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Quantitative study of some trace elements and blood parameters in the third trimester of Iraqi pregnant women with Pre-eclampsia

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Abstract

Pre-eclampsia complicates 2-8% of all pregnancies and it is one of the leading causes of maternal mortality and pre-term delivery in the world. Unfortunately, there is scarcity of documents discussing the circulating level of several essential trace elements in Pre-eclampsia patients in Baghdad especially in the last trimester of the pregnancy. The present study was designed to quantitative evaluation the whole blood concentration of two trace elements, copper (Cu), and iron(Fe), in pre-eclamptic women in the third trimester of pregnancy. The study was conducted on 18 Pre-eclamptic pregnant women as patients group with clinical detected high blood pressure $\geq 140/90$ mmHg and 13 normotensive pregnant women as control group from Al-Alwiya for obstetric and gynecological hospital, clinical data were collected at routine obstetric visits. Hemoglobin (Hb), Packed cell volume (pcv) and measurements of 2 trace elements concentrations were measured in the whole blood of both patients and control group. Hematological parameters measurements explored non-significant differences was found in Hb value and pcv between the patients and the control group, although their mean levels were increased in the patients compared to the control group. According to the statistical analysis it was noticed there was non-significant differences ($P > 0.05$) was found in the concentration of the copper between patients and control group. But significant ($P < 0.05$) elevated concentration of Fe was conducted in the pre-eclamptic patients compared to the control. In conclusion, our study suggest that pre-eclampsia in the third trimester is associated with significant increase of maternal blood iron and these increasing levels may be lead to increase the risk of pre-eclampsia in pregnant women.

Keywords: trace elements, pre-eclampsia, third trimester

دراسة كمية لبعض العناصر الثقيلة ومعايير الدم في الربع الثالث من الحمل في النساء الحوامل العراقيات المصابات بتسمم الحمل.

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الخلاصة:

يشكل تسمم الدم الحلمي نسبة 2-8% من مجموع حالات الحمل وهو احد الاسباب المؤدية لموت الام والولادة المبكرة في العالم. ولان المصادر التي تناولت مستويات العناصر النادرة في دم الحوامل المصابات بتسمم الدم الحلمي في مدينة بغداد مازالت شحيحة خصوصا خلال الربع الاخير من الحمل. وضعت هذه الدراسة للتقييم الكمي لتركيز عنصرين من المعادن الثقيلة، النحاس والحديد في دم النساء الحوامل المصابات بتسمم الحمل في الاشهر الثلاث الاخير من الحمل. اجريت الدراسة على 18 حامل مصابه بتسمم الحمل اعتبرت مجموعه المرضى مع التشخيص السريري لارتفاع ضغط الدم اكثر من 90/140 ملم زئبق و 13 امرأة حامل سليمة كمجموعه سيطرة من مستشفى العلوية للولادة، تم جمع المعلومات السريرية من خلال

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الزيارات الروتينية للعيادة النسائية في المستشفى. تم قياس تراكيز الهيموغلوبين وحجم الخلايا المضغوطة وعنصرين من العناصر الثقيلة في الدم الكلي لمجموعتي المرضى والسيطرة. وجد عدم ظهور فروق معنوية في معايير الدم (الهيموغلوبين وحجم الخلايا المضغوطة) بين مجموعتي المرضى ومجموعتي السيطرة بالرغم من ان معدلاتها كانت مرتفعة في مجموعتي المرضى مقارنة مع مجموعتي السيطرة، اعتمادا على التحليل الاحصائي فقد وجد عدم وجود فرق معنوي ($P < 0.05$) في تركيز النحاس بين مجموعتي المرضى ومجموعتي السيطرة لكن وجد ارتفاع معنوي ($P > 0.05$) في تركيز الحديد في دم الحوامل المصابات بتسمم الحمل مقارنة مع مجموعتي السيطرة. نستنتج من دراستنا هذه ارتباط تسمم الحمل خلال الربع الثالث من الحمل مع زيادة تركيز الحديد في دم الامهات المصابات بتسمم الحمل وهذه النسب المرتفعة قد تؤدي الى زيادة خطورة تسمم الحمل في النساء الحوامل.

