Original Article

Level of Serum Copper and Zinc in Pregnant Women with Gestational Diabetes Mellitus.

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Summary:

Background: *Gestational diabetes mellitus (GDM) is associated with increased perinatal mortality and morbidity. Hence, it is important to detect and treat these cases effectively. Some trace elements like copper and zinc are needed for carrying out essential biochemical reactions. Serum level of copper and zinc in GDM women are not well studied or understood.*

Aim of the study: *In this work, the serum copper and zinc were estimated in GDM women and compared with healthy pregnant women.*

Patients and Methods: *Thirty one Iraqi women who have gestational diabetes in addition to thirty one healthy pregnant women as control group were participated in this study. Serum copper and zinc were measured using atomic absorption spectrophotometry technique.*

Results: *Serum copper showed a significant increase at ($p<0.05$) in GDM patients as compared with healthy pregnants, while Serum zinc showed a decrease at ($p<0.05$) as compared with healthy pregnants.*

Conclusion: *The profile of serum concentration of zinc and copper_were same as in diabetic nonpregnant peoples. Hence, there is a change in immunity system and inflammatory response in GDM. There are no changes in these trace elements related to pregnancy but associated with hyperglycemia.*

Keywords: *Gestational diabetes mellitus, hyperglycaemia, copper, zinc, pregnancy.*

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Introduction:

Normal pregnancy is characterized by hyperinsulinemia in response to the production of hormonal insulin antagonists such as human placental lactogen and progesterone. A suboptimal endocrine pancreas may be unable to meet this demand [1]. The term gestational diabetes is used to refer to hyperglycemia occurring for the first time during pregnancy in individuals who have an inherited predisposition to develop diabetes. There is an increased requirement for nutrients in normal pregnancy, not only due to increase demand, but also increase loss. There is also increase insulin-resistant state during pregnancy mediated by the placental anti-insulin hormone, estrogen, progesterone hormone, human somatomammotropin the pituitary hormone prolactine, and the adrenal hormone cortisol [2]. Gestational diabetes is associated with excessive nutrient losses due to glucosuria. Specific nutrient deficiency of chromium, magnesium, potassium, and pyridoxine may potentiate the tendency towards hyperglycemia in gestational diabetic women because each of these four material deficiencies causes impairment of pancreatic insulin production [2].

The estimated incidence of GDM in different areas was about 3.5% [3-4]. The adverse outcomes associated with GDM pregnancies were hypertension/pre-eclampsia, hyaline membrane disease, neonatal jaundice, and macrosomia [3].

Since even minimal hyperglycemia in pregnancy is associated with increased perinatal mortality and morbidity, it is important to detect and treat these cases effectively. In diabetes there is a strong relationship between insulin resistance and hyperglycemia. Women with pre-gestational diabetes or gestational diabetes plus fasting hyperglycemia have a three- to four-fold increased risk of infant malformations, whereas women with mild gestational diabetes have malformation rates not different from the general nondiabetic obstetric population (5). Women with impaired glucose tolerance test were at increased risk for premature rupture of membranes; preterm birth; breech presentation; and high birth weight; adjusting for maternal age, pregravid body mass index (BMI), and other confounding factors. The presence of impaired glucose tolerance test in pregnancy is predictive of poor pregnancy outcomes (6). BMI and percentages of saturated fat were associated with impaired glucose tolerance or gestational diabetes in all patients (7). There are different interested researches related to the changes in different trace elements in different organs in GDM. In one study, plasma chromium during pregnancy does not correlate with glucose intolerance, insulin resistance, or serum lipids (8). While there is a difference in hair chromium concentration in normal and diabetic pregnant women suggested that impaired utilization of chromium may be a possible etiology for gestational diabetes mellitus (9). Zinc is implicated in the functioning of more than 200 enzymes, some

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of them related with DNA and RNA synthesis. Also there is a clear relationship related to the functioning of the immune system. Zinc influences many body systems and functions including growth, bone formation, brain development, reproduction, fetal development, sensory functions (like taste and smell), immune mechanisms (10-11) , and membrane stability and wound healing (12-15) . Copper is an important essential trace element and is a component of numerous key metalloenzymes and proteins (16). Copper is required in the synthesis of hemoglobin (17) and a number of copper containing enzymes like cerruloplasmin, lysyloxidase, tyrosinase, cytochrome C oxidase and superoxide dismutase (18). Serum level of copper and zinc in GDM women are not well studied or understood. In this work, the serum copper and zinc were estimated in GDM women and compared with healthy pregnant women.

