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Original article

Zinc in pregnancy, associated with prolonged labor

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Abstract

Background: It is plausible that pregnancy may result in a decrease in the serum zinc concentration. The concentration of serum zinc is an important determinant of maternal complications. The aim of the current study was to identify serum zinc concentration and evaluate the possible correlation of this concentration with the length of first and second stage of labor in the pregnancy.

Methods: In an observational prospective study, 432 pregnant women, 18 to 35 years of age, from urban primary health care centers in Tehran (Iran) were selected through a multi-stage sampling method and sampling proportionate to size. The blood samples were obtained for the measurement of maternal serum of iron and zinc in healthy singleton pregnancy between 14 to 20 weeks of gestational age, which was accomplished through electro-thermal atomic absorption spectrometry and zinc the standard procedure, respectively. Meanwhile, the length of the stages of labor was also recorded. Serum zinc and serum iron concentrations during early pregnancy, which are associated with prolonged labor, were also analyzed.

Results: Maternal zinc and iron deficiency during pregnancy were found to be around 28.7% and 16.0%, respectively. The overall proportion of prolonged labor was 13.5%. The women with prolonged labor significantly had lower zinc concentration (p=0.03), However, there was no association between prolonged labor and zinc/ iron deficiency after adjusting for confounders.

Conclusion: The findings of the current study indicated that a high prevalence of zinc deficiency was identified among the pregnant women in the second stage of pregnancy. Therefore, it is important to emphasize the need for further research for the evaluation of potential risk factors for maternal complications.

Keywords: Pregnancy, Prolonged labor, Zinc

Introduction

Prolonged labor is one of the most important risk factors for maternal morbidity and mortality (1-3). Existing data suggests that 3 to 8% of all women are affected during a prolonged labor (4). Prolonged labor is more common in developing countries due to lack of poor diet, poverty, and socio-economic factors (5).

Experimental studies on animals and humans showed that the deficiencies of zinc/iron during pregnancy may cause such maternal complications as pregnancy-induced hypertension, preeclampsia,

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intrapartum hemorrhage, infections, prolonged labor, infertility, intrauterine growth retardation, teratogenesis, or embryonic or fetal death (6, 7, 8), although their mechanisms are not known (7). Also, less attention has been given to the correlation between maternal zinc deficiency and prolonged labor.

The pregnant women are facing zinc and iron deficiency more than other groups (5, 9, 10), specially within developing countries (11). Iron supplements may have adverse effects on trace elements like zinc and magnesium (12). Accordingly, it is critical to identify the status of maternal serum zinc level during pregnancy and also its relationship with prolonged labor.

Materials and Methods

The design of this study was an observational prospective study. It was conducted on 432 pregnant women, 18 to 35 years of age, from urban primary healthcare centers in Tehran (capital of Iran). The sampling technique was multi-stage random sampling method with the following inclusion criteria: having a healthy singleton pregnancy, being in the gestational age between 14 to 20 weeks, not smoking or drinking, living in Iran, and having the ability to communicate in Persian. Having signed the informed consent, the eligible participants were given a face to face interview to collect information about the pregnancy history and the socio-demographic variables. Then, blood samples were obtained for the measurement of maternal serum levels of iron and zinc. The participants were followed until labor, during labor, and also after delivery by trained personnel to complete the checklist and the questionnaire designed by the research team (type of childbirth, taking the medicine during labor, length of the stages of labor and others). The study protocol was approved by the Ethics Committee.

The blood samples were obtained between 14 to 20 weeks of gestational age for the measurement of maternal serum of zinc and iron in healthy singleton pregnancy. This step was taken through electro-thermal atomic absorption spectrometry and zincs the standard procedure, respectively. The normal ranges of serum zinc and iron were defined 51 - 80 and 44 - 178 µg/dl, respectively (13). The pregnant women were placed in the zinc deficiency if a level of zinc was less than 51 µg / dl. In addition, serum iron levels less than 44 µg / dl were considered as iron deficiency (14, 15).

A prolonged labor was considered to be either a prolonged active phase or a prolonged second stage. The prolonged active phase of labor is defined as > 12 hours for primiparous women and > 5 hours for multiparous women. Also, the prolonged second stage of labor is defined as > 2 hours for primiparous women and > 1 hour for multiparous women (14). To determine the association between the prolonged labor with zinc deficiency, the prolonged labor was considered as a dependent variable, and logistic factors such as age, maternal education, economic status, BMI, maternal height, parity, any complications in pregnancy, and the use of iron, vitamins or mineral supplements were adjusted as confounders.

Descriptive and inferential statistics were used for the description and analysis of variables. Statistical analyses were performed through T-test and chi-squared test. To avoid the effects of the covariates and to predict the effects of independent variables (zinc and iron) on prolonged labor, multiple logistic regressions were used. Multivariate-adjusted odds ratios (OR) and 95% confidence intervals (CI) were calculated from logistic regressions to examine the factors that influenced prolonged labor. All analyses were performed using the Statistical Package for Social Sciences (SPSS 16.0). P< 0.05 was considered statistically significant.

