" To Study the Impact of Zinc supplementation from 4 to 9 Month age on growth of breast fed babies

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Abstract

Objectives- To study the impact of Zinc supplementation from 4 to 9 month of age on growth of breast fed babies.

Methods:- A case control study, it was carried out at Lata Mangeshkar Hospital between 2007 to 2009. A total of 123 patients were studied. They were divided into two groups. Group A of 61 infants were given zinc supplementation and Group B of 62 infants were not given any supplement. They were followed up till 9 month of age and anthropometric data was collected at monthly interval. Plasma zinc levels were measured at the start and the end of study.

Results:- There was no difference in the zinc supplemented and non-zinc supplemented group in both sexes in relation to age of starting weaning food (mean age of weaning =6.1 months for both groups). At 4 month age, weight of both male and female infants were lower in the zinc supplemented group than the non-zinc group. At the end of 9 month, there was a significant increase in the weight of male infants in the zinc supplemented group (p value= 0.0001). At the end of 9 month, the head circumference of male infants in zinc supplemented group was greater than that of non-zinc group (p value=0.03). At the end of 9 month there was no statistically significant difference in the chest circumference between the zinc supplemented and non-zinc group in both male and female infants. The serum zinc level at 4 month age was found to be significantly higher in the non-zinc group than the zinc supplemented group in both sexes.

Conclusion:- Zinc though a trace element, in this study ,has been found to be an important nutrient contributing to growth of infants. The growth of male children is more affected by zinc supplementation than that of female infants. Studies at a larger level need to be conducted to support this observation.

Key Words : breast fed babies, zinc supplementation

INTRODUCTION

Zinc is an essential mineral that is naturally present in some foods, added to other, and available as a dietary supplement. Zinc is involved in numerous aspects of cellular metabolism. It is required for the catalytic activity of approximately 100 enzymes and it plays a role in immune function, protein synthesis and cell division. Zinc also supports normal growth and development during pregnancy, childhood and adolescence and it is required for sense of taste and smell. A daily intake of zinc is required to maintain a steady state because the body has no specialized Zinc storage system.

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Zinc Deficiency

Zinc deficiency is characterized by growth retardation, loss of appetite, and impaired immune function. In more severe cases, zinc deficiency causes hair loss, diarrhea, delayed sexual maturation, impotence, hypogonadism in males, and eye and skin lesions. Many of these symptoms are non-specific and therefore, a medical examination is necessary to ascertain whether a zinc deficiency is present.

The present study was undertaken to study the effect of zinc supplementation on the growth of infants.

AIM AND OBJECTIVES

This study was conducted-

1. To estimate the plasma zinc level in the 4 month old infants initially before zinc supplementation and then at the end of 9 month after zinc supplementation.
2. To assess the effect of zinc supplementation from 4 to 9 month age on the growth of breast fed infants

MATERIAL AND METHOD

The study was a case control study, conducted in a tertiary care hospital from 2007 to 2009. The study design and protocol was approved by the institutional ethics committee. A written informed consent was taken from the parents of every infant before participating in the study.

