

THE RELATIONSHIP BETWEEN MATERNAL ZINC LEVEL AND INFANT BIRTH WEIGHT

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ABSTRACT

Purpose: To determine whether there is any association between infant birth weight and maternal serum zinc level. **Methods:** This case-controlled study was carried out at the Obstetrics and Gynaecology Department of the Social Insurance Organisation Hospital (SSK Hospital) in Ankara between July 27 and August 3, 1998. Venous blood samples were obtained from the mothers. Serum zinc level was determined by the colorimetric method. Twenty women who had delivered low-birth-weight infants (≤ 2500 g) were taken as the case group, and from the mothers who had delivered normal birth weight (>2500 g) infants, 40 were selected at random as the control group. **Results:** Mean serum zinc level of women with low-birth-weight infants was significantly lower than that of their counterparts with normal birth weight infants. **Conclusion:** The effect of maternal zinc deficiency on fetal development and infant birth weight should be studied in different populations. While evaluating the results of this study, it was concluded that low maternal serum zinc might be the cause of delivery of low-birth-weight infant.

Key Words: Zinc Level, Mother, Birth Weight.

INTRODUCTION

Zinc is a trace element which is an essential component for normal growth and development (1-3). It has a crucial function in the development of an organism, and experimental studies have shown that zinc deficiency in pregnant animals might produce fetal growth retardation, chromosomal aberrations, and various congenital defects (2-7). For normal development of the human fetus, adequate zinc intake during pregnancy is important (8, 10). Some studies revealed that low serum zinc level in pregnant women might cause some complications, such as intrauterine growth retardation, low infant-birth-

weight (LBW), low neonatal Apgar score, vaginal bleeding, or pre-and post-term labour (3, 7, 8, 11, 12).

In this study, we aimed to determine whether there is any association between newborn's birth weight and mother's serum zinc level.

PATIENTS AND METHODS

This case-controlled study was carried out at the Obstetrics and Gynaecology Department of the Social Insurance Organization Hospital (SSK Hospital) in Ankara. SSK Hospital treats people from different socioeconomic backgrounds that live in urban and semi-urban parts of the city and

the inner Anatolian region. In general, the patients are low- and middle-income earners, and individuals of high socioeconomic status very rarely, if ever, visit the hospital.

From July 27 to August 3, 1998, the SSK Hospital maternity ward recorded 538 deliveries. Among them, 493 postpartum women who gave a live birth and consented to participate in the study were included. Two investigators visited the mothers the day after delivery. A standardized questionnaire asked relevant information about the women's socio-demographic features, ie. age, education level, employment status during their last pregnancy, and parity. Prenatal, natal, and postnatal risk factors that may cause infant's low birth weight were also sought. Prenatal follow-up records of the mothers and hospital records for the labours were examined and relevant information regarding pregnancy complications, neonatal birth weight, sex, and apgar score were noted. Venous blood samples were then collected from the mothers.

The mothers who did not carry any apparent risk factor for giving birth to LBW infant according to prenatal history and medical records were recorded. The women who had any of the risk factors for delivering a LBW infant and those without reliable prenatal medical records were not included in the study (Fig. 1).

Thus, the study population for investigating the possible effect of maternal zinc level on

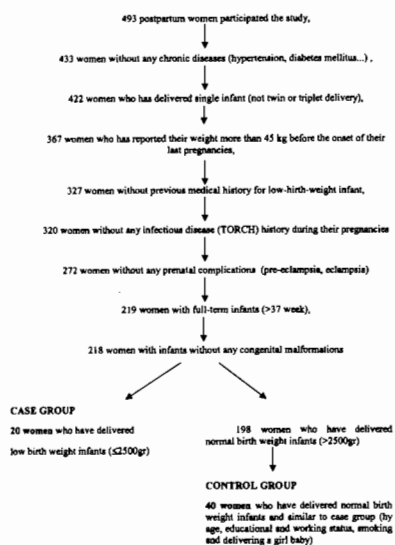


Fig. 1: Selection of the study population.

infant's birth weight consisted of 218 postpartum women. Among them, 20 women have delivered LBW infants with birth weights of less than 2500 g (≤ 2500 g). These women with their babies made up the low-birth-weight group (LBW group, n: 20). Among the remaining 198 women who gave birth to infants with normal birth weight (> 2500 g), 40 women with their babies were randomly selected to constitute the control group (control group, n: 40; case to control ratio=1/2)

Some socio-demographic data for the LBW and control groups were summarized in Table 1.

The mothers with LBW infants and mothers with normal birth weight infants did not show any statistically significant difference between their socio-demographic characteristics.

