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Could Zinc Supplementation in Pregnancy Improve Infancy Outcomes?

Farajzadegan Z*, Mahmoodian A[Ω], Giahchin L**, Yekta Z[§].

* Assistant Professor, Department of Community Medicine, Isfahan University of Medical Sciences, Isfahan, Iran, [Ω] Associate Professor, Department of Internal Medicine, Isfahan University of Medical Sciences, Isfahan, Iran, ** General practitioner, Isfahan, Iran, [§] Assistant Professor, Department of Community Medicine, Urmia University of Medical Sciences, Urmia , Iran.

Correspondence: Dr. ziba Farajzadegan, Department of Community Medicine, Isfahan University of Medical Sciences, Isfahan, Iran, Telephone and Facsimile: +98(311) 792-2542, E-mail: farajzadegan@med.mui.ac.ir

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Abstract:

Introduction: Zinc is a microelement that recently has been more studied in human development and pregnancy outcome. the aim of study is to assess if supplementation of zinc during pregnancy may improve infancy growth and developmental parameters.

Material and Methods: 190 infants in two different groups (exposed and non exposed) followed via a historical cohort study 6-9months to assess their growth and development. We assessed them by measuring of anthropometric indicators, and also we used DDSTII (Denver developmental scoring test) for evaluating their developmental status.

Results: there were no significant differences between anthropometric indicators among exposed and non exposed group ($P>0.05$), but exposed group showed, significantly high percent of advanced score of development ($p<0.05$).

Discussion: In conclusion, our results don't support this hypothesis that anthropometric indexes of infants are related to zinc supplementation of their mothers. Nevertheless, more specified studies are recommended to assess zinc effects on infant development.

Key Words: Zink, development ,anthropometric, infant.

Introduction:

Zinc is a microelement that recently has been more studied in human development, pregnancy outcome, mortality and morbidity rate of pregnant women and infants and other high risk groups such as malnutrition pregnant or infants, zinc deficient patients, preterm labor, small for gestational age, low birth weight and fetal loss [1-6].

Many review studies concluded that early zinc supplementation in low birth weight or small for-gestational age infants reveal an effective improvement in growth, which suggests a prenatal depletion or insufficient zinc intake to support postnatal catch-up growth [2], zinc supplementation during normal pregnancy is needed especially if the interval between pregnancies is short [3], and in developing nations and among poor populations in which the diet is inadequate, additional supplies of micronutrients are advisable [7].

Many studies revealed that; zinc deficient mothers have delivered neonates with low capacity of Iron uptake [8], administration of zinc sulfate plus ferrous sulfate results in accelerated treatment of anemia in anemic pregnant patients [5], measurement of maternal plasma zinc concentration in the third trimester would highly suggest mothers at risk of delivering intrauterine growth retardation babies, and mothers selected in this way might benefit from dietary advice and zinc supplementation during the remaining pregnancy [9].

Recent clinical trials have reported that regular intake of zinc supplement at nutritional dose is sufficient to improve micronutrient status of apparently healthy pregnant women and can prevent low birth weight of newborn [10], supplementation of zinc plus Ca, Fe and vitamin D during pregnancy is the best way to improve infant development and growth (birth weight, weight for age) [11], daily zinc supplementation in women with relatively low plasma zinc concentrations in early pregnancy is associated with greater infant birth weights and head circumferences, with the effect occurring predominantly in women with a body mass index less than 26 kg/m2 [12], and additional zinc supplementation should be considered for the further decrease in the recurrence and occurrence of neural tube defects [13].

WHO has reported zinc deficiency among 18.6% of infants and 31% of infants in Iran, and among 11.6% of infants and 33.85 of infants in Isfahan (central Iran) [1]. In addition, Zinc serum level of pregnant (70%) and breast feeding (63%) Isfahanian women are less than 60 mg/dl [14].

Therefore, zinc therapy of our pregnant women may increase pregnancy outcome and infant development.

Our aim was to compare developmental and anthropometric indexes of infants that their mothers had received supplemental zinc or placebo in their pregnancies.

