

Assessment of Zinc, Copper, Cobalt and Chromium Levels in Sera of Diabetic Menopausal Women

*Noor T. Tahir

**Enas J. Hasan

*Aufira S. Nsiaf

Noor9t@yahoo.com

enasjabbar2010@yahoo.com

afrashaker@gmail.com

*National Diabetic Center/AL-Mustansiriya University,

** College of Basic Education / AL-Mustansiriya University.

Abstract

The comparative study included 60 women their age ranged between (45-55) years from April 2014 to November 2014. The study categorized them into two groups, 30 diabetic menopausal women and 30 a non diabetic menopausal women as a control. Subjects trace elements were determined using atomic absorption spectrophotometer, and some hormones estrogen, prolactin, FSH, and LH hormones were determined using minividas. All measurements were done in the National Diabetic Center (NDC)/ Al-Mustansiriya University and Ministry of Science and Technology/ Baghdad. –

Results indicated that there is a significant higher level of serum copper and follicle stimulation hormone in diabetic menopausal women compared with the control group. While the levels of zinc, cobalt, chromium, prolactin, luteinizing hormone, and estrogen were a significantly lowered in diabetic menopausal women compared with control group. There were no significant correlation between trace elements measured and prolactin, follicle stimulation hormone, luteinizing hormone, and estrogen, except a significant negative correlation between FBS and copper.

Keywords: Zinc, copper, cobalt, chromium, trace elements, and diabetic menopausal women.

الخلاصة

اجريت الدراسة على 60 امرأة اعمارهم تتراوح بين (45 – 55) سنة من شهر نيسان الى تشرين الثاني 2014 وقسموا الى مجموعتين : 30 امرأة مصابة بالسكري و 30 امرأة غير مصابة بالسكري كمجموعة ضابطة وكلتا المجموعتين في مرحلة انقطاع الطمث، تم قياس تراكيز العناصر النزرة باستخدام جهاز الامتصاص الذري اللهبى وقياس تراكيز الهرمونات النسائية بجهاز المنيفيداس. بينت الدراسة ان هنالك ارتفاع معنوي في مستوى النحاس والهرمون المحفز للجريبات لدى النساء المصابات بالسكري في مرحلة انقطاع الطمث مقارنة بالمجموعة الضابطة، بينما كانت مستويات الزنك، الكوبلت، الكروم، الهرمون اللوتيني، والاستروجين أقل معنوياً لدى النساء المصابات بالسكري في مرحلة انقطاع الطمث مقارنة بالمجموعة الضابطة، وكذلك وجد انه لا توجد علاقة ترابطية إحصائية بين العناصر النزرة وتركيز هرمون الحليب، الهرمون المحفز للجريبات، الهرمون اللوتيني، والاستروجين، ما عدا العلاقة المعنوية السالبة التي تربط بين مستوى السكر في الدم والنحاس. نستنتج من هذه الدراسة نقصان مستوى الزنك، الكوبلت، والكروم في المصل بينما زيادة مستوى النحاس في مصل النساء المصابات بداء السكري في مرحلة انقطاع الطمث عند مقارنتهم بمجموعة النساء غير المصابات بداء السكري في مرحلة انقطاع الطمث . يعزى النقص في تراكيز العناصر النزرة لدى النساء المصابات بداء السكري في مرحلة انقطاع الطمث في احيانا كثيره الى الخلل الهرموني الحاصل لديهن.

كلمات مفتاحية: الزنك، النحاس، الكوبلت الكروم، العناصر النزرة، والنساء المصابات بداء السكري في مرحلة انقطاع الطمث.

Introduction

Diabetes mellitus (DM) results in disturbance of chemical elements concentration in the body (Al-Shaban, 2011) . Diabetes mellitus often simply referred to as diabetes , is a group of metabolic diseases in which a person has high blood sugar, rather because the body does not produce enough insulin, or because cell does not respond to the insulin that produced (Porter, 1996; Mohammed *et al.*, 2012). Menopause, by definition, is the final menstrual period. It is a universal and irreversible part of the overall aging process as it involves a woman's reproductive system. Menopause is diagnosed after 12 months of amenorrhea and is characterized by a myriad of symptoms that include, but are not limited to, changes from regular,

