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ASSESSMENT OF TRACE ELEMENTS IN SUDANESE PREECLAMPTIC PREGNANT WOMEN

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ABSTRACT

Background: Preeclampsia is a common gestational disorder which complicates 5-8% of pregnancies and it is associated with maternal, fetal and neonatal morbidity and mortality. Minerals have important influence on the health of pregnant women and growing fetus and their Alterations in serum have been suggested as effective factors in causing preeclampsia. **Objectives:** This study was aimed to assess the serum trace elements; zinc, copper and magnesium levels in preeclamptic and normal pregnant women. **Methods:** Hospital-based matched case control study was conducted during the period from October 2013 to April 2014. Cases were One hundred twenty two preeclampatic women and controls were 79 apparently health pregnant women from the Khartoum Teaching Hospital and Omdurman maternally hospital in Khartoum state, Sudan. Blood specimens were collected from both groups and serum levels of Zn, Cu and Mg were estimated using atomic absorption spectrophotometer. The characteristic base line data were collected using structural questionnaire. Processing and analysis of data was carried out by means of statistical package for social science (SPSS version 16). **Results:** The means of serum trace elements zinc, copper magnesium levels in pregnant women with preeclampsia were significant lower (49.4 ± 17.0), copper (47.9 ± 20.0) and (1.23 ± 0.38) compared to (90.3 ± 16.8) , (91.7 ± 23.2) and (2.04± 0.22) in healthy pregnant women , respectively . The trace elements zinc,

copper & magnesium levels were found to be significantly decreased in pregnant women with preeclampsia. The maternal mean serum level of Zinc, Cu and Mg were lower among the severe PE patients compared to the mild patients (P.value < 0.05). There was no correlation between Age, parity and gestational age and serum level of zinc, copper and magnesium in mild and severe preeclamptic women (p. value <0.05). **Conclusion:** This study established that the levels of zinc, copper and magnesium were significantly altered in pregnant women with pre-eclampsia supporting the hypothesis on the role of magnesium copper and zinc deficiency in preeclampsia pathophysiology .

KEYWORD: Zinc, Copper, Magnesium & Pre-eclampsia.

INTRODUCTION

Preeclampsia is a common complication of pregnancy associated with high maternal morbidity and mortality and intrauterine fetal growth restriction. The number of maternal deaths from pre-eclampsia is equivalent to the loss of 170 pregnant women in the developing world each year. The features of pre-eclampsia are hypertension and proteinuria occurring after 20 weeks gestation in women who were not previously known to be hypertensive [1].

Minerals and trace elements, such as zinc, copper, iron, selenium, calcium, magnesium and other micronutrients, have significant influence on the health of pregnant women and the growing fetus [2, 3]. Recently, the importance of zinc and other micronutrients in relation to pregnancy outcomes and fetal health have been the concern of many studies [3, 4].

The abnormality in concentration of minerals and trace elements in serum exposes the subject to a risk of pregnancy complications, which includes pre-eclampsia.

In recent times, there has been an increasing prevalence in the incidence of pre-eclampsia globally, but there are conflicting reports on the relationship between trace elements and pre eclampsia. Several previous study reported lower serum level of zinc, copper and magnesium compare with normal pregnant women[5]. Minerals and trace elements, such as zinc, copper, iron, selenium, calcium,magnesium, and other micronutrients, have significant influence on the health pregnant women and the growing fetus[3]. Hence the present study had undertaken to assess trace elements; zinc, copper and magnesium in preeclamptic pregnant women.

MATERIALS AND METHODS

This study was done in Khartoum teaching hospital and Omdurman maternary hospitalin Khartoum state during the period from October 2013toApril 2014. The study samples comprised 122 Sudanese pre-eclamptic women as cases and 79 healthy volunteers' pregnant women as control group. Both groups were age and duration of gestation matched. Those with diabetes mellitus, hypertension, Blood disorder, women that take medication may be affect the parameters under study were excluded. Permission of this study was obtained from to local authorities in the area of the study. An informed consent was obtained from each participant in the study after explaining objectives of the study. Interview and questionnaire was used to collect data including. Non probability sampling technique was used. Using antiseptic technique, 5 ml of venous blood was collected from each participant. Serum was separated directly from the plain container bycentrifugation at (300 rpm) for 5 minutes. Serum levels of zinc, copper and magnesium were measured by Atomic absorption spectrophotometer. To evaluate the severity of pre eclampsia the study groups grouped in to two group according to blood pressure and proteinuria (mild and sever), and then this tow group compared with age, gestational age and parity to evaluate the effected of this variable on the severity of disease.