Introduction

Pre-eclampsia [PE], also known as toxemia or pregnancy-induced hypertension is a women pregnancy-specific disorder which can be defined as the new onset of hypertension and significant proteinuria after the 20th week of gestation with or without pathological edema [1,2], effects on many body organs, liver, kidney, and cardiovascular system. In developing countries, pre-eclampsia accounts for 20-40 % of the maternal mortality and 15% of preterm deliveries [3]. According to the reports of the WHO, the pregnancy-induced hypertension in Iraq accounts for 9% until 2013 [4]. The pre-eclampsia is characterized by a hypertension syndrome has several systemic symptoms like a systolic blood pressure of ≥ 140 mmHg and diastolic pressure of ≥ 90 mmHg [5] and protein in urine [6]. Typically blood pressure elevation and pre-eclampsia occur in the late second or third trimester and gestational outcome is hardly affected . It has been reported that, pre-eclampsia is a major cause of both maternal and fetal morbidity and mortality [7]. Although many pathophysiologic factor such inflammation, cytokine production, dyslipidemia and oxidative stress have been implicated in the etiology of pre-eclampsia [8,9], many factors which involved in the etiology still remains incompletely understood ,but many theories have been considered ,like impaired immunological adaptation between maternal placental and fetal tissues, impaired maternal adaptation to the cardiovascular changes of normal pregnancy as well as the nutritional factors [10]. The changes in metal levels of blood observed in pre-eclampsia patients may be associated with pathogenesis of pre-eclampsia [7]. Nutritional deficiencies are common during pregnancy and pregnant women in developing countries have been reported to consume diets that are low in minerals and vitamins [11]. An inadequate dietary intake before and during pregnancy might be a high risk not only for the mother but also for the fetus. Deficiencies of trace elements such as zinc, copper, selenium and magnesium have been implicated in various reproductive events like infertility, pregnancy wastage, congenital anomalies, pre-eclampsia, placental abruption, premature rupture of membranes, still births and low birth weight [12]

Materials and Methods

This study was randomized review to investigate the levels of two trace elements [Fe and Cu] in the whole blood of pregnant women with pre-eclampsia collected from Al-Alwiya for obstetric and gynecological hospital, the study was begin from January 2016 until June 2016.

The study was carried out on 18 patients with clinical diagnosed cases of pre-eclampsia at the third trimester of gestation [>20 weeks] and 13 normotensive pregnant women as control group with age range 20-39 years.

Hemoglobin levels [Hb], packed cell volume [pcv] were measured as the standard methods [13] and analysis of ferric and copper values were carried out on the whole blood samples according to the [14]

Statistical analysis

All data were expressed as mean \pm standard error mean [mean \pm SEM] with their corresponding p values. Statistical analysis was performed using the statistical software package SPSS, version 16.0 [SPSS Inc., Chicago]. Comparison between patients and control groups was performed using independent sample test. [15]

Results

The comparison of some blood parameters between control and pre-eclamptic pregnant women were shown in Table-1 and Figure-1 and -2. The results appeared that not significant differences [$p>0.05$] in the level of the Hb and PCV between the pre-eclamptic pregnant women and the normal pregnant women, in another side, the present study was found significant increase correlation [$p<0.05$] in levels of the PCV within the pre-eclamptic pregnant women group compared with the Hb.

Table 1- Blood parameters in control and pre-eclampsia women

Hematological parameters	control	patient
Hb (g/dl)	10.623 \pm 1.6922 a	10.939 \pm 1.2594 a
PCV (%)	33.000 \pm 4.7610 b	34.550 \pm 4.4423 b