predictable menses, vasomotor and urogenital symptoms such as vaginal dryness and dyspareunia, and sleep and mood dysfunction (Butler, 2011; Santoro *et al.*, 2011). Trace elements are essential nutrients with regulatory, immunological, and antioxidant functions resulting from their actions as essential components or cofactors of enzymes throughout metabolism and pathogenesis of obesity, DM and their complications, mainly through their involvement in peroxidation and inflammations (Yerlikaya *et al.*, 2013). Literature survey shows that some trace elements as Cr, Mg, Va, Zn, Mn, Mo, and Se play important role in insulin action (Candilish, 2000; Chen *et al.*, 2000), including activation of insulin receptor, serving as cofactor or components for enzyme systems involved in glucose metabolism (Vincent, 2000). Chromium (Cr) is important for glucose metabolic regulating has been seen in clinical states of relatively severe Cr deficiency, characterized lipid disorders (Goldhaber, 2003; Calton, 2010). Zinc (Zn) is involved in the synthesis, storage, secretion and conformational integrity of insulin (Haase *et al.*, 2008). In the presence of Zn, insulin monomers assemble to dimeric insulin (Jansen *et al.*, 2012). Copper (Cu) is an essential nutrient in humans and acts as a critical cofactor when incorporated into specific cupro-enzymes that catalyze electron transfer reaction required for cellular respiration, iron oxidation, pigment formation (Berglund *et al.*, 2011). Cobalt (Co) is essential in trace amounts for human life. It is part of vitamin B12, and plays a key role in the body's synthesis of this essential vitamin (Ufuk *et al.*, 2010).

Objective

The objective of the study was to assess the concentrations of Zn, Cu, Co, and Cr levels in diabetic menopausal women and to find the relationship with some biochemical parameters.

Materials and Methods

The present study included 60 women their age ranged between (45-55) years from April 2014 to November 2014. The study categorized them into two groups; the first group included 30 normal menopausal women without DM considered as apparently healthy as control group. The second group included 30 menopausal women with DM. Data collection to all subject included age, duration of the disease and BMI which was calculated as body weight in kilograms divided by the squared value of body height in meters (kg/m^2), after an overnight fasting (from 8 Post Meridiem (p.m.) to 8 Ante Meridiem (a.m.)) 5ml blood was drawn from the capital vein of each participant using sterile disposable plastic syringe. The sample left for 30 minutes to clot and the serum was separated by centrifugation and blood samples were taken for laboratory investigation which included, fasting blood sugar (FBS), glycated hemoglobin (HbA1c). Luteinizing hormone (LH), follicle stimulation hormone (FSH), and estrogen were measured by using minividas (Biomerieux).

Levels of metals Zn, Cu, Co, and Cr were estimated by the atomic absorption spectrophotometer (AA670)-Shimadzu Japan. All measurements were done in the National Diabetic Center (NDC)/ Al-Mustansiriyah University and Ministry of Science and Technology/ Baghdad.

Data Analysis

To compare the significance of the difference in the mean values of any two groups, student's t-test was applied and $P \leq 0.05$ was considered statistically significant. The correlation coefficient (r) test is used to describe the association between the different studied parameters.

Results and Discussion

Table (1) showed the biochemical serum and clinical variables in menopausal women groups. There were no significant differences in age and BMI between the two groups. Data also revealed the higher levels of FBS and HbA1c in menopausal women with DM than in their respective control group, which is in agreement with the findings of Chan *et al.* (Chan *et al.*.,2005) . Serum FSH levels was significantly higher in menopausal women with DM (61.41 ± 5.43) than in the menopausal women without DM (56.17 ± 8.31), while serum levels of prolactin, LH, and estrogen appeared significantly lowered in menopausal women with DM, which were (20.39 ± 3.99), (28.63 ± 3.42), and (23.61 ± 11.8) respectively as compared with the menopausal women without DM (24.23 ± 5.10), (31.25 ± 2.33), and (42.9 ± 6.01) respectively. Females have estrogen hormone, which protective for developing diabetes (Evans and Goldfine ,2002) . Estrogen makes the body cell more receptive or sensitive to insulin (Mayumi *et al.* ,2003) , estrogen seen to contribute in glucose homeostasis in women.