Statistical Package for Social Science (SPSS version 16) computer software was used for data analysis. We used independent ANOVA-test and correlation test (significance levels was set at $P<0.05$).

RESULT

The base line characteristics of study population are shown in {table 1}. The test group was 51 with mild preeclampsia and 71 with sever. Pre-eclampsia.

As shown in table 2, the serum level of zinc, copper and magnesium were significantly lower in preeclamptic women compare to healthy pregnant women (p.value<0.0001). When preeclamptic women divided into two groups according to severity of the disease, serum level of zinc, copper and magnesium were significantly more decreased in severe preeclamptic women compared to milid (p.value< 0.05) {table3}.

The parity and gestation age of pregnancy had no significant effect on serum serum level of zinc, copper and magnesium in mild and severe preeclamptic women (p.value > 0.05) {table 4 and table 5}.

There was insignificant correlation between age of with zinc, copper and magnesium figure (4), (5) and (6).

Table: 1. Base Line Characteristic of study population

Variable		Control	Mild preeclampsia	Severe Preeclampsia
Age/Year		25.8 ± 6.1	28.9 ±6.8	30.1 ± 8.7
Age group	15-24	39 (49.4%)	12(23.5%)	23(32.4%)
	25-34	28 (35.4%)	29(56.9%)	19(26.8%)
	35-44	12 (15.2%)	10(19.6%)	29(40.8%)
Residence	Khartoum	62(78.5%_)	28(54.9%)	26(36.6%)
	Out of Khartoum	17(21.5%)	23(50.6%)	45(63.4%)
Gestational age	2nd trimester	39(49.4%)	14(27.5%)	18(25.4%)
	3rd trimester	40(50.6%)	37(72.5%)	53(74.6%)
Parity	Primagraved	29(36.6%)	19(37.3%)	37(52.1%)
	Multiparity	50(63.3%)	32(62.7%)	34(47.9%)
Proteinuria	Negative	79(100%)	1(2%)	0(0%)
	++	0(0%)	40(78.4%)	7(9.9%)
	+++	0 (0%)	10(19.6%)	38(53.5%)
	++++	0(0%)	0(0%)	26(36.6%)

- The table shows the mean ± SD (mini - max) and probability (P)
- T-test was used for comparison.
- P value ≤ 0.05 is considered significant.

Table:2. comparison of the mean of serum levels of trace element between the control and patients with preeclampsia

	Control n= 79	patient n= 122	P.value
Zink (µg/dl)	90.3 ± 16.8	49.4 ± 17.0	<0.000
Copper (µg/dl)	91.7 ± 23.2	47.9 ± 20.0	<0.000
Magnesium (mg/dl)	2.04± 0.22	1.23 ± 0.38	<0.000

- T.test used to calculate p.value between case and control.
- P value ≤ 0.05 is considered significant.

Table:3. comparison the serum levels of trace element between controls and mild & sever preeclaptic patients

	Control n= 79	Mild n=51	Severe n= 71	P.value*	P.value**
Zink (µg/dl)	90.3 ± 16.8	65.11 ± 5.7	38.3 ± 13.1	<0.0001	<0.0001
Copper (µg/dl)	91.7 ± 23.2	66.6 ± 9.9	34.6 ± 13.9	<0.0001	<0.0001
Magnesium (mg/dl)	2.04± 0.22	1.58 ± 0.18	0.99 ± 0.29	<0.0001	0.002

- *ANOVA comparison between three groups, ** T.test between mild and severe.
- P value ≤ 0.05 is considered significant.

Table: 4.comparison of trace elements in preclamptic women according to parity

	primgravidy n= 56	multiparity n=66	P.value
Zink (µg/dl)	46.6 ± 17.7	51.9 ± 16.2	0.09
Copper (µg/dl)	46.8 ± 18.7	48.9 ± 21.3	0.59
Magnesium (µg/dl)	1.18 ± 0.38	1.28 ± 0.38	0.56

- T.test between parity and trace element.
- P value ≤ 0.05 is considered significant.

Table: 5. comparison of trace elements in preclamptic women according to gestational age

	second trimester n= 32	third trimester n=90	P.value
Zink (µg/dl)	49.3 ± 17.3	49.5 ± 17.0	0.95
Copper(µg/dl)	47.1 ± 20.2	48.3 ± 20.1	0.78
Magnesium (µg/dl)	1.28 ± 0.35	1.23 ± 0.39	0.54

- T.test between second and third trimester.
- P value ≤ 0.05 is considered significant.

