



Blood lead and calcium levels in pregnant women suffering from severe preeclampsia in Baghdad, Iraq

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Abstract

The estimation of serum lead and calcium levels in Iraqi pregnant women suffering from severe preeclampsia provides a very useful index for the study of some physiological and pathological changes during pregnancy. The study subject comprised of two groups aged between 26–45 years selected from Baghdad city. Group I- severe preeclamptic women, group II- normal pregnant women. Serum was analyzed for estimation of lead and calcium. The results showed a highly significant ($P < 0.001$) increased in serum lead level (32.58 ± 4.08 in severe preeclamptic women 13.06 ± 3.11 in normal pregnant) with a significant ($P < 0.001$) decreased in serum calcium level (6.99 ± 0.99 in severe preeclamptic women 11.48 ± 1.89 in normal pregnant). The results of the present study indicate that high blood lead levels in Iraqi pregnant women may be an important factor in the development and progression of severe preeclampsia and its responsible for calcium deficiency because of its ability to compete on the sources of calcium in the body.

Keywords: Lead, Calcium, Preeclamptic, Blood pressure.

Introduction

Preeclampsia is the common complication of pregnancy which is the most major causes of mortality in pregnant woman (Allahyari *et al.*, 2009). This complication is the major problem in midwifery which causes prenatal morbidity and mortality in all over the world and its responsible for 15% of mortality of the mothers (Sibai, 2005). The preeclampsia happens when the systolic blood pressure equal or more than 140mm/Hg and the diastolic blood pressure is equal or more than 90mm/Hg in two times whit 4-6hrs interval after 20th week and along with 300mg of protein exertion in the urine during 24hrs (Laivuori, 2007; Sibai, 2003).

The etiology of preeclampsia is yet to be fully elucidated despite numerous studies that have been done. Some studies have concluded that changes in levels of blood metals observed in preeclamptic patients, may implicate the pathogenesis of preeclampsia (Bringman *et al.*, 2006; James *et al.*, 2006). Other studies have however not shown an association between the serum concentration of these elements and occurrence of preeclampsia (Cunningham *et al.*, 2005; Gabbe *et al.*, 2002). The high rate of preeclampsia in developing countries have made some authors come to the conclusion that

malnutrition is a risk factor in the etiology of preeclampsia, in some cases deficit intake of calcium and zinc has been implicated (Caughey *et al.*, 2005). Other study (Chanvitya *et al.* 2008; Pallavi *et al.* 2012) showed that calcium and Potassium K^+ play an important role in preeclampsia as they contribute significantly in the functioning of the vascular smooth muscles, Ca^{2+} plays a critical role in the function of vascular smooth muscles. Alteration of plasma Ca^{2+} concentration leads to raised blood pressure. Some studies shows that blood Ca^{2+} have a relaxant effect on the blood vessels of pregnant women (Anjum *et al.*, 2013; Chanvitya *et al.*, 2008).

The role of environment factors such as exposure to lead is important in preeclampsia. Lead as a neurotoxin can carry a lethal legacy. Young women who live in lead-contaminated housing or who were lead-poisoned themselves as youngsters can pass lead on to their unborn fetuses (Gary *et al.*, 2007; Klitzman *et al.*, 2002). In Vigeh *et al.* (2005) study increase concentration of lead in serum causes increasing the risk of preeclampsia in more times. According to severe complication of pre-eclampsia for mothers and their fetus. This study was carried out to find out the role lead and calcium and may play in the etiopathogenesis of severe preeclampsia in Iraqi pregnant women in Baghdad city.

Materials and Methods

Diagnosis:

- Severe pre-eclampsia pregnant: Its defined as having one or more the following criteria blood pressure of at least 160/110mm/Hg measured on two occasions each 6hrs apart, protein urine of at least 5gm per 24hrs, or at least 3+ on dipstick testing. Two random midstream urine specimens, collected \geq 4hrs apart taken from each women to avoid error due to false positive tests, the two results must be positive, so the diagnosis of protein urine was significant (National Institute for health and clinical excellence).
- Normotensive pregnant: Its defined as having one or more the following criteria blood pressure $<$ 140/80 mmHg measured on two occasions each 6 hours apart. No protein in urine or protein less than 10 mg/dl.