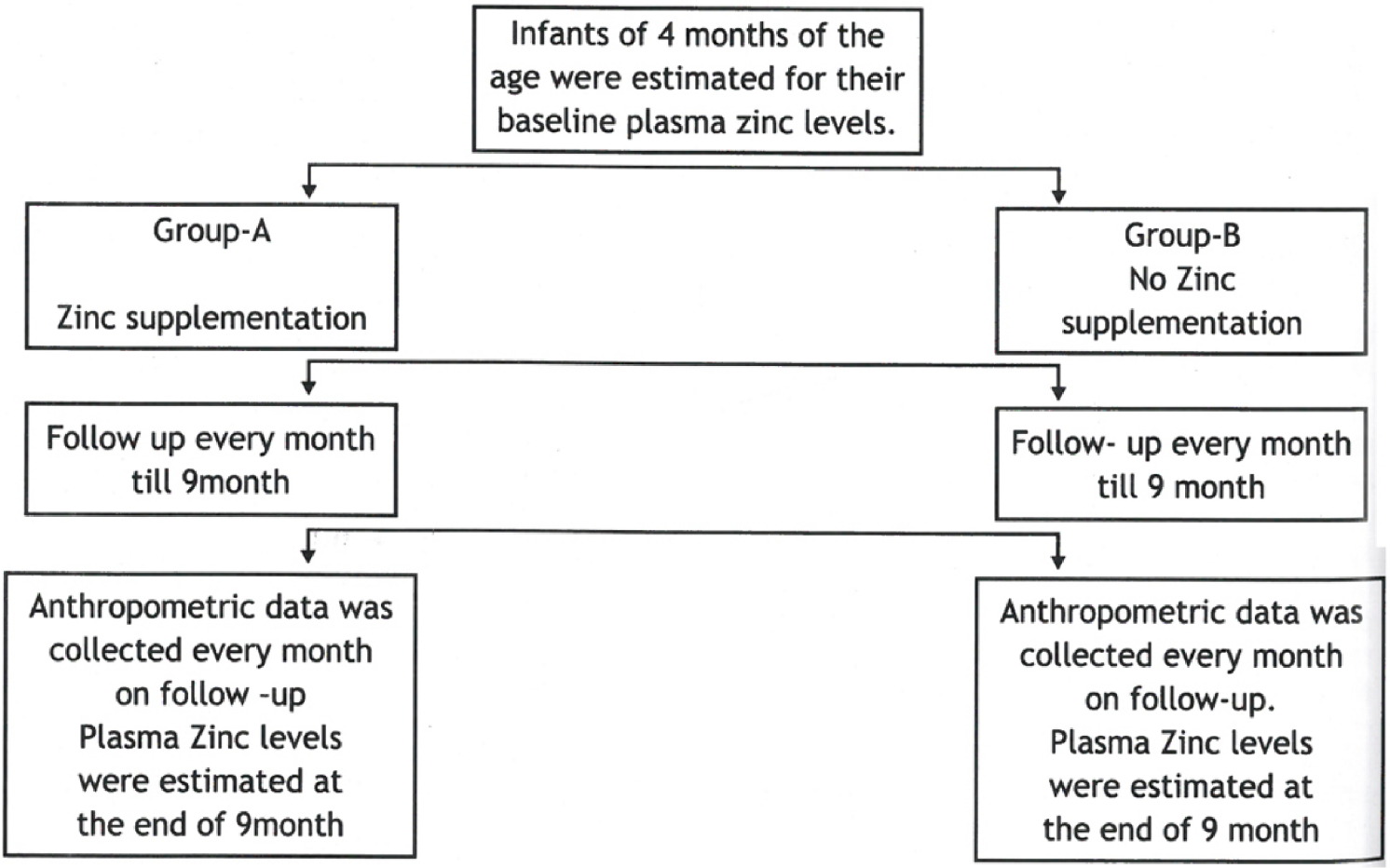
Subject

In this study, infants whose birth weights were >2.5kg and were exclusively breast fed from birth till 4 months of age were included.

They were given zinc in a dose 5 mg/day, (higher than the recommended daily allowance) given in twice a day dosing pattern in the form of a flavored shahi gulab based syrup in order to maintain a good compliance. The supplement bottles contained 20 mg of elemental zinc per 5 ml of the syrup in the form of zinc-gluconate.

All infants in the study group were asked to return the empty bottles on monthly follow -up visits and they were also enquired for any unusual symptoms or any side- effects related to zinc after taking the supplements.

Infants who were top-fed, who had previous episode of diarrhea, skin infections or eczematous lesion recently, who had received



any multivitamin supplementation, who were failure to thrive, who developed vomiting, diarrhea and convulsions and other sign of zinc intoxication after continuing zinc supplementation were excluded.

Intervention

A total of 123 patients were studied.

In group A 61 infants were given zinc supplementation.

In Group B 62 infants were not given any supplements.

Both groups were followed till 9 month age and anthropometric date were collected at monthly interval. Plasma zinc levels were measured at the start and the end of study.

STUDY DESIGN

Case control Study

Outcome variables: Age of the subject was calculated from the nearest month of their birth records. Detailed dietary history regarding duration of exclusive breast feeding, age of starting the weaning food, type of feeding pattern and frequency of giving feeds were recorded. A 24-hour dietary recall was taken by personal interview of the infants' mothers. From these dietary recall total calories and proteins consumed per day by the infants were calculated. Weight was recorded using an electronic weighing machine. The weight was measured to the nearest 0.01kg. The scale were checked regularly against the standard weights. Length was measured in the supine position to the nearest 0.1 cm using a standard infantometer. Occipito -frontal head circumference was determined as the largest measurement taken across occiput and forehead using a non-stretchable tape. Mid-upper arm circumference was recorded on the left upper-arm midway between the acromion and olecranon process. Chest circumference was measured at the level of nipple using non-stretchable tape. All the infants included in this study were estimated for their baseline plasma zinc level at 4 month age and then finally at the end of 9 month. Blood samples were obtained from all infants included under the study by means of an antecubital vein puncture and 1mL of blood was drawn into a trace element-free evacuated(B.D.) tube. Serum was separated by the use of disposable sterile pipettes and stored at 20°C for subsequent analysis. Serum zinc was assayed by Atomic Absorption Spectrophotometer.

