Original Article

The effect of mineral levels in the mother's circulation on the outcome of pregnancy

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Abstract:

Background: Dietary intakes are critical during pregnancy, because inadequate amounts of key nutrients may compromise fetal development or maternal health. In addition to that maternal diet could be one of the methods to select the gender of the baby. The aim of the study is to correlate the level of the minerals in the mother's blood with the gender and wellbeing of the baby after delivery.

Patients and Methods: Fifty women were involved in this study with a mean age (23.92 ± 4.75), collected from the labor room during labor in the period between December 2013 and May 2014, in Baghdad teaching hospital. After taking a full history from the women, 10 ml of blood was withdrawn from them, 2ml in EDTA tubes for lead estimation and 8 ml in plain tubes, centrifuged and the serum was used for magnesium, copper, calcium and zinc estimation. The estimation was done by spectrophotometer method.

Results: Birth weight of the delivered babies was correlated negatively but not significantly to the age of the delivered women. The level of the minerals in the maternal blood was not different between those who delivered male or female babies except for the zinc level which was higher in those women who give birth to male babies. The correlation between the birth weight of the babies and the level of maternal minerals shows a not significant positive correlation between them except for zinc which was significant and the lead level was correlated negatively but not significantly with birth weight.

Conclusions: Age seems to have no significant effect on birth weight. There is no significant effect of the minerals level on the selection of the baby's gender except for zinc which is higher in women with male babies, in addition to its significant effect on the birth weight being higher in women with higher birth weight babies.

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Introduction:

Pregnancy is a state that allows a life form to develop with the support and protection from mother's body. The growth and development of the fetus in gestation is partially determined by the genome of the fetus, which produces its own growth factors as well as the majority of its hormones (1). One environmental factor vital in the growth and development of the fetus is nutrition. The fetus is solely dependent on the mother to supply its nutrients. It is also dependent on the placenta, an essential organ in pregnancy, to transfer these nutrients from the maternal system to its own. Thus the fetal nutrition is a reflection of that of the mother's. This interaction exists in a sensitive equilibrium; if disturbed, there are fetal developmental consequences (2). So maternal nutrition often is considered important regulator of human fetal growth (3), and there is growing evidence that despite the absence of marked deficiencies, diet during pregnancy has important implications for maternal and child health in industrialized countries (4). Work from some studies, performed on mice, suggests that age of the mother and maternal diet, rather than the maternal body condition per se, play directive roles in controlling sex ratio (5).Today one of the good known methods on sex constitution is the preconception diet method. This method claims 80% accuracy and the theory is that by altering diet to include and exclude certain food, the condition in the reproductive tract will be directly affected (6). There are methods which use different food combinations and especial diets to maximum the chance of having a baby with specific sex 7().Natural sex selection methods have been applied for several decades, but their use and effectiveness are still a matter of debate, therefore studies were done based on mineral blood values and timing of intercourse of participants, to predict the rule for conceiving a girl or a boy (8). The effect of nutrition on the sex ratio in animals have been studied also, and it was shown that female horses deprived of food every other day one week before mating and those deprived every third day during gestation produced a lower proportion of males than did control females (9).Sex determination has been the subject of many human studies for a long time. Advances in genetic showed that some genetic diseases are sex linked and only occurs in certain sexes. Therefore, sex determination found scientific basis in addition

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to social backgrounds (10). The aim of the study is to correlate the level of the minerals in the mother's blood with the gender and wellbeing of the baby after delivery.

Patients and Methods:

Fifty women with a mean age (23.96 ± 4.93) were involved in this study, collected from the labor room in the period between December 2013 and May 2014, in Baghdad teaching hospital. All women are of nearly the same socioeconomic levels, delivered normally (normal vaginal delivery) at term with a mean gestational age of 40.42 ± 1.23.Women with history of hypertension, diabetes, anemia or other disease that needs medication were excluded. After taking the women's consent for aspirating blood, full history was taken from them (including number of pregnancies and abortions, history of other diseases like diabetes and hypertension, history of taking medications during the pregnancy period or and supplementations, and socioeconomic state). Blood samples were aspirated from the delivered women after delivery for the PCV (packed cell volume) assessment. Table 1 shows the mean age of women and the number of male and female babies who were born.