Study population: This study comprising of fifteen patients and fifteen controls that were selected from Department of Obstetrics and Gynecology in Baghdad Teaching Hospital and Fatima Al-Zahra Teaching Hospital during the period from July to December 2013. The patients were selected based on preset criteria: age, 26–45 years, pregnancy in the third trimester diagnosed (preeclampsia). The controls were selected from pregnant normotensive women also in the third trimester, undergoing caesarean section but not diagnosed as having preeclampsia, in the same age range. Excluded from the study are patients with medical complications such as diabetes mellitus, renal failure, heart failure or is chemic-heart diseases (diseases that alters vascular response).

Clinical investigation: Maternal systolic blood pressure (SBP) and diastolic blood pressure (DBP) was measured with the subject in supine position, using a standard mercury sphygmomanometer (Accoson, Essex, UK). The subjects were also tested for presence of protein in their urine using Medi-Test Combi2 strips (Macherey-Nagel, Duren, Germany). Blood pressure measured during at least 2 visits after the 22nd week of gestation, such that the elevated levels could have occurred during or across any of the weeks, at any point after 22 weeks. 5 ml of urine from each pregnant woman in this study was collected and separated after centrifugation for 5 minutes at 3000 rpm for the testing of the present of albumin in urine. 7ml of venous blood was collected from the cubital veins. The blood was separated after centrifugation for 5–10 minutes at 3000 rpm and the plasma were

stored frozen at -200°C , until analysis was carried out for calcium and lead estimations.

Laboratory analytical: Atomic absorption spectrophotometer model 200A (Buck Scientific, East Norwalk, UK) with detection limit of $1\mu\text{g}/\text{dl}$ was employed for blood lead determination, as described by Welz (1985) the digested samples were analyzed in duplicates by the atomic absorption spectrophotometry methodology using wavelength of 283 nm, and the mean value computed. Repeated analyses of standard solutions confirmed the method's precision. Serum calcium level was assayed using a spectrophotometric manual method using O-cresolphthalein–complex one as the color indicator (Gitelman, 1967) chemical kits supplied by human diagnostica (Wiesbaden, Germany) was employed.

Statistical analysis: Means \pm standard deviations were calculated for all treatment. Means of tests and controls were compared using t-test (using a program of statistic for epidemiology) and P-values were obtained. P-value was regarded significant if it is less or equal (0.05).

Results and Discussion

The estimation of serum lead and calcium levels in Iraqi pregnant women suffering from severe preeclampsia provides a very useful index for the study of some physiological and pathological changes during pregnancy. The results of serum lead levels in normal-pregnant and severe Preeclamptic women along with blood pressure and urine albumin for 24hrs are shown in (Table 1). There was a significant increase ($P=0.001$) insystolic, diastolic blood pressure and urine albumin for 24hrs parallel with a significant increase ($P=0.001$) in serum lead levels in the severe Preeclamptic women as compared to normal pregnant women (Table 1). Our findings are in keeping with the results of Motawei *et al.* (2013) who found a significant correlation between the serum blood lead and manifestations of pre-eclampsia, proteinuria and both systolic and diastolic blood pressure in women suffering from pre-eclampsia in Egypt. On other hand, our results are in contrast with the findings of Yao and Huang (2003) who measured blood lead levels (BLL) in a group of pregnant women to determine the association between maternal BLL and pregnancy complications. They concluded that BLL is not correlated with pregnancy complications. In Vige *et al.* (2005) increase concentration of lead in serum causes increasing the risk of preeclampsia in more times

The association between lead and hypertension in adults was first identified in the early 1980's and it has since been proposed that lead may also have

a role in gestational hypertension (Kennedy, 2012). Nosratola *et al.* (2000) demonstrated that chronic oxidative stress can lead to the induction and maintenance of severe hypertension in genetically normotensive rats. Lyn Patrick (2006) revealed that lead affects mammalian systems by directly lowering antioxidant reserves and generating reactive oxygen species (ROS), specifically hydroperoxides and lipoperoxides. These ROS alter cellular membranes and tissue, resulting in vascular, neurological, and genetic damage. Hypertension is a lead-induced condition where the pathway between exposure and pathology is most clearly understood through nitric oxide metabolism. On other hand, Supplementing of antioxidant such as calcium, iron, zinc, and milk, or avoiding contact with risk factors may help people especially pregnant women to reduce lead exposure (Kang-sheng *et al.*, 2013).