To analyze the maternal serum zinc levels, blood samples from the study population of 60 women were centrifugated at 3000 rpm for 5 minutes, and sera were stored at -70°C until they were assayed. The serum zinc level was determined by colorimetric method (Randox-UK) (13). Zinc in serum was chelated in 2-5-bromo-2-pyridylazo 5-N-propyl-N-sulfopropylamino-phenol reagent. The coloured complex formation was measured at 560-nm-wave-length with a spectrophotometer. The normal serum zinc level by this method is between 70 and 114 mgr/dl (13).

For statistical analysis, the chi-square test and Student's t-test were used by the SPSS for Windows. P values <0.05 were accepted as indicating statistically significant results.

RESULTS

In this study, LBW and control groups were similar with respect to maternal age, educational and working status, smoking and delivering a girl baby (Table 1). Mean weight of infants was 2367 ± 151 g for the LBW group, and 3387 ± 357 g for the control group.

It was found that the mean serum zinc level of women with LBW infants was significantly lower than that of their counterparts with normal birth weight infants. (Table 2, 58.6 ± 11.2 mg/dl versus 70.6 ± 23.3 mg/dl, $p < 0.05$).

Of the 20 women with LBW infants, 18 (90.0%) had low serum zinc level, whereas of the

Table - 1: Some socio-demographical data for the LBW and control groups.

	LBW Group (n=20)	Control Group (n=40)	
Maternal age (year) (mean \pm SD)	25.5 \pm 5.8	24.1 \pm 4.0	p>0.05
Percent of women with an educational level higher than primary school	95.0	97.5	p>0.05
Percent of women who were employed and worked outside during their last pregnancy	10	4.8	p>0.05
Percent of women who had smoked during last pregnancy	10	20	p>0.05
Percent of women who had delivered girl baby	65	62.5	p>0.05
Infant birth weight (gram) (mean \pm SD)	2367 \pm 151	3387 \pm 357	P<0.05

Table - 2: Serum zinc levels of mothers with low-birth-weight (LBW) and normal birth weight infants.

	LBW Group	Control Group	
Serum zinc level (mg/dl) Mean \pm SD	58.6 \pm 11.2	70.6 \pm 23.3	p<0.05
Percent (number) of mothers with low serum zinc level (< 70 mg/dl)	90.0 (18)	52.5 (22)	p<0.05
Percent (number) of mothers with normal serum zinc level (\geq 70 mg/dl)	10.0 (2)	47.5 (18)	
	Odds Ratio=7.36		
	Confidence Interval=1.35-52.94		

40 women with normal birth weight infants, 22 (52.5%) had normal serum zinc level. (Odds Ratio=7.36, Table 2)

DISCUSSION

The methodology used in this study was accurate in two aspects. First, it was important from the epidemiological aspect that all deliveries occurring in a certain period were included in the study. Second, there was no statistically significant difference between the case and control groups for the factors that may cause delivery of a LBW infant. Thus, it was possible to avoid the biases in this case-controlled study.

There are many studies on the relationship between maternal zinc status and the infants birthweight. Some of these studies report a significant relation whereas some report no relation between maternal zinc status and pregnancy outcome (7, 14). The results of this investigation suggested that the serum zinc level of mothers might influence the birth weight of infants. Zinc is known to be actively transferred across the placenta and fetal serum zinc level is directly associated with the maternal zinc level

(1, 4). If a pregnant woman has zinc deficiency, the fetus will possibly suffer from zinc deficiency during fetal development. Zinc is a component of many enzymes; it takes part in normal cell division; and has a role in carbohydrate, lipid, protein, and nucleic acid synthesis. Therefore an impairment in these processes can retard fetal growth and result in LBW of the infant (1, 4, 6, 7, 15).

One finding in this study was that over 50 per cent of the mothers with normal birth weight infants had lower serum zinc levels than the normal levels according to our analysis method. This figure was found to be 90 per cent for mothers with LBW infants. There are two possible explanations for the low zinc levels. First the plasma zinc concentrations decline in pregnancy due to the increase in plasma volume and some hormonal changes take place. The second is an inadequate intake (1, 7, 14).

The major source for zinc supply is meat. Energy sources such as sugar, fat, and alcohol have a low zinc content (1). Because our study population consisted of women of low socio-economic status and their diets possibly

depended on cereals and vegetables, these low zinc levels could also be due to the inadequate zinc intake. Also it has to be remembered that cereal based diet which is high in phytate could reduce maternal zinc level (7). For the evaluation of the real reason for this issue, more detailed studies have to be done.

CONCLUSION

We suggest that the effect of maternal zinc deficiency on fetal development and infant birth weight should be studied in large and varied populations. While evaluating the results of this study, it was concluded that low maternal serum zinc level might cause delivery of a LBW infant

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