Table (1): Age, gestational age, PCV of delivered women and number of male and female babies.

	Male babies	Female babies	Age (Years) (Mean ± SD)	Gestational age (Weeks) (Mean ± SD)	PCV (Mean ± SD)
Delivered women	28	22	23.92 ± 4.75	40.42 ± 1.23	41.64 ± 5.99

Blood samples for the maternal blood minerals were analyzed using standard atomic absorption spectro-photometry. 10 ml of blood was withdrawn from them immediately after labour, 2ml in EDTA tubes and 8 ml in plain tubes. Blood samples (in the plain tubes) were centrifuged (3000 RPM for 10 minutes), the serum was collected and stored at -10 degrees centigrade and stored until examination.

Blood lead level was examined in a sample of the whole blood collected in the EDTA tubes by the following method:

1- 2.5 ml of the whole blood sample was shaked in a shaker for 1 hour duration.

2- Add 2.5 ml of TCA (Trichloro acetic acid), wait for 5 miutes, then centrifuge for 10 minutes.

3- Collect the supernatant and read the results by the atomic absorption spectrophotometer (normal value 25 µg/dl,wave length of the device is 283.3 nm.

For Copper and Zinc the following method was done: 0.5 ml of serum was taken and 5ml of distilled water was added to it and was read directly by the atomic absorption spectrophotometer (normal value 80- 150 µg/dl, wave length of the device for cupper is 324.6 nm and for zinc 213.9 nm.For Calcium and Magnesium the following method was done:

50µl of serum was taken and 5ml of Lanthium chlorid was added to it and was read directly by the atomic absorption spectrophotometer (normal value for Magnisium 1.2-2.4 mg/dl, wave length of the device for Magnisium is 285.2 nm and normal value for Calcium is 8.3-10.4mg/dl, wave length 422.7 nm.After delivery the weight, sex and well being of the baby were recorded.

Statistical analysis:

All statistical analyses were performed using (SPSS version 17). Statistical significance between mean values was attributed to two-tailed $P < 0.05$. The results are expressed as Mean ± SD. Significant relationships were evaluated by the Spearman correlation coefficient test (11).

Results:

Age has been recorded in all delivered women and correlated to the birth weight of the baby, and it was found that there is a negative correlation between them, as the women get older the birth weight decreases although it is not significant correlation (table2).

Table (2): Correlation between age of the delivered women and birth weight of the babies.

	Age of the woman	
	r	P
Birth weight of the baby	-0.087	0.547

Comparing the level of the minerals in maternal blood in those who delivered male babies to those who delivered female babies, it was obvious that there is no significant difference in the level of calcium, lead, copper and magnesium between them but there is a significant high concentration of zinc in the blood of women delivered male babies (table 3).

Table (3): Mineral levels in the serum of women according to the gender of the delivered babies.

Delivered babies Mineral	Male (Mean ± SD)	Female (Mean ± SD)	P value
Calcium	8.56 ± 0.57	8.09 ± 0.7	0.495
Lead	15.5 ± 2.49	14.4 ± 3.02	0.425
Copper	117.29 ± 6.25	121.86 ± 18.62	0.358
Zinc	118.26 ± 12.77	94.68 ± 17.03	0.012 *
Magnesium	1.24 ± 0.28	1.05 ± 0.29	0.490

* P<0.05 significant difference.

After delivery birth weight was measured and was correlated with the level of minerals in the maternal blood. There is a positive but not significant correlation between the birth weight of the babies and each of calcium ,copper and magnesium ,but the correlation was significant with the level of zinc in the maternal blood .On the other hand the correlation was negative but not significant between the birth weight and the maternal lead level (table 4).

Table (4): Correlation between birth weight and maternal mineral levels.

