Estimation of serum zinc, sodium and potassium in normotensive and hypertensive primigravida pregnant women

May N. Yussif, Salih M. Rahim*, Sami Ak. Zbaar **., Mossa M. Marbut***.*
Dept. of Biology, College of Education, Tikrit University.*
*Depts. of Biochemistry**, Physiology ***, College of Medicine, Tikrit University.*

Abstract

Pregnancy induced hypertension (PIH) occurs at about 20 weeks in 6% to 10% of pregnancies. PIH is a form of high blood pressure in pregnancy also called toxemia of pregnancy. It is more common in twin pregnancy or in women who had PIH in a previous pregnancy. The exact cause of PIH is not known. A cross sectional study was done in Tikrit teaching hospital from the beginning of September 2007 to the end of may 2008. 46 primigravida pregnant women were participated in this study (16 normotensive & 30 hypertensive women). Serum sodium, potassium & zinc were measured by a flame photometer. There are no significant differences between hypertensive pregnant women & normotensive pregnant regarding age, body weight, height, & BMI. The mean value of hemoglobin for hypertensive pregnant was 11.6 ± 0.11 gm/dl. While the heamoglobin value for normotensive pregnant women was 10.77 ± 0.49. There is no significant difference between hypertensive pregnant women & normotensive pregnant regarding blood hemoglobin. There is significant difference at p value of less than 0.01 between hypertensive pregnant women & normotensive pregnant regarding serum sodium level, which is higher in hypertensive group. Moreover, there is significant difference at p value of less than 0.05 between hypertensive pregnant women & normotensive pregnant regarding serum potassium level. However, there is no significant difference between hypertensive pregnant women & normotensive pregnant regarding serum zinc level.

Key Word: hypertensive, normotensive, pregnant women, serum zinc, potassium, & sodium level.

Introduction

Gestational hypertension is hypertension occurring for the first time during the second half of pregnancy in the absence of proteinurea. Hypertension in pregnancy is defined as two recordings of a blood pressure of at least 140/90 mmHg at an interval of 6 hours (1).

During pregnancy, the cardiovascular system undergoes changes in vascular resistance, plasma volume, & cardiac output. In terms of vascular resistance, there is progesterone induced relaxation of arteriolar smooth muscle. In addition, the placenta acts as a low resistance circuit which also results in a decrease in systemic vascular resistance(2).

The blood volume expands in response to increased plasma volume & increased red cell mass. The increase is significant & ranges from 20 % to 100% above pre-conception levels. The increase in red cell mass is not as great as the increase in plasma volume; the result is the physiologic anemia of pregnancy (3,4).

Pregnancy induced hypertension (PIH) occurs at about 20 weeks in 6% to 10% of pregnancies. It is more common in twin pregnancy or in women who had PIH in a previous pregnancy. The exact cause of PIH is not known. Some conditions may increase the risk of developing PIH which are the followings (5, 6);-

1-pre-existing hypertension.
2-Kidney diseases.
3-Diabetes.
4-Women with a previous pregnancy induced hypertension.

5-Mother's age younger than 20 or older than 40 years.
6-multiple fetuses (twins, triplets).

Early identification of at risk for pregnancy induced hypertension may prevent some complications of this disease (6).

The aim of the study is to determine the relationship of plasma sodium, potassium & zinc with the existence of pregnancy induced hypertension in primigravda pregnant women.

Patients & Methods

Forty six primigravida pregnant women were participated in this study (16 normotensive & 30 hypertensive women). A cross sectional study was done in Tikrit teaching hospital from the beginning of September 2007 to the end of may 2008.

All pregnant women were asked by special form of questionnaire about the age, presence of any disease, gestational period & family history).

Also, body weight was measured by balance scale with the subject wearing light cloths, & without shoes. The body weight is recorded in kilograms & to the nearest 100 gm.

Body height is measured by asking the subject to put her heels together & stand up right, the height measured by height scale to nearest centimeters. Body mass index was calculated from body weight in Kg divided by height in meter square (BMI).

Complete physical examination was done for all patients, including measuring of blood pressure after 5 minute rest post arrival to the clinic.

All pregnant women with edema, protein urea, kidney diseases, chronic hypertension, & diabetic women were excluded from the study.