Disposable plastic materials were used wherever possible in order to avoid contamination of the samples with the mineral under study. Rest of the material was washed with nitric acid and distilled water (1.1) and then dried in an oven at 150° C. De-ionized water was used for the dilution of samples, standards and controls.

Statistical analysis

All the data was obtained and arranged according to age -wise and sex wise distribution. A Statistical analysis was performed with medical software version 11.1 for windows. For paired sample, Wilcoxon test was applied which was equivalent to the paired sample t-test.

RESULT

A total of 123 infants were studied. Out of 123, 61 infants were supplemented with zinc while the remaining 62 infants were not given any supplements. This study demonstrated a male preponderance of 56% in the zinc supplemented groups while 53% in the non-supplemented group. (Table-1)

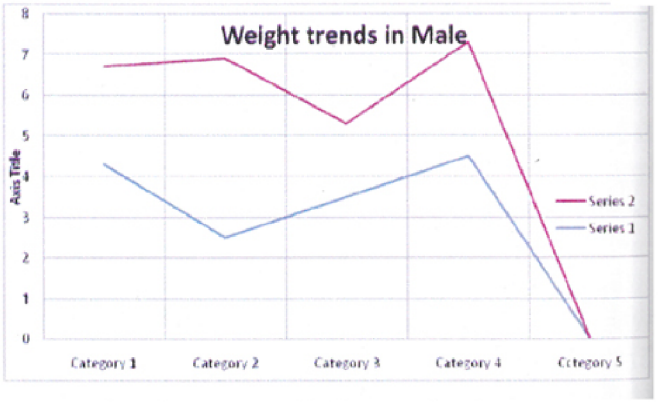
There was no difference in the zinc supplemented and non-zinc supplemented group in both sexes in relation to age of starting weaning food (mean age of weaning =6.1 months for both groups)(Table-1).

Table NO. 1 (Description of the study population)

Parameters (mean)	Zinc supplemented (n=61)	Non-zinc supplemented (n=62)
Frequency (%) Male sex Female sex	34(56%) 27(44%)	33(53%) 29(47%)
Age of weaning (in months) Male Female	6.1 6.1	6.1 6.1
Mean calorie intake (Kcal/day) Male Female	560 559	592 579
Mean daily protein intake (gms/ day) Male Female	11.2 11.3	12.1 11.8

At 4 month age, weights of both male and female infants were lower in the zinc supplemented group than the non-zinc group. Therefore, initially there was a significant negative differences in the zinc supplemented group in both males as well as females (in males, p value<0.0001 and in females, p value <0.05). At the end of 9 month, there was a significant increase in the weight of male infants in the zinc supplemented group (p value= 0.0001). While there was no change in the weight of female infants in both zinc supplemented and non-zinc group (P value 0.7800) (figure-1, table -1). Over all, at the end of month there was a weight gain of 500 grams in the male infants in zinc supplemented group.

Figure-1



At the age of 4 month there was no significant difference in the zinc supplemented group and non-zinc group in terms of length of male infants (p value= 0.9404). Similarly in case of female infants also there was no significant differences in the length between the two groups (p value = o.6892). This indicates that initially both the groups were similar in terms of length in both males as well as females. At the end of 9 month, length of male infants of zinc supplemented group was

higher as compared to the female infants of the same group (p value = 0.0027) (figure- 2, table-2). While in case of female infants, there was also increase in the length in the zinc supplemented group as compared to non- zinc group but the differences in the length between the two groups was not significant (p value= 0.7457). Overall the male infants in zinc supplemented group had 1.2cm increase in length as compared to the non-zinc group.

Figure-2

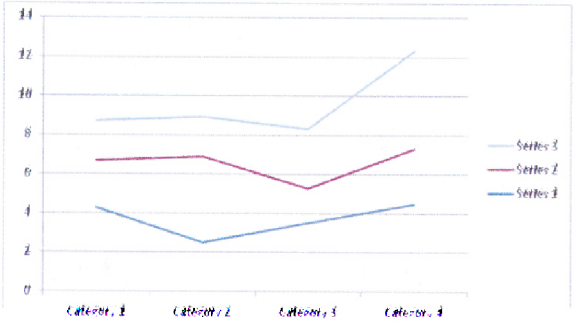


Table NO. 2 (Outcome Variables)