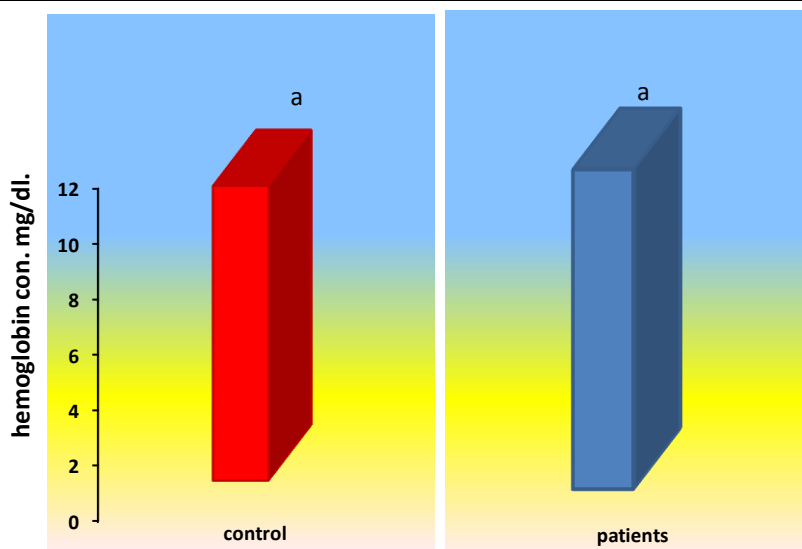


Figure 1- Hemoglobin concentration in control and pre-eclampsia women

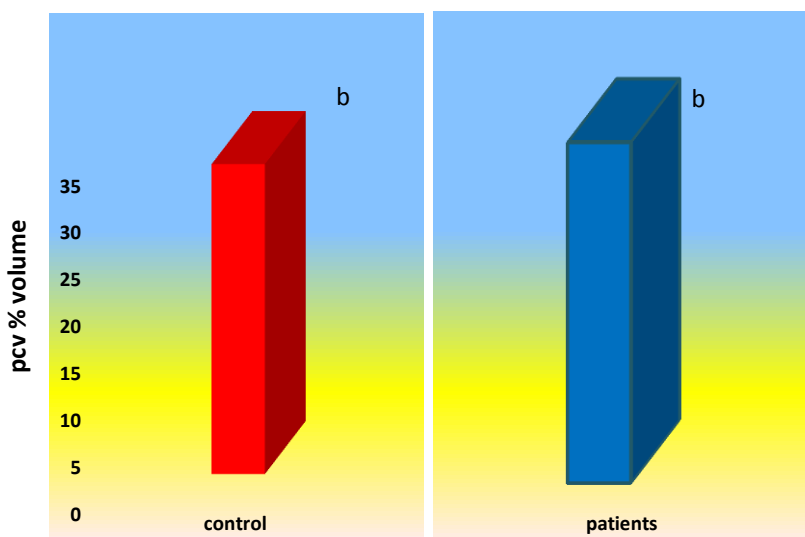
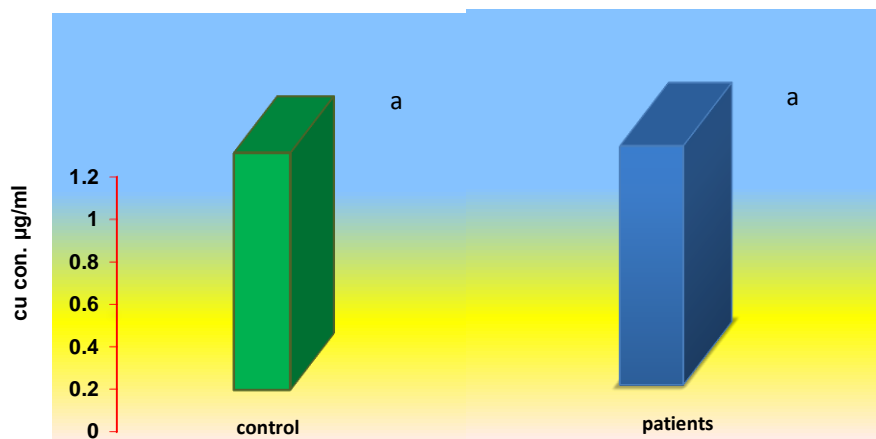
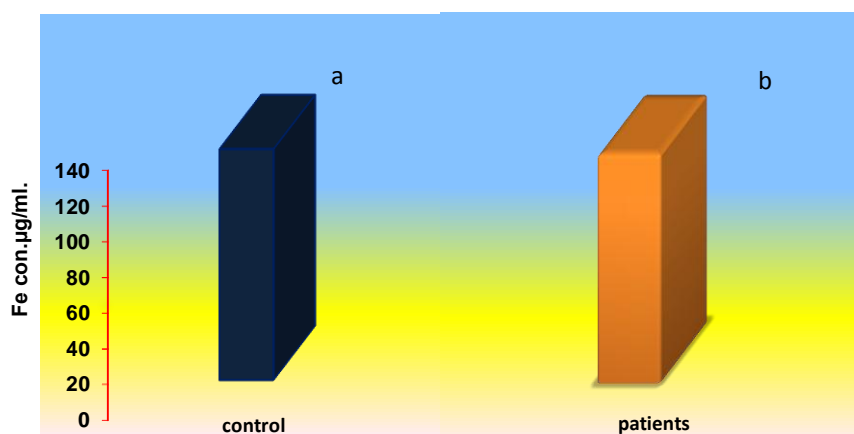


Figure 2- Packed cell volume in control and pre-eclampsia women

In Table-2 and Figure-3 and 4, measurements of whole blood trace elements found that mean values of Cu, were non-significant differences ($p>0.05$) between pre-eclamptic pregnant women and normal pregnant women at the third trimester of the gestation, while there were significant high level ($p<0.05$) in the whole blood Fe concentration between pre-eclamptic pregnant women (181.588 \pm 64.782) compared of normal pregnant women (129.462 \pm 70.313).