Materials and Methods:

This is a historical cohort study that has followed a double blind ,randomized field trial, which 450 pregnant women re-

ceived zinc (n=225) or placebo (n=225). They were from 3 central cites of Isfahan province (central of Iran) from 2003 to 2004.

Inclusion criteria were: permanent living in their city, between 15 to 49 years age, pregnancy age less than 18 weeks, and no history of any disease. Exclusion criteria was discontinuing placebo or zinc more than 2 weeks. Serum zinc level was measured before the study. The mothers were administered zinc (15 mg) or placebo from 16^{th} to 20^{th} gestational weeks until they delivered. Three hundred mothers completed the study but among them, 60 women migrated, 40 women were not visited on time and 10 women had fetal death or abortion. (data not shown).

Then , 190 infants of those mothers were followed in two groups: whom their mother had received zinc (n=68) as exposed and (n= 122) whom their mothers had got placebo ,considered as non exposed group . they were in different ages (6,7,8,9 months) .All infants were in healthy condition and non of them did not have underlining or genetic disorder . Via a checklist, some characters of subjects and their mothers were recorded. We examined infants physically by unique instrument, and measured weight, length and head Circumference through standard manner. We used DDST II (Denver developmental scoring test for determining of developmental status. DDST is a standard tool for this purpose, It contains 15 items and measures (skeletal, verbal, and social adaptation).The range of score is 9-42.

We compared the acquired scale of each infant with standard schedule ; and categorized as following:

1) Advanced; score over 90 percentile (right side of age line)

2) OK; score between 75-90 percentiles,

3) Caution; score between 25- 75 percentile,

4) Delayed; score under 25 percentile (left side of age line).

To estimate of reliability(Persian version), we used Test – re Test. a pilot study was carried out with 30 nursing mothers in two different time (10 days interval) correlation coefficient was 0.81.(r=0.81) we gathered data via interview on the mothers, observation and examination of infants and reviewing their profiles.

The data were analyzed by SPSS software, using independent t-test, chi-square test multiple regression.

Results:

68 exposed and 122 non exposed infants were studied and some fators compared to show comparability between groups. Their mothers ages were 25.9±5.9 VS 25.7± 4.7; (T test; Pv>0.05). serum zinc levels of mothers before intervention were same. (75.2±23.6 micro gram/dl vs 85.4±23.8; T test, P>0.05).

Socioeconomically; the families had similar status. Demographic characteristics of family were showed in table 1. Anthropometric indicators [weight (gr). height (cm) ,and head Circumference (cm)] were compared at 6,7,8 and 9 months. In general there were no significant differences between two groups with considering the ages (table 2).

Table 1: comparison of some basic characteristic of families

characters		exposed (n=68)	Non exposed (n=122)	P value
Mean mother age		25.9±5.9(years)	25.7±4.7(years)	NS
Mean serum zinc level		75.2±23.6(µg/dl)	85.4±23.8(µg/dl)	NS
Education Level	Academic	13.2%	13.1%	NS
	Diploma	38.2%	33.6%	NS
	Under Diploma	48.5%	53.3%	NS
Employed		7.4%	6.6%	NS
Number of Infants≤2		83.9%	84.4%	NS
Pregnancy age(<37 weeks)		0	2.5%	NS
Cesarean Section		59%	61.8%	NS
Neonate's sex (male)		58.8%	45.1%	NS
exclusive Breast Feeding		12.5%	9.3%	NS
Feeding Activator (shirafza)		6.3%	7.2%	NS
Active Smoking of mother		1.6%	2.1%	NS
Passive Smoking		7.9%	3.1%	NS
Disease history in Pregnancy		5.5%	9.4%	NS

Table 2: anthropometric indexes of exposed and non exposed infants

	Index	exposed	Non exposed	P value
6 months infants	Weight	7050±1089	7445± 886	NS
	Height	64± 4.2	66 ±2	NS
	Head Circumference	42.4± 1.8	42.9± 1.2	NS
7 months infants	Weight	8010 ±1002	7928 ±886	NS
	Height	66.8 ±1.6	68.5 ±2.1	S
	Head Circumference	43.1 ±0.63	43 ±1	NS
8 months infants	Weight	8739 ±1231	8145± 1084	NS
	Height	70.3 ±2.8	69.8 ±3.4	NS
	Head Circumference	44.2 ±1	44 ±1.4	NS
9 months infants	Weight	8538 ±1318	8325± 1066	NS
	Height	69.9 ±3.2	70.5 ±3.1	NS
	Head Circumference	44.7 ±1.6	44.3 ±1.2	NS

NS=Non Significant S=Significant at 0.05

Table 3: Developmental status of the infants exposed and non exposed to zinc.

