ZINC, COPPER AND IRON LEVELS OF NORMAL AND LOW BIRTH WEIGHT NEONATES AND THEIR RESPECTIVE MOTHERS

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ABSTRACT

Human body and all biological systems need a wide range of nutrients including minerals to perform various functions and to lead a productive life. Thus a number of minerals' intake daily is recommended for maintenance of sound health (1). Inadequate dietary intake of trace elements in pregnancy has adverse effects on birth weight. Therefore, elements including zinc, copper and iron were determined in normal and low birth weight neonates and their respective mothers. For this purpose blood samples were collected from Allied Hospital, Faisalabad and Gynecology, Centre, Jhang. They were centrifuged immediately; serum was separated into small serum cups and stored at 4°C for further analysis. Physical parameters, i.e., age, body temperature, height, weight and blood pressure were also recorded. Elemental analysis was done by using atomic absorption spectrophotometer. Significant differences were observed in body temperature, blood pressure, pulse rate, age, zinc, copper and iron levels of pregnant women, normal birth weight neonates and the pregnant women delivering low birth weight (LBW) neonates. All the determined nutrients were significantly transferred from pregnant women to their neonates in both normal birth and LBW. Therefore, it is conceivable that improvement of nutritional status of pregnant women will improve body weight of the neonates.

Keywords: Zinc, Copper and Iron levels, normal and low birth weight neonates,

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INTRODUCTION

The newborn babies have been reported to depend for their growth *in utero* on the nutrients transferred from mother and their birth weight depends to a large extent on her nutritional status, not only during pregnancy but also before it. Thus, birth weight would be an indirect mechanism of assessing maternal nutrition, but this is a retrospective method of assessment which precludes any meaningful intervention to prevent possible harmful effects of malnutrition on the foetus. The

simplest way of assessing the nutritional status during pregnancy would be by knowing pre-pregnant height (which in itself reflects maternal nutrition during growing years) and the weight increases (2). Inadequate dietary intake of trace elements in pregnancy has an adverse effect on the birth weight and all bodily processes depend upon the action and presence of minerals (3). Vitamins cannot be assimilated without aid of minerals and although body can synthesize a few vitamins but not a single mineral. All tissues and internal fluids of our body contain varying quantities of minerals. Minerals are constituents of bones, teeth, soft tissue, muscle, blood and nerve cells. They are vital to overall mental and physical well being (4). The relationship between low birth weight and concentrations of six metals in maternal and cord plasma was studied by Behrman *et al.* (5) who found that mean material plasma levels were significantly lower in low birth-weight group than in controls for zinc, iron and copper. However, similar data on local neonates and their mothers was not available. Therefore, present study was undertaken to measure serum copper, iron and zinc levels in the blood of pregnant women and the cord blood of their neonates..

MATERIALS AND METHODS

Assessment of Nutritional Status:

Nutritional status was assessed through anthropometric measurements i.e., height and weight and food consumption pattern while age and month of pregnancy were recorded through antenatal cards. For height measurements, women were asked to stand erect and straight without tipping their head up and down. Height was recorded from foot to head without shoes and simple weighting balance was used for measuring weight. It was periodically checked by using known weights. Pre-pregnancy weight was recorded after enquiring and if not known it was obtained by subtracting standard weight gain during pregnancy from the recorded weight. Standard weight gain was obtained by the procedure recommended by W.H.O. (6).

Blood sample collection:

The permission of the institutional ethical committee was first also obtained and blood samples were collected in accordance with good clinical practice guidelines. Volunteers enrolled for this study were motivated and detailed about all aspects of the study in easy understandable language and terminologies. Those who agreed and gave written voluntarily were registered for the study. They were recruited from Allied Hospital, Faisalabad and Gynecology Centre, Jhang.

Body Mass index (Kg/M_2):

BMI was calculated by the following formula:

$$BMI = weight/ (height)^2$$

Body temperature was recorded using a clinical thermometer while systolic and diastolic blood pressures were taken using a mercury sphygmomanometer. Pulse rate was counted as per minute basis by using a stop watch.