In the present study, a significant increase in serum lead level was seen, parallel with this there was a significant decrease ($P=0.001$) in serum Ca^{+2} level in the severe Preeclamptic women as compared to normal pregnant women (Figure 1). A similar finding of this type of effect was demonstrate in women with preeclampsia in Edo State, Nigeria (Ikechukwu *et al.* 2012). Our study clearly indicate that blood Lead levels increase during severe Preeclampsia, While the concentrations of serum calcium in the blood is decline. This may be due to the mobilization of

bone lead, along with Noticeable change in calcium metabolism during severe Preeclampsia. In the study by Gulson *et al.* (1997) two women who took dietary calcium supplements had the lowest mobilization of lead from bone to blood. In other studies of blood lead changes during pregnancy, Johnson (2002) found that high calcium intake (>2000 mg/day) may attenuate pregnancy-induced increases in maternal blood lead concentrations by decreasing maternal bone resorption/demineralization during pregnancy and the subsequent release of lead from the bone. Wiemann *et al.* (1999) believe that the lead tends to accumulate in bone from where it is released during bone resorption, thus leading to high local concentrations of lead with the risk of cellular toxicity. There is also evidence supporting that lead can substitute for calcium and zinc as a second messenger in ion-dependent events (Black *et al.*, 2000; Puzas *et al.*, 1992) lead's ability to substitute for calcium is a factor common to many of its toxic actions. For example, lead's ability to pass through the blood-brain barrier (BBB) is due in large part to its ability to substitute for calcium ions Ca^{+2} (Bradbury and Deane, 1993). Positive findings of blood lead among pregnant women may be indicative of contemporaneous exposure to lead or may result from remobilization of lead from bone stores due to either the aging process or the physiological stress of pregnancy.

Table(1): Clinical findings of normal pregnant and severe preeclamptic pregnant.

Parameters	Severe preeclamptic (n= 50)	Normal pregnant (n= 50)	P- value
Systolic blood pressure (mmHg)	180.21 ± 11.34	119.11 ± 9.89	0.001
Diastolic blood pressure (mmHg)	120.17 ± 8.01	79.08 ± 7.98	0.001
Urine albumin 24hrs (mg/dl)	7.10±6.11	420.01± 23.15	0.001
Lead (µg/dl)	32.58 ± 4.08	13.06 ± 3.11	0.001

Value (Mean ± Standard Error)

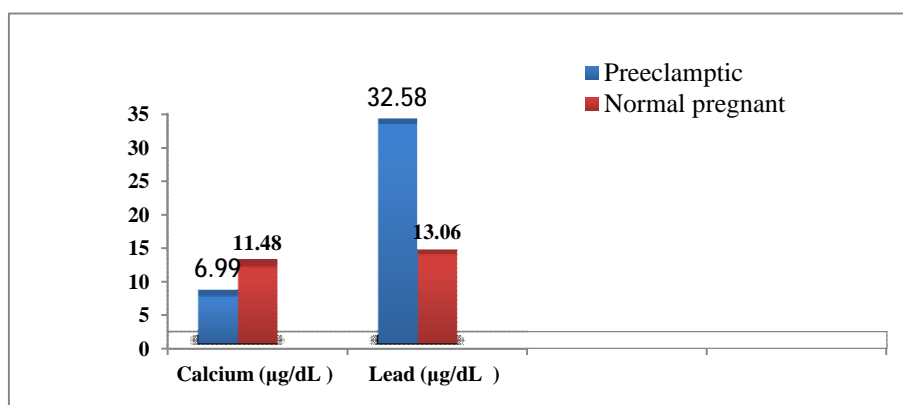


Figure (1): Serum concentration of calcium and lead in normal and severe preeclamptic women.

Conclusions

The results of the present study indicate that high blood lead levels in Iraqi pregnant women may be an important factor in the development and progression of severe preeclampsia and its responsible for calcium deficiency because of its ability to compete on the sources of calcium in the body.

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