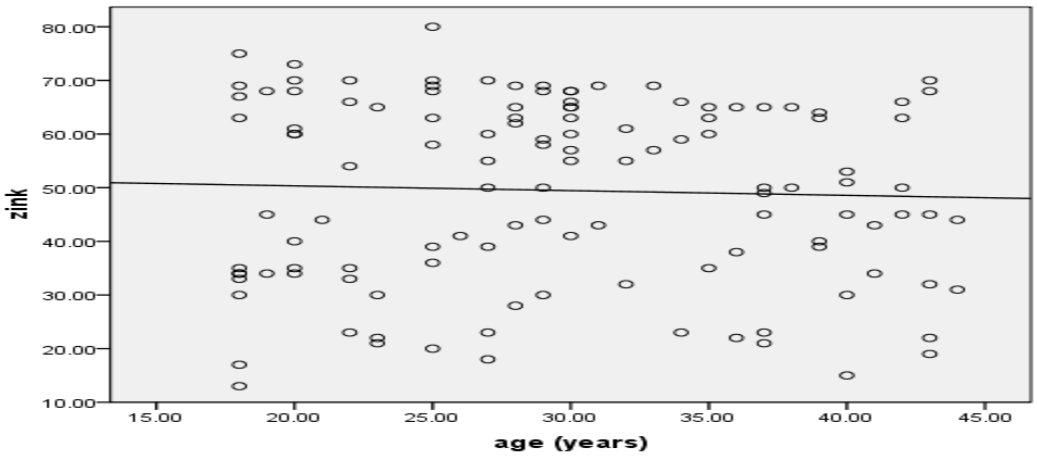

Figure:4. scatter plot shows correlation between age and serum level of znic in preeclamptic women.(R = -0.04 , P= 0.65).

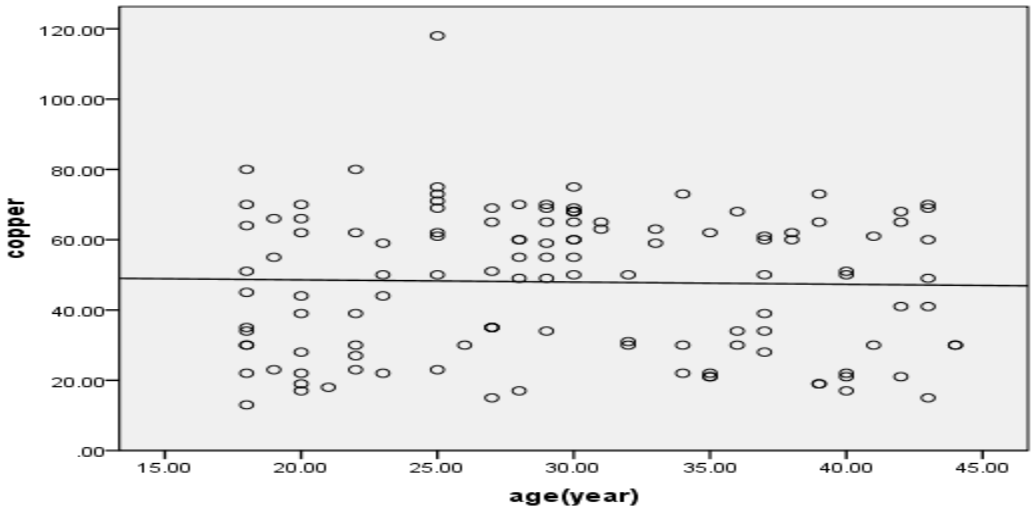

Figure: 5. scatter plot shows correlation between age and serum level of copper in preeclamptic women.(R = -0.03 ,P= 0.78).