Table (1): Biochemical serum and clinical variables in menopausal women groups

Clinical variables	Menopausal women without DM	Menopausal women with DM	P- value
Age (years)	48.21 ± 6.9	48.35 ± 5.1	≤ 0.05
BMI (Kg/m ²)	37.68 ± 4.13	36.22 ± 4.3	0.05
FBS (mg/dl)	96.81 ± 9.73	184.84 ± 75.4	0.001
HbA1c%	4.45 ± 1.58	8.43 ± 2.29	0.01
Prolactin (ng/ml)	24.23 ± 5.10	20.39 ± 3.99	0.05
FSH (mIU/ml)	56.17 ± 8.31	61.41 ± 5.43	0.05
LH (mIU/ml)	31.25 ± 2.33	28.63 ± 3.42	0.01
Estrogen (pg/ml)	42.9 ± 6.01	23.61 ± 11.8	0.001

Many essential metals are shown to have interactive connection with DM (Zheng *et al.* ,2008), and alterative in the metabolism of several essential minerals, including Cu and Zn have been associated with impaired insulin release, insulin resistance, and glucose intolerance (Faur *et al.* ,2005) . Jansen *et al.* (Jansen *et al.* ,2009) found that Zn supplementation of animals and humans has been shown to ameliorate glycemic control in type1 and type 2 DM.

In this study, Zn concentrations were significantly lowered in menopausal women with DM (688.22 ± 95.42) than in the menopausal women without DM (712.82 ± 185.31), as shown in table (2).

Table (2): Serum levels of trace elements in menopausal women groups

Trace elements (ng/ml)	Menopausal women without DM (n=30)	Menopausal women with DM (n=30)	P- value
Zn	712.82 ± 185.31	688.22 ± 95.42	0.003
Cu	569.50 ± 164.50	690.45 ± 131.81	0.05
Co	36.56 ± 4.37	34.87 ± 3.78	0.21
Cr	37.23 ± 4.18	28.47 ± 3.03	0.04

These results consist with the findings reported by Walter *et al.* (Walter *et al.* ,1991) and Anetor *et al.* (Anetor *et al.* ,2002) . Serum Cu level was increased in menopausal women with DM (690.45 ± 131.81) compared with the

menopausal women without DM (569.50 ± 164.50), this increased in serum Cu concentration is well correlated with macroangiopathy, microangiopathy, hypercholesterolemia and hypertension that are associated with DM (Walter *et al*.,1991; Abiaka *et al*.,2003).

Co concentrations were significantly lowered in menopausal women with DM (34.87 ± 3.78) than in the menopausal women without DM (36.56 ± 4.37).

Cr levels were decreased in menopausal women with DM (28.47 ± 3.03) compared with the menopausal women without DM (37.23 ± 4.18). This may be due to many reasons such as: type of the food and its source which can affect the Cr level, consumption of refined sugar, white flower and lack of exercise (Anderson *et al*.,2001).

Table (3): Correlations of trace elements levels with clinical variable of menopausal women groups

Clinical variable	Menopausal women without DM				Menopausal women with DM			
	Zn	Cu	Co	Cr	Zn	Cu	Co	Cr
FBS (mg/dl)	-0.414*	+0.528*	-0.049	-0.354*	-0.212	-0.532*	-0.022	0.199
HbA1c%	-0.370*	-0.155	-0.130	-0.724*	0.157	0.185	-0.134	0.166
Prolactin (ng/ml)	0.579	-0.159	-0.100	0.088	-0.128	0.079	0.147	0.094
FSH (mIU/ml)	0.061	0.214	-0.158	0.185	-0.011	0.109	0.235	-0.016
LH (mIU/ml)	0.163	0.260	0.062	0.138	-0.091	0.068	0.101	-0.036
Estrogen (pg/ml)	+0.376	0.397	0.089	0.134	-0.225	0.048	0.222	0.288

*Correlation is significant at the 0.05 level

Table (3) showed that no significant correlations were found between serum trace elements measured and prolactin, FSH, LH, and estrogen in menopausal women with . This result showed that there was a non significant correlations between Zn, Co, and Cr levels with FBS and HbA1c in menopausal women with DM as shown in table (3). In a study of Al-Sharefi *et al*, Zn supplement had no significant effect on HbA1c in diabetic patients, but reduced oxidative stress(Al-Sharefi *et al*., 2008) . Also there was a negative correlations between FBS and Cu levels, but when compared with the menopausal women without DM showed that there was a negative correlations between FBS and HbA1c with Zn and Cr levels and positive correlations between FBS and Cu, these finding is in agreement with Dougle *et al*. (Dougle *et al*., 2009) .

These results concluded that a decreased serum levels of Zn, Co, and Cr in menopausal women with DM while serum Cu level was increased in menopausal women with DM when compared with the menopausal women without DM. The defect hormones in menopausal women with DM may be at a risk factor of developing imbalances and deficiencies of these trace elements.

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