Table 1. The characteristics of the study samples (N=432)

Characteristic	Mean	SD
Age (Year)	26	4.2
Years of education	11	3.4
Body mass index (kg/m^2)	24	4.3
	N	%
Occupation status		
Housewife	358	82.9
Employed	74	17.1
Parity		
0	310	71.8
1≤	122	28.2
Taking Supplement		
Iron	233	53.9
Multivitamin	139	32.2
Prolonged first stage of labor	50	11.5
Prolonged second stage of labor	10	2.3

Table 2. The relationship between maternal serum zinc and iron levels with prolonged labor

Variables	Normal labor	Prolonged labor	P-value
logarithm of the zinc serum level (µg/dl)*	4.25	4.12	0.03
Root of iron serum level (µg/dl)	9.8	9.4	0.28

Results

As shown in Table 1, the mean age of the pregnant women was 26 ± 4.18 years. The majority of the participants were housewives (82.9%) and nulliparous (71.8%). The mean zinc and iron levels in the women were 77.87 ± 38.4 and 104.3 ± 60 µg / dl, respectively. According to the data, 28.7% of participants had zinc deficiency and also 16% of them had iron deficiency. The proportion of wome with prolonged active phase and prolonged second stage were 11.5% and 2.3%, respectively. As a whole, 13.8% of them had prolonged labor.

As Table 2 presents, there was a significant difference between zinc and prolonged labor, but there was not significant difference between iron and prolonged labor. Women with prolonged labor had significantly lower serum zinc during pregnancy than women with normal labor (p=0.03).

Logistic regression analysis was used to identify the association between zinc and prolonged labor after adjusting the potentially confounding variables. As can be seen from Table 3, there was not a significant association between prolonged labor and zinc and others, except parity.

Discussion

In this study, we found zinc deficiency in 28.7 % of the pregnant women in the first half of pregnancy. The other researches in Iran reported 42 % (16) and 16% (11) of zinc deficiency for pregnant women. This finding is consistent with the results of other research studies on pregnant women in other countries, ranging from 22 %, 53.5% to 73.5 % in India, Egypt and China (17-19). Of course, these differences may be due to the various criteria of zinc deficiency. As in the case of the present study, serum zinc level less than 51 µg /dl was considered as the deficiency while the zinc level of less than less than 66 µg / dl was reported in another survey (20).

The higher prevalence of zinc deficiency in pregnancy is probably related to the low consumption of zinc compounds, the increased estrogen levels during pregnancy, a disproportionate increase in plasma volume (21), and very high amounts of copper or iron in the diet, which compete with zinc at absorption sites (22).

According to the data, iron deficiency was found to be 16% among the samples. In a research study, 16.7% of mothers had anemia (23). This finding is similar to

Table 3. The adjusted logistic regression analysis *: The association of zinc with prolonged labor and covariates, [odds ratio (OR) and confidence interval (CI)].

Predictor	Prolonged labor		
	OR	95% CI	p-value
Iron deficiency			
No	1.00		
Yes	1.12	0.57, 2.19	0.732
Zinc deficiency			
No	1		
Yes	1.39	0.77, 2.48	0.266
Iron Supplement			
Yes	1.00		
No	1.73	1.00, 3.00	0.051
Multivitamin Supplement			
Yes	1.00		
No	1.60	0.94, 2.73	0.081
Age			
18-24	1.00		
25-29	1.06	0.58, 1.93	0.832
30-35	1.19	0.52, 2.72	0.664
Educational status			
University	1.00		
Primary/ Intermediate	1.02	0.44, 2.39	0.951
Secondary/ Diploma	1.42	0.76, 2.64	0.264
Parity			
0	1.00		
1≤	0.47	0.23, 0.95	0.036
Body mass index (BMI)			
< 19.8	1.00		
19.8-26	1.99	0.98, 4.01	0.054
26.1-29.9	1.85	0.77, 4.39	0.163
≥ 30	2.17	0.71, 6.58	0.170
Height (cm)			
>155	1.00		
≤155	1.03	0.49, 2.15	0.935

*Potential confounders used in each characteristic were other characteristics

those of other studies. Studies conducted on pregnant women in Zimbabwe, China, India, and Mexico from 1996 to 2008 indicated that between 7% and 33% of the women suffered from iron deficiency anemia (24).

In line with the main objective of this research, T-test analysis showed a significant relationship between the zinc serum level and the prolonged labor, but after adjusting other variables in the multivariable logistic regression analysis; this association did not remain significant with the risk of prolonged labor. Also, the iron serum level was not found to have any relationship with prolonged labor. Although there is a dearth of this kind of research in the world, the studies conducted in Pakistan and Russia reported that labor disorders and the induction of labor were higher in women with zinc deficiency (12).

Conclusion

One limitation of this study was that the serum level of zinc was evaluated at 14 - 20 weeks of pregnancy. It would be better to checked it in the last weeks of pregnancy, as well.

Like the results of other studies, the findings of this study indicated that there was a high prevalence of zinc and iron deficiency among pregnant women in the second trimester of pregnancy. Therefore, it is important to emphasize the need for further research for the evaluation of potential risk factors for maternal complications. If the risk of prolonged labor were confirmed by future studies, it would be beneficial to counsel and evaluate the pregnant women, who are at stake.

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Conflict of Interest

None declared.

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