	Birth weight of the baby	
	r	P
Calcium	0.168	0.215
Lead	-0.065	0.612
Copper	0.077	0.597
Zinc	0.308	0.029 *
Magnesium	0.169	0.241

* P<0.05 significant difference.

Discussion:

One of the predictors of the wellbeing of the newborn baby is the birth weight, which is affected by many factors including the age of the mother ,in this study there was negative correlation between mothers age and birth weight of the baby but it was not significant (12, 13). Studies by Nancy and et al in 1997 showed that there is significant effect of mothers' age on the birth weight of the babies (14), (15). The effect of minerals in the maternal blood on the gender of the baby is studied also the results showed no significant difference in their levels between those who gave birth to male or females except for the zinc level which is found to be high in those with male babies, this goes with a study done by Baig et al (16). Chandraju et al in2011 gave hamsters calcium and magnesium supplements and they found that there was high female to male ratio (17) they claimed that the diet may influence the condition of the cervical mucus within the reproductive tract and follicular fluid enabling only one of the two types of sperm to penetrate the egg depending on which diet is adhered to (18). In this study the level of minerals had been measured in the later part of pregnancy and after delivery, however maternal diet throughout pregnancy found to affect the endocrine status and the fetus growth and development depending on the stage of gestational exposure as found by other studies (19).Copper is an important trace element that is needed for optimum human growth and development (20). During pregnancy, maternal copper increases as gestational age advances. This is due to increase synthesis of cerulo-plasmin, a copper binding protein, in response to high levels of estrogen during pregnancy. This ensures the availability of copper, as fetal and maternal demand increases. Copper is a cofactors in many antioxidants enzymes that protect the cell against free radicals (21). Many studies proved that there is significant positive correlation between copper level and the birth weight as that done by Mirzarahimi in 2012 (22) and Rihab et al in 2014 (21). As this study shows that the level of zinc in maternal blood significantly affect the weight of the newborn, other studies revealed that zinc deficiency can lead to clinically relevant disturbances in tissue functions and particularly important for birth weight of neonates. Maternal zinc concentration was shown to affect birth weight and prematurity (23). Zinc is involved in normal metabolic and physiological processes that control cell growth, and its requirements is increased during pregnancy therefore low levels of zinc is independently associated with a risk of LBW neonates (23,24).Other studies showed that maternal zinc supplementation during pregnancy resulted in a reduction of the health risks in Bangladeshi low-birth weight infants (25). Other study showed mild deficiency of zinc has no significant effect on pregnancy outcome (26). Lead has a negative effect on the birth weight. In fact high blood lead levels (BLL) in pregnancy are associated with poor pregnancy outcome and neuro-behavioral deficits in infants (37).So there was evidence for adverse effects of maternal blood lead on the incidence of preterm delivery, birth weight, head circumference and crown–heel length, (28).While another research suggests that low levels of fetal lead exposure, as estimated by umbilical cord blood-lead levels at birth, may have an adverse effect on birth weight (29). The mechanisms by which lead affects pregnancy outcomes include an impairment of fetal bone growth caused by competition with calcium for deposition into bone, reductions in fetal thyroid hormones, accumulation of lead in the placenta causing abnormal placental function and reduced nutrient transfer, and oxidative stress (30. The level of magnesium in maternal blood has a positive effect on birth weight but not significant which agrees with other studies that found that there is no significant difference between serum magnesium levels of low birth weight infants' mother and normal weight infants' mother (31, 32, 33), although it plays a fundamental role in many physiological reactions such as protein synthesis, and being involved in various metabolic processes such as bone formation and wellbeing of the fetus (34).

Conclusion:

Age does not significantly affect the birth weight of the newborn babies. Zinc is the micronutrient in maternal blood which seems to be higher in females giving birth to male babies and it seems that it affect the weight of the babies significantly.

Authors' contribution:
Israa F Jaaffar who suggested the subject of the research and its aims. Hanan Luay and Zainab Muthana have participated in the collection of data. The article is reviewed by Israa F. Jaaffar and Hanan Luay.

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