Blood sample was done by taking five ml of venous blood & was obtained from the basalic vein in the anticubital fossa of each pregnant woman & drawn by using plastic syringe. Each blood sample was divided into two tubes as follow:

One ml of venous blood in tube containing anticoagulant EDTA was used for hemoglobin concentration & was measured by the cyanmethemoglobin method (7).

The remaining venous blood transferred to free tubes to allow clotting, centrifuged at 3000 rpm for 5 minutes, & the serum was then removed to another plain tube & store at -20C until the time of analysis, sample showing hemolysis was discarded.

Serum sodium, potassium & zinc were measured by a flame photometer. Each sample was run in duplicate tubes & its mean value was considered.

Statistical analysis was done by using student T test. P value less than 0.05 was acceptance as significant value. All data were presented as a mean & standard deviation (SD).

Results

Forty six primigravida pregnant women were participated in this study. According to existence of high blood pressure, pregnant women were divided into two groups. The first group consist of16 normotensive women as control & the second group with hypertension consist of 30 hypertensive women.

Table 1 shows the characteristics of pregnant women. There are no significant differences between hypertensive pregnant women & normotensive pregnant regarding age, body weight, height, & BMI. The mean value of hemoglobin for hypertensive pregnant was 11.6 ± 0.11 gm/dl. While the heamoglobin value for normotensive pregnant women was 10.77 ± 0.49. There is no significant difference between hypertensive pregnant women & normotensive pregnant regarding blood hemoglobin.

There is a significant difference between hypertensive pregnant women & normotensive pregnant regarding systolic

& diastolic blood pressure. The mean serum sodium level for hypertensive pregnant women was found to be 167.36 mmol / L (range were between 160 to 176 mmol/L). While, The mean serum sodium level for normotensive pregnant women was found to be 149.29 mmol / L (range were between 135 to 158 mmol/L). So, there is significant difference at p value of less than 0.01 between hypertensive pregnant women & normotensive pregnant regarding serum sodium level.

The mean serum potassium level for hypertensive pregnant women was found to be 3.04 mmol /L (range were between 2.6 to 3.4). While, The mean serum potassium level for normotensive pregnant women was found to be 3.886 mmol / L (range were between 2.9 to 4.6). There is significant difference at p value of less than 0.05 between hypertensive pregnant women & normotensive pregnant regarding serum potassium level.

The mean serum zinc level for hypertensive pregnant women was found to be 100.73 mmol / L (range were from 78 to 118). While, The mean serum zinc level for normotensive pregnant women was found to be 103.43 mmol / L (range were between 86 to 121). There is no significant difference between hypertensive pregnant women & normotensive pregnant regarding serum zinc level.

Discussion

Primary hypertension results from the interplay of internal derangements (primarily in the kidney) & the external environment. Sodium, the main extra cellular cation, has long been considered the pivotal environmental factor in the disorder. Numerous studies show an adverse effect of sodium on arterial pressure (8, 9, 10, and 11).

In the present study, the mean serum sodium level for hypertensive pregnant women was found to be 167.36 mmol / L. While, the mean serum sodium level for normotensive pregnant women was found to be 149.29 mmol / L. Therefore, there is significant difference between hypertensive pregnant women & normotensive pregnant regarding serum sodium level.

In previous studies, differences in the prevalence of hypertension among these populations have been attributed to differences in the amounts of dietary sodium consumed, but they could also reflect differences in potassium intake (11, 12, 13).

The mean serum potassium level for hypertensive pregnant women was found to be 3.04 mmol /L. While, the mean serum potassium level for normotensive pregnant women was found to be 3.886 mmol / L. Therefore, there is significant difference at p value of less than 0.015 between hypertensive pregnant women & normotensive pregnant regarding serum potassium level.

In clinical studies, a diet low in potassium (10 to 16 mmol per day) coupled with the participant's usual sodium intake (120 to 200 mmol per day) caused sodium retention & an elevation of blood pressure; on average, systolic pressure increased by 6 mmHg & diastolic pressure by 4 mmHg in normotensive subjects, & systolic pressure increased by 7 mmHg & diastolic pressure by 6 mmHg in hypertensive subjects (14, 15,16).

Unlike other conditions that cause high blood pressure, salt restriction & use of diuretics can worsen preeclamsia by reducing blood flow to the kidneys & placenta (8).