Sr. No.	Outcome variables (Mean+- SD)		Male			Female		
			Zinc Supplemented	Non Supplemented	P Value	Zinc Supplemented	Non Zinc Supplemented	P Value
1	Weight (in kg)	(at 4 months)	5.59	6.21	<0.0001	5.48	6.10	<0.050
2		(at 9 months)	8.58	8.80	+0.0001	8.29	8.33	0.7800
3	Length (in Cm)	(at 4 months)	61.84	61.88	=0.9404	62.09	62.13	=0.6892
4		(at 9 months)	66.58	65.38	=0.0027	66.83	66.64	=0.7457
5	Head circum ferences (in cm)	(at 4 months)	41.12	39.86	<0.0001	40.77	39.89	=0.0009
6		(at 9 months)	43.90	43.43	=0.030	43.64	43.42	=0.0974
	Chest circum ferences (in cm)	(at 4 months)	37.58	36.83	=0.0029	37.43	36.52	=0.0005
		(at 9 months)	41.17	40.60	=0.0553	40.85	40.39	=0.0634
	Mid-arm circum ferences (in cm)	(at 4 months)	10.52	10.62	=0.4405	10.45	10.41	=0.6891
		(at 9 months)	12.19	13.09	<0.0001	12.16	13.11	<0.0001
	Serum Zinc Level (IN ug/dl)	(at 4 months)	61.88	72.06	<0.000	122.79	64.30	<0.0001
		(at 9 months)	59.37	70.17	<0.0001	123.33	67.41	<0.0001

At 4 month age, the head circumference of both male and female infants in the zinc supplemented group was greater as compared to the non zinc group. But at the end of 9 month, the head circumference of male infants in zinc supplemented group was greater than that of non-zinc group (p value=0.03) (Table -2)

In case of female infants there was no significant difference in the head circumferences between the zinc supplemented group and non-zinc group (p value = 0.0974). Thus, the head circumference of male infants remained greater throughout the study in zinc supplemented group but this similar effect was not observed with the female infants in the zinc supplemented group.

At 4 month age, the chest circumference of both male and female infants was greater in the zinc supplemented group than in the non-zinc group. At the end of 9 month there was no statistically significant difference in the chest circumference between the zinc supplemented and non-zinc group in both male and female infants (Male, p value= 0.0553) (Females, p value =0.0634) (Table-2). There was no significant difference in the chest circumferences between the zinc supplemented and non-zinc group in both male and female infants (Males, p value= 0.0553) (Females p value= 0.0634. At the end of 9 months, the mid-arm circumferences of male infants was significantly lower in the zinc supplemented group than the non- zinc group in both males as well as females (p value < 0.0001).

The serum zinc level at 4 month age was found to be significantly higher in the non-zinc group than the zinc supplemented group in both sexes. (p value < 0.0001) . Thus, it was observed that initially at the age of 4 months infants of both sexes in the zinc supplemented group had lower serum zinc levels as compared to the non-zinc supplemented group (p value<0.0001). The serum zinc level at the age of 9 month was higher in the zinc supplemented group than in the non-zinc group in both sexes. (p value <0.0001) (Table-2).

DISCUSSION

The present study was carried out in the tertiary care hospital in order to evaluate the effect of zinc supplementation on growth of breast fed infants from 4 to 9 month age.

Growth of infants was studied in terms of following anthropometric parameters: Weight, Length, Head circumference, Mid-arm circumference. The infants included in this studied in terms of following anthropometric parameters: Weight, Length, Head circumferences, Mid-arm circumferences. The infants included in this study were followed every month from 4 month onwards till 9 month of the age and their anthropometric data was collected for assessment of growth. Serum zinc levels were estimated at 4 month of age and then at the end of 9 month.

Weight

At the end of 9 month, there was a significant increase in the weight of male infants in the zinc supplemented group (p Value=0.0001). This indicates that zinc supplementation has a positive effect on the weight gain of male infants in the study group but similar effect was not seen in the female infants after zinc supplementation.

A reasonable explanation for this sexual dimorphism in terms of weight gain is not yet available. Some authors have postulated differences in zinc requirement (1) but a definite reason is presently not known.

Length

At the end of 9 month there was an increment of 1.2 cm in the length of male infants in the zinc supplemented group. This indicates that zinc supplementation has a positive effect on the length of male infants in the study group. The explanation for these results was postulated by some authors in terms of differences in the zinc requirements (2). There were some animal data which supports this hypothesis (3). But more research is still required in this issue. Some authors had also suggested that this effect of zinc is mediated by changes in growth hormone and testosterone concentrations (4,5). In some studies, the number of females in the study group was less, so the result obtained in the study can not considered to be a generalized observation (6,7).