Sample Collection:

Five ml of blood sample was collected from a prominent vein of each volunteer with the help of disposable B.D. syringe (5cc). The blood was centrifuged for 20 minutes and the serum was separated and transferred to a numbered glass viol and stored in a freezer at 4℃ for further analysis.

Elemental Analysis:

Serum zinc, iron and copper levels were determined in the blood samples by atomic absorption spectrometry. All samples were subjected to wet digestion (7). Standard curves were obtained by plotting absorbance against standard concentration.

RESULTS AND DISCUSSION

The effect of poor nutrition in the first trimester includes poor fetal development, a lighter and smaller placenta, prematurity anemia. During the 2nd and 3rd trimester, poor nutrition has a negative effect on the baby's growth, including development of the nervous system and contribution to pregnancy-induce hypertension (PIH). The state of maternal nutrition in the months leading up to pregnancy also plays a role in fetal development, such as the need for adequate folic acid (40). A deficiency cn result in impaired cell division, mgalablastic anemia and number of sequella including fetal malformation (including neural tube defect), spontaneous abortion, eclampsia, pre-term delivery, SGA and prenatal hemorrhage. Fetal development depends on genetic codes, maternal hormones, environmental factors and nutritional supplies. A nutritional deficiency or overdose at a critical time can contribute to poor development.

Certain other parameters; body temperature, height, weight and blood pressure were also recorded. A significant differne for body tgemprature, blood pressure, pulse rate, age of pregnant women of normal birth weight neonates and pregnant women of LBW neonate were observed as given in Table 1.

Table 1. Pulse rate, body temperature, systolic blood pressure and diastolic pressure of the pregnant women of NBW neonate and LBW neonates.

Treatment	Pregnant women of NBW of neonate (N = 20)	Pregnant women of LBW neonate (N = 20)
Pulse rate		
Maximum	85	85
Mean	71	78.55
Minimum	72	71
Body temperature		
Maximum	98.80	98.50
Mean	97.91	97.82
Minimum	97.10	97.10
Systolic blood pressure		
Maximum	120.0	130.0
Mean	117.5	118.8
Minimum	114.0	115.0
Diastolic blood pressure		
Maximum	85.0	85.0
Mean	78.6	79.9
Minimum	75.0	75.0

Pregnant women of NBW neonate n= 20 NBW - Normal Birth Weight
Pregnant women of LBW neonate n= 20 LBW - Low Birth Weight

Serum Zinc level in normal and low birth weight neonates and their mothers have been recorded in Table 1 which clearly shows that zinc in pregnant women was 17.84 ppm and its range was 14.67 to 20.78 ppm while mean zinc value of normal birth weight neonates was 18.78 ppm and the range was 17.12 to 20.78 ppm. The mean value of low birth weight neonates was 16.71 ppm and ranged between 14.43 to 19.56 ppm.

The study indicate that Zn value in cord blood were significant higher than those of the mothers. Accorfign to Okonofua et al. (8) cord zinc was significantly greater than maternal zinc. Marsal & Furgyik, (9) reported Zinc deficiency was reported to lead to congenital malformations and abnormal fetal development. Zinc concentration in amniotic fluid has been found to be correlated with fetal birth weight. Zinc is the constituent of 25 enzymes involved in digestion and metabolism. It is component of insulin and essential in the synthesis of nucleic acid to control different proteins in cell. It is also important for the properly development of the reproductive organs. Babacan et al., (10) reported Zinc values in cord blood were significantly higher than those of the mother. Serum Zinc concentration was significantly lowers in the maternal blood.

Table 2. Zinc, copper and Iron levels in the pregnant women of normal birth weight (NBW) neonate and low birth weight (LBW) neonate.