Table 2- heavy metals concentration in control and pre-eclampsia women

Mean value of Trace elements($\mu\text{g/ml}$)	Control	patient
Cu	1.114 \pm 0.7795 a	1.126 \pm 0.4689a
Fe	129.462 \pm 70.3130 a	*181.588 \pm 64.7821 b

*=($p < 0.05$)**Figure 3-** Concentrations of Cu in the control and pre-eclampsia women**Figure 4-** Concentrations of Fe in the control and pre-eclampsia women

Discussion

Pre-eclampsia is still one of the leading causes of maternal and fetal mortality, despite active research for many decades, the etiology of this disorder remains unknown completely and therefore the pre-eclampsia is a life-threatening complication of both mother and fetus.

Determination of the hematology parameters is of primary interest in connection with the detection of the health problems in pregnancy women. The current study was observed that, non-significant differences of the level of the Hb and PCV between pre-eclamptic pregnant women and normal pregnant women, although the mean values were higher in the pre-eclamptic pregnant women, these findings are agree with the previous study by [16]. In general the Hb level in both pre-eclamptic pregnant women and normal pregnant women was increased during third trimester of the gestation compared of non-pregnant women, but the maternal anemia is a common pregnancy complication in developing countries, [17] was reported that the risk of anemia increase with the severity of the hypertension disorders although increased value of Hb during pregnancy and this may due to rapid drain of hemoglobin to meet the need of the fetus and the elevated oxidative stress occur during this period, this elevated level of Hb in the pre-eclamptic pregnant women in the third trimester of pregnancy is associated with the risk of pre-eclampsia and measurement of the Hb during this time is more accurate than the other trimesters as was reported by [18,19] , because the unstable level of the

Hb during first and second trimester of pregnancy, at this point, there is a suggested issue in which the third trimester Hb can better predict pre-eclampsia than the other trimesters, [20].

The whole blood concentrations of copper (Cu) and Ferrous (Fe), were detected in both groups, there were not significant differences of concentrations of the Cu between pre-eclamptic pregnant women and normal pregnant women, but generally the statistical means of Cu were lower in the pre-eclamptic pregnant women than normal pregnant women, these findings agrees with the previous detected concentration of these metals [21].

Many reports are different in the detection of the concentrations of copper in the blood of pregnant women between decreased and elevated and unchanged levels [22]. The possible causes of these changes are related to the hormonal metabolic and enzymatic changes in pre-eclampsia. The physiological increase in copper concentration in pregnancy is in part associated with estrogen induction of copper carrying protein [23].

The present study agrees with ref. [16], they found also not significant differences of zinc and copper between pre-eclamptic and normotensive pregnant women.

In the current study, the mean concentration of the Fe was higher significant in pre-eclamptic pregnant women than normal pregnant women these present concentrations agree with the results were reported by [24]. Normal pregnant women had a decrease in serum iron and ferritin during the third trimester of pregnancy because the stores of the iron are depleted to meet the need of the fetus [25] and so the elevated level of the serum iron was observed in pre-eclamptic pregnant women compared to normal pregnant women in other previous reports by [26, 27] like the present findings. Local iron excess is considered a result from the deficiency of the total iron binding capacity in the serum and thus elevated the concentration of free iron in the circulating blood of the pre-eclamptic pregnant women, leads to excessive oxidative stress in the blood and many organs especially the placenta, this may lead to excessive of the concentration of free radicals to fetus blood through ischemic placenta [28]. but the false common use is the continuous requirements of iron during all the periods of the pregnancy by a recommended dose of ferritin was given to the pregnant starting early pregnancy, this will lead to increase the level of the ferritin in her blood especially if she not has anemia and cause an acute and chronic phase response to free radicals which cause many complications during the pregnancy like the pre-eclampsia, these findings were suggested the role of the oxidative stress in the pathogenesis of the pre-eclampsia, therefore its necessary measured the iron status of the pregnant women before giving the iron supplementations as these may cause a more harm than benefit [29]

Conclusions

Based on our study findings, it could be concluded that among the trace elements measured the iron whole blood concentration has a role in the pre-eclampsia incidence besides other causes and the hematological parameters were used together may be a suitable marker in monitoring these patients during the third trimester of pregnancy, and the iron status of pregnant women should be assessed before giving iron supplementations as these may cause more harm than benefit.

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