significance of serum copper in diabetes mellitus remain conflicting as well as controversial and many questions still remain unanswered but the decreased serum copper found in NIDDM in our study may merit further investigation of the relationship between copper and non-insulin dependent diabetes.

Key Words: Serum Copper, Diabetes Mellitus

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INTRODUCTION

Copper is an integral component of at least (16) essential metalloprotein within the body predominantly on connective tissue formation, CNS function and haemotopoiesis. (1)

Direct association of trace element in relation to human disease has been observed in many research studies, in many cases, an alteration in the metabolism of these minerals has been demonstrated. (2, 3, 4, 5)

Diabetes mellitus is a neterogenous disease characterized by an absolute or relative deficiency of insulin as well as insulin resistance. (6) Numerous authors have evaluated mineral levels and status in diabetic subjects yet; often inconsistent and contradictory results have been presented. (7) This difference may be due to number of subjects, sex, laboratory processing and life style. (8)Copper act as antioxidant and prevent membrane peroxidadtion. Cereuloplasmin, the major plasma copper – transporting protein, possesses a potent antioxidant property. (9) Also Copper is involved in oxidation – reduction reaction and has a dominant role in divers' proteins such as cytochrom oxidase and cytoplasmic superoxide-dismutase. (9, 10)

In this study we evaluated the levels of copper in the serum of Iraqi patients with non-insulin dependent diabetes mellitus (NIDDM) in an effort to evaluate the status of this element in such patients particularly after the dietary shortage as sequel of 13 years of sanctions and to, clarify its role in this disease.

MATERIALS & METHODS

This study was conducted during the period from March 2002-Feb. 2003 in AL-Rashid Military Teaching Hospital, the study included seventy-four NIDDM patients aged (40-62) and other seventy normal healthy control person aged (40-65) years. Within diabetic patients there were forty-four patients had retinopathy and twenty-four had albuminuria (>50mg/day). Blood samples were drawn fasting and the blood was left at room temperature for 10 minutes, centrifuged 3000 RPM for 10 minutes, then serum was separated and stored at –20c^0.

Urine samples taken randomly freshly on morning and urine albumin were measured quantitatively by Lowery method. (11)

The serum copper were determined by International Head quarter, Randox Laboratories LTD, Diamond Road, Crumlin, CO. Autrim, United Kingdom, when copper at pH 4.7, is released by reducing agent, then reacts with a specific color reagent, to form stable colored chelate, the intensity of color is directly proportional to the amount of copper in the sample (Randox – Cu 2340, Cu2341). [12]

RESULTS

Table (1) show significant decrease in serum copper levels in NIDDM patients (80±20 µg/dl) as compare to normal healthy control (105±34 µg/dl) P< 0.001.The NIDDM patient, with positive retinopathy had significantly lower serum copper (69±_39ug/dl) as compare to NIDDM patient with no retinopathy (89±40 µg/dl) as table (2) showed. Table (3) demonstrated the serum copper in NIDDM patient with positive albuminuria (>50 mg/dl) was lower than patient with negative albuminuria (<50mg/dl).

Table (1): shows the biostatstical calculation and student t-test for serum copper in NIDDM patient as compare to normal healthy control groups

Cu µg/dl	NIDDM	Normal control
No	74	70
Mean	80	105
SD	20	34
SE	2.4	3.9
t-test	6.4	-
P-value	<0.001	-

Table (2): the biostatistical calculation and student t-test for serum copper in NIDDM patient with retinopathy as compare to non-retinopathic patients.

Cu µg/dl	NIDDM *Retinopathy*	NIDDM *No retinopathy*
No	44	30
Mean	69	89
SD	39	40
SE	5.9	7.4
t-test	2.2	-
P-value	<0.01	

Table (3): shows the biostatistical Calculation and student t-test for serum copper in NIDDM patient with positive albuminu as compare to negative

Cu µg/dl	NIDDM Positive albuminuria	NIDDM Negative albuminuria
NO	24	50
Mean	63	83
SD	31	42
SE	6.4	6.0
T-test	2.2	
P-value	P<0.01	

DISCUSSION

Generally, serum copper level has been found to be anon specific indicator of disease activity in many diseases, [13] and abnormalities in copper metabolism have become as a hallmark for diagnosis of many disease states. [14]

Our result from diabetic patients revealed significant lower serum copper in diabetic patient as compared to normal and there was a significant decrease in complicated diabetic patient with retinopathy and albuminuria (nephropathy) as compared to non-complicated cases. This finding consistent with results reported by Ibrahim and Watts 1999 [15] 2000 [19].

When deficiency of certain minerals or vitamins has been correlated with presence of diabetic complication, although Zargar AH, *et al* 1998 [7] Noto R, *et al* 1983 [16] reported that serum copper levels were significantly elevated in diabetic patients.

The lowering serum copper in our NIDDM patients particularly with complication could be due to poor dietary intake during sanction and copper deficiency has long been associated with disturbed carbohydrate metabolism and with oxidative stress. [17, 20] Also the disturbances in mineral metabolism are more pronounced in diabetic population with specific complication. [18, 21] It is not known whether this change in element status is a consequence of diabetes or alternatively, whether it contributes to the expression of the disease. [18]

CONCLUSION

We concluded that the clinical significance of serum copper in diabetes mellitus remains conflicting as well as controversial and many questions still remain unanswered.

Even though, the data presented in this paper is consistent in some aspects with previous findings of other researchers, the author feel that large number of specimen should be obtained in order to fully elucidate the relation ship between copper, diabetes mellitus and life style.

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