Treatment	Pregnant women (ppm) (N =20)	Normal weight neonate (ppm) (N =20)
Zinc level in the Pregnant women and NBW neonate		
Maximum	20.782	19.316
Mean	17.837	15.563
Minimum	14.67	12.225
Zinc level in the NBW neonate LBW neonate		
Maximum	20.782	19.56
Mean	18.775	33.82
Minimum	17.115	14.426
Zinc level in Pregnant women and NBW neonate		
Maximum	20.782	19.316
Mean	17.837	15.563
Minimum	14.670	12.225
Zinc level in NBW neonate and LBW neonate		
Maximum	20.782	19.560
Mean	18.775	33.820
Minimum	17.115	14.426

Values are presented: mean±S.E.M NBW - Normal Birth Weight
**=P <0.001, *=P <0.05, NS=P>0.05. LBW - Low Birth Weight
Ratio (M/N) = Ratio (Mother / Newborn).

The mean value of copper in the pregnant women was 18.19 ppm and the range was 1.102 to 22.563ppm while the mean value of copper in normal birth weight neonates was 0.287ppm (Table 2). The mean value of copper in low birth weight neonate was 0.482ppm an the range was 0.011ppm to 1.102ppm. While the mean value of their mothers was 0.297ppm (range of 0.011ppm to 1.102ppm). The mean value of Cu in the pregnant women in NBW neonate was found to be 18.19ppm and the range was 1.102ppm to 22.563ppm. while the mean value of NBW neonate was found to be 0.297ppm and the range was 0.105ppm to 1.102ppm. the mean value of LBW neonates was found to be 0.297ppm and the range was 0.105ppm to 1.102ppm.

Copper assists in the formation of hemoglobin and red blood cells by facilitating the absorption of iron. Zinc and Copper have similar elemental properties and have a balancing effect on each other and correlated with functioning of the nervous system.

Osada etal., (11) reported maternal serum copper concentration was significantly higher than cord serum concentration during pregnancy. Traces elements are indispensable for life maintenance mother and fetus. Evaluation of whether fetal growth is associated with altered levels of trace elements in maternal blood, fetal blood and placenta tissue is one of the main objectives of this study. Makinde et al., (12) reported maternal serum copper concentration was significantly higher than cord serum concentration. There was no significant difference in

maternal and cord serum levels of copper. There is a weak correlation between cord copper and maternal copper. Copper may have a negative effect on fetal growth.

Table 3. Copper level in the pregnant women of normal birth weight (NBW) neonate and low birth weight (LBW) neonate.

	Pregnant women (ppm) (N =20)	Normal birth (ppm) (N =20)
Copper level in Pregnant women and NBW neonate		
Maximum	22.563	0.416
Mean	18.190	0.287
Minimum	1.102	0.010
Copper level in NBW neonate and LBW neonate		
	Pregnant Women (ppm)	LBW (ppm)
Maximum	1.102	1.102
Mean	0.297	0.482
Minimum	0.011	0.011
Copper level in Pregnant women and NBW neonate		
	Pregnant Women (ppm)	LBW Neonate (ppm)
Maximum	22.563	1.102
Mean	18.190	0.297
Minimum	1.102	0.105
Copper level in NBW neonate and LBW neonate		
	NBW Neonate (ppm)	LBW Neonate (ppm)
Maximum	0.417	1.102
Mean	0.287	0.482
Minimum	0.107	0.010

Values are presented: mean±S.E.M NBW - Normal Birth Weight
**=P <0.001, *=P <0.05, NS=P>0.05. LBW - Low Birth Weight
Ratio (M/N) = Ratio (Mother / Newborn).

In nutshell, Zinc in cord blood was significantly higher than those of the mothers. Height of the mother and antenatal care were also associated with low birth weight which is also accordance with many other studies. I found that the height less than 150 cm was associated with a higher percentage of bodies having LBW. Horn & Strobino (13), Kraemar (14), in their widely reviewed articles quoted from several studies highlighted a significant association between maternal height and birth weight. Thus the improvement of nutritional status of pregnant women will improve micronutrients transfusion of neonates.

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