Increasing evidence indicates that hypertension in pregnancy is an under-recognized risk factor for cardiovascular disease (CVD). Compared with women who have had normotensive pregnancies, those who are hypertensive during pregnancy are at greater risk of

cardiovascular & cerebrovascular events (17).

There is a growing body of evidence indicated that endothelial dysfunction has a crucial role in the pathogenesis of gestational hypertension (18). Also, clinical studies have indicated that a relative deficiency of nitric oxide might worsen the state of generalized vasoconstriction reported in pre-eclampsia (19).

However, in the present study, in addition to the above causative agents of gestational hypertension, an increase in serum sodium & a decreased in serum potassium levels were found. This finding could be explaining part of mechanisms of pathogenesis of gestational hypertension. Because sodium sensitivity, defined as an increase in blood pressure in response to a higher sodium chloride intake than that in the baseline diet, occurs in many normotensive & hypertensive subjects (20).

In normotensive subjects, sodium sensitivity appears to be a precursor of hypertension. Dietary potassium has been shown to exert a powerful, dose dependent inhibitory effect on sodium sensitivity. With a diet that was low in potassium (30 mmol per day), 79% of normotensive blacks & 36% of normotensive whites had sodium sensitivity (13, 14, 15, and 16).

In animal & human, a low potassium diet itself causes renal sodium retention by means of several mechanisms (2). A low potassium diet leads to a potassium deficit in the body as a result of inadequate conservation of potassium by kidney & alimentary tract; with such a diet, fecal potassium losses can exceed even urinary losses (21).

The present study concludes that in gestational hypertension, there is a reduction in serum potassium & increased in serum sodium. On the basis of this results, pregnant women should take diet contain adequate amount of potassium.

Also, in the present study, there is no significant difference between hypertensive pregnant women & normotensive pregnant regarding serum zinc level. The mean serum zinc level for hypertensive pregnant women was found to be 100.73 mmol / L (range were between 78 to 118). While, the mean serum zinc level for normotensive pregnant women was found to be 103.43 mmol / L (range were between 86 and 121).

A marginal zinc deficiency has been reported in some women with preeclampsia (22,23). The common practice of prescribing iron & folic acid supplements to pregnant women can lead to reduced zinc absorption (24). Trails studying the relationship between zinc supplementation & preeclampsia incidence have produced conflicting results.

In one double blind trail, the incidence of preeclampsia was significantly lower in women receiving a multivitamin – mineral supplement, which provided 20 mg of zinc per day, than women who received the same supplementation without zinc (25). However, in another double blind trail a higher incidence of preeclampsia was reported in pregnant women given 20 mg of zinc per day than was reported in women given a placebo (26).

In the present study, there is no significant difference between hypertensive pregnant women & normotensive pregnant regarding serum zinc level. Also, it was worthwhile to mention, in this study no hypertensive pregnant women have the sign & symptoms of preeclampsia. Therefore, from the present result & current evidence does not sufficiently support the use of zinc as away to protect against preeclampsia.

The present study concludes that there is a significant increase in serum

sodium & a significant decrease in serum potassium in hypertensive women comparing with normotensive pregnant women.

Also, the present study recommended that to pay attention for serum electrolytes as a cause or play role in the path physiology of gestational hypertension.

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Table (1) shows the characteristics of pregnant women (mean & standard deviation)

	Hypertensive pregnant women	**Normotensive pregnant**
Age (years)	25.8 ± 6.8	27.2 ± 5.4
Body weight (kg)	80.53 ± 8.5	75.54 ± 8.85
Height (cm)	160.8 ± 2.2	159.8 ± 2.3
BMI (kg/M2)	30.11 ± 2.6	29.6 ± 2.8
Systolic blood pressure	149.3 ± 7.76	114.5 ± 12.1
Diastolic Bp (mmHg)	98.0 ± 9.6	70.5 ± 10.4
Hemoglobin (gm/dl)	11.6 ± 0.11	10.77 ± 0.49

Table (2) shows the mean & standard deviation of the concentration of zinc, sodium & potassium in serum of pregnant women.

	Serum zinc	**Sodium (mmol/L)**	**Potassium (mmol/L)**
Hypertensive pregnant women	100.73 ± 13.6	167.36 ± 4.9	3.04 ± 0.25
Normotensive pregnant	103.43 ± 11.5	149.29 ± 9.0	3.886 ± 0.61
P value	NS	0.01	0.05