Scores	Exposed N (%)	Non exposed N (%)
Delayed(under 25th percentile)	0	0
Caution(25-75th percentile)	3(4.4)	11(9)
OK(75-90th percentile)	36(59.9)	80(65.9)
Advanced(over 90th percentile)	29(42.6)	31(25.4)

X2 test Value= 6.5 Degree of Freedom=3 P value<0.039

Developmental indexes contain four items; (movement, verbal, social and adaptive) there were significant difference between exposed and non exposed group; particularly among adaptive and movement indexes. Overall mean developmental score was 28.4± 6.2 in exposed and 26.2 ±5.6 in non exposed group ($p<0.05$). After adjusting acquired scores to expected standard value, these scores classified to 4 categories. We couldn't find infants with delayed developmental status in any groups, but the present of them who need more attention were two times in non exposed group (9% Vs 4.4%).also infants with advanced condition were more in exposed group (42.6 5Vs 25.4).

Discussion:

Plasma zinc levels decrease during pregnancy [15]. In addition, diet requirements in pregnant women may be different in various populations. We observed more weight and head circumference in the infants of zinc than placebo supplemented pregnant women but, this difference was not statistically significant.

Similar studies showed similar results as well:

Zinc sulfate had no effect on weight gain in the milk feeded infants in Mazandaran, north of Iran [16]. No significant difference was found in the birth weights between Pakistani pregnant women supplemented with 20 mg elemental zinc and controls receiving oral placebos [17]. In a study of pregnant women and their infants in rural Nepal, maternal micronutrient supplementation failed to reduce overall fetal loss or early infant mortality [18].

Prenatal supplementation with zinc (30 mg) alone in poor women from Bangladesh does not seem to confer benefit on infants' mental development [19]. A significant proportion of pregnant women in Nigeria have biochemical hypo zincemia which is not responsible for fetal growth retardation in this population, and there is at present no justification for giving routine zinc supplementation to pregnant women in Nigeria [20]. No significant correlation was found between serum zinc concentration and birth weight of infants [21]. Serum zinc levels are significantly lower in teenagers with pregnancy-induced hypertension than in normotensives and zinc supplementation does not affect outcome of pregnancy [22].

Zinc effect on human based population studies does not support routine zinc therapy for pregnant women. Our ability to measure zinc accurately is improving, but the routine use of zinc supplements during pregnancy cannot be recommended at this time. It may be that zinc will be a useful diagnostic marker, rather than a therapeutic intervention [23]. As findings of experimental studies are not always feasible to extrapolate to humans, the biology of deficiency as well as excess of micronutrients in humans must continue to be investigated with vigor [24].

Therefore, standardization and modification of similar studies are necessary. For example, measurement of maternal plasma zinc concentration in the third trimester would highly suggest mothers at risk of delivering intrauterine growth retardation babies. Mothers selected in this way might benefit from dietary advice and zinc supplementation during the

remaining pregnancy [9], or Zinc supplementation may be beneficial to women at risk of delivering small for gestational age babies [25]. With regard to micronutrient supplementation, such as zinc, magnesium and fish oil, randomized non exposed trials with sufficient power to detect clinically important differences in maternal and infant outcomes are needed [26].

This situation requires the screening of high-risk groups, the definition of adequate dietary intakes for each population, and the supplementation with zinc when deficits are detected [27]. Zinc requirements and interactions are also important to consider when designing mineral supplements for preterm babies, infant formulae and food fortification in developing countries [25].

In conclusion, our results don't support this hypothesis that anthropometric indexes of infants (developmental index scores, weight, length and head circumference) are related to zinc supplementation of their mothers. But, more specified studies are recommended to assess zinc effects on infant development.

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