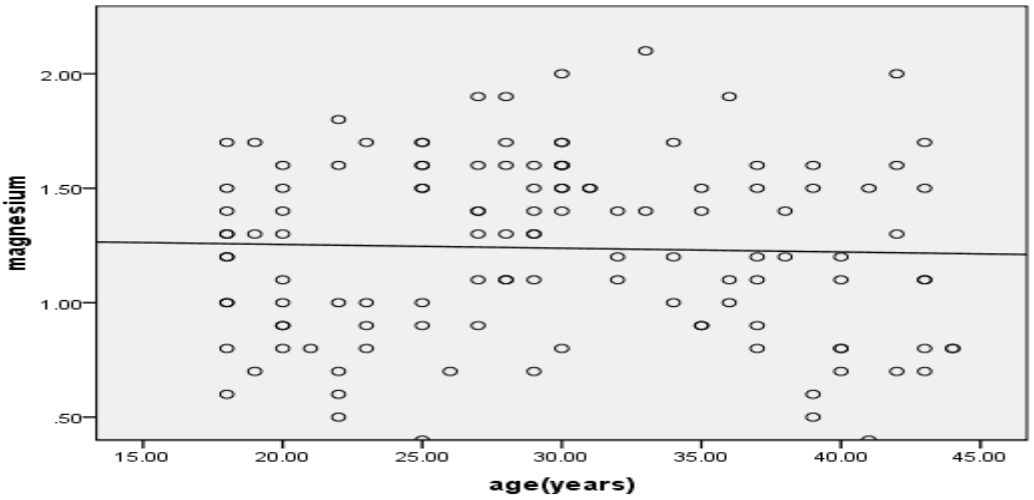

Figure :6. scatter plot shows correlation between age and serum level of magnesium in preeclamptic women. (R = -0.03 ,P= 0.71)

DISCUSSION

In this study the status of serum levels of trace elements in Pre-eclampsia in Sudanese was evaluated compared to healthy pregnant women. The Pre-eclampsia is defined as the onset of proteinuria hypertension after mid-pregnancy; a systemic disease of the later stages of pregnancy that affects about 5 - 7% of all pregnancies[6,7]. It is a rapidly progressive condition characterized by high blood pressure, platelet aggregation, swelling of the lower extremities and protein in urine, Sudden weight gain, headaches and changes in vision are important symptoms [8]. Pre-eclampsia is a major cause of both maternal and foetal morbidity and

mortality Bringman et al [9]. Despite its prevalence and severity, the patho-physiology of this multi-system disorder is still poorly understood. Nutritional deficiencies of both macro- and micro-nutrients are common in women of reproductive age in developing countries [10, 11]. The trace elements zinc, copper and magnesium are essential elements that presents in many metalloproteins and enzymes as a cofactors. Previous studies suggest that deficiencies of these traces elements as risk factor for developing of pre-clampsia or it may be contribute in its pathogenesis.[12,13]

In This case control hospital based study, which was carried out in Khartoum teaching hospital and Omdurman maternally hospital it was found that serum levels of zinc, copper and magnesium are significantly decreased among Sudanese preeclamptic pregnant women compared to control group .This finding is consistence with many previous studies which reported deficiency of these trace elements in pre-clamptic women [5, 14, 15, 16]. The decreased concentration may be explained increased utilizing this trace element during pregnancy or due to nutritional deficiency [14].However, some previous studies reported normal magnesium levels in pre-clampsia [17], which disagree with our finding. This may explained partially by ethnic and nutrients differences between different populations.

Our result showed that maternal mean serum level of Zinc, Cu and Mg were more deficient among the severe PE patients compared to the mild patients. This result agree with *Essam et al* [14] , who reported that maternal mean serum Cu and Zn were lower among the severe PE patients compared to the mild patients . These findings support the suggestion of the role of deficiency of these trace elements in development of pre-clampsia or their contribution to pathogensis and severity of this disorder [18]. The metallprotein Zinc is important trace elements for nucleic acid metabolism and synthesis of many structural proteins and passively transferred from mother to fetus. The zinc deficiency is reported to be associated with pregnancy complications including pre-clamsia [19]. The role of magnesium in health of maternal and fetus is well established. It acts as coenzyme for many enzymes and calcium channel blocker; therefore, its deficiency is associated with pregnancy complications [20]. The magnesium sulphate is recommended treatment to prevent eclampsia [21].

According to our finding their was gestational age and parity had no significant effect in alteration of serum trace levels among preeclamptic women. Similar results were obtained by Farzinet al [16] and Ugwuja et al [18] and Funmilola et al [22] who reported that there is insignificant correlation of estational age and parity among pre-eclamptic women.

CONCLUSION

This study established that the levels of zinc, copper and magnesium are significantly lower in pregnant women with pre-eclampsia with more pronounced deficiency in sever pre-eclampsia supporting the hypothesis on the role of magnesium copper and zinc deficiency in preeclampsia pathophysiology.

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