Patients & Methods:

Patients: Thirty one Iraqi women who have gestational diabetes in addition to thirty one healthy pregnant women as control group were participated in this study. These cases were collected from different hospitals at Baghdad city. All gestational diabetic women were examined by senior gynecologist, and there are no other complications. Fasting blood sugar levels were more than 10mmol/L using enzymatic method. All pregnant women were in the third trimester of pregnancy. The age range of these women was 17-40 year. Venous blood samples were collected from patients before taking any medications. Sera were separated and stored at (-20°C) until analysis.

Assay: 0.1ml of serum was diluted to total volume of 1ml using 6% n-butanol solution and analyzed for their copper and zinc contents using atomic absorption spectrophotometer (Shimadzu AA-646). Hollow cathode lamps of copper and zinc were used at wavelengths of 324.75 nm. and 213.9 nm. respectively. The diluted solutions were aspirated directly into air-acetylene flame

(19).The results were analyzed statistically, and values were expressed as (mean ± SED). The level of significance was determined by employing (t) test .Only when the p value was less than 0.05; the difference between two groups was considered as statistically significant.

Results

Serum copper showed a significant increase at ($p<0.05$) in GDM patients as compared with healthy pregnant women, while Serum zinc showed a decrease at ($p<0.05$) as compared with healthy pregnant women as shown in Figure (1).

Discussion:

The increase in copper in pregnant women is well known (1).The increase in serum copper may be due to the increase in the inflammatory response especially in copper containing enzymes (ceruloplasmin) (20-21).

In diabetes mellitus, oxidative stress seems primarily due to both increased plasma free radical concentrations and a sharp reduction in antioxidant defense (22). Among the causes of enhanced free radical production are hyperglycemia and hyperinsulinemia (23-24). Trace elements play an important role in biological processes through their action as activators or inhibitors of enzymatic reaction, or by influencing the permeability of cell membrane, or by its essential role of direct anti-oxidant enzyme (25-27).

Zinc is a metal essential for maintaining the integrity of immune system (28). The underlying requirement of zinc in maintaining immunocompetence requires further study, but may be a result of its requirement in many enzyme systems, or its ability to stabilize biologic membrane (28).Several laboratories have found that zinc deficiency depresses antibodies responses possibly owing to a loss of T-helper–cell function (29). Zinc deficiency affects the biological activity of thymus hormones and has a major effect on cell mediated immunity perhaps as a result (30). Hence, the decrease in zinc may be one possible cause for the attenuation of immunity or the changes in different gestational membranes.

In one study, the result is differing from our result. Loven et al (1992) (31) investigated whether there is an involvement of copper metabolism in the mechanism of gestational diabetes mellitus. They found that there is no statistically significant difference in serum copper and ceruloplasmin concentrations between healthy pregnant women and women with GDM. However, the activity of ceruloplasmin in women with gestational diabetes mellitus was slightly higher and its specific activity significantly raised. The Cu-Zn superoxide dismutase activity was significantly increased ($P<0.05$) in women with gestational diabetes mellitus when comparing the two groups by matched pairs according to age. The results indicate that oxidative stress may have a role in gestational diabetes mellitus [31]. These results confirmed that, the changes in serum metals may be due at least to the hyperglycemia rather than gestational hyperglycemia as separated syndrome.

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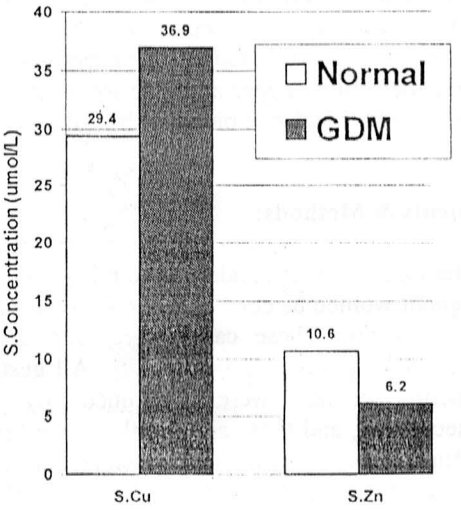

Figure (1) :serum copper & zinc in normal pregnant women & women with gestational diabetes mellitus(GDM)