Head Circumferences

At the end of 9 month, head circumference of the male infants in zinc supplemented group was significantly greater than that of non-zinc group (p value= 0.03). While at the end of 9 month there was no significant difference in the head circumferences between Zinc supplemented group and non- zinc group in female (p Value= 0. 09). Overall there was an increment of 4.47 cm in the head circumference of male infants in the zinc supplemented group at the end of 9 month in the study group suggests that zinc also has a positive effect on the head circumference of these infants. But more research is further required to conclude this issue.

Chest circumference

At the end of 9 month of age statistically significant difference was observed in the chest circumference between the zinc supplemented and nom-zinc group in both male and female infants. (Males, p value =0.0553) (Females, p value = 0.0643). This indicates that zinc supplementation has no effect on the chest circumference of the infants in the present study.

Mid-arm circumference

There was a significant decrease in the mid-arm circumference of both male as well female infants in the zinc supplemented group as compared to the non-zinc group. This indicates that the supplementation has no significant effect on the mid-arm circumference of both male and female infants (Males, p value<0.0001) (Females, p value<0.0001). The decrease in mid-arm circumference in the zinc supplemented group can be explained on the basis of the study conducted by Golden and Golden et al (8)in 1981 who found that zinc supplementation permits accelerated lean tissue synthesis at the expense of fat laden adipose tissue synthesis in children. Therefore this could be one of the reasons for decreased mid-arm circumference in the infants of zinc supplemented group in present study.

Serum zinc level at 4 month age

The mean value of baseline serum zinc level at 4 month in zinc supplemented group for male infants was 61.88ug/dl and for female infant was 59.37ug/dl. While the mean value of serum zinc level at 4 month age in the non-zinc group for male infants was 72.06ug/dl and for female infants was 70.17ug/dl. This indicates that initially at 4 month age, infants of both sexes in the zinc supplemented group had lower serum zinc levels as compared to the non-zinc supplemented group (In males, p value < 0.0001) (In Females, p value <0.0001).

As per Nelson's textbook of Pediatrics 18 th edition (10), the reported normal range

of plasma zinc levels in the pediatrics age group is 64-118 ug/dl (6). On comparing these reference values with serum zinc levels of infants included in the zinc supplemented group, it was observed that the serum Zinc level of both male and female infants of zinc supplemented group were slightly lower than the normal reference values. This indicated that there was a slightly lower zinc level in the plasma of these infants in the study group indicating zinc deficiency biochemically. This also further indicates that mild zinc deficiency was present in the infants of test group at 4 month age. These result are consistent with the study done by Bhaskaram et al (9) who had reported that plasma zinc levels of breast-fed infants fall gradually during the period of weaning, indicating that infants are at risk of zinc deficiency at the time of weaning period.

Serum zinc level at 9 month age

The mean value of serum zinc level at the end of 9 month in the zinc supplemented group for the male infant was 122.79ug/dl and for female infants was 123.33ug/dl. While the mean value of serum zinc level at the end of 9 month in the non-zinc group for male infants was 64.30ug/dl and for female infants was 67.41ug/dl. It was observed that the serum zinc level at the end of 9 month of study was much higher in the zinc supplemented group than in the non- zinc group in both male and female infants, (p value< 0.0001). This indicates that zinc supplementation has significant positive effect on the serum zinc concentration of both male and female infants of the test group (p value <0.0001).

In the present study, the total quantity of zinc ingested by the infants in the test group was 5mg/day which was higher than the recommended daily allowance, given in a twice a day dosing pattern in the form of a flavored shahi gulab based syrup in order to maintain a good compliance. All the infants in the study group were asked to return the empty supplement bottles on monthly follow-up visits and they were also enquired for any unusual symptoms after taking the supplementation. All the infants in the study group tolerated well the supplements and no side effects were observed after supplementing them with zinc. Although it has not been completely proved that zinc as a drug has a pharmacological effect on growth studies are being conducted in this regard to assess its various effects on growth and development.

CONCLUSION

Daily supplementation in this study was observed to be associated with improved growth of the infants in the study group. The growth velocity in terms of weight and length was observed to be significantly greater after supplementing with zinc in the male infants of the study group. In the present study, the mean plasma zinc levels were observed to be higher at the end of the study in the zinc supplemented group which has emphasized the evidence that zinc could be one of the factors which affect of growth and it has a positive effect on the growth of infants. As there could be multiple factors affecting the growth, it is difficult to interpret this result in respect to general population. Large multi-centric trials are needed further to confirm the result of the present study. In our setting with high rates of stunting, underweight, low plasma zinc concentration, or a combination of these factors, programs to enhance zinc status may be useful interventions to increase

children's growth and decrease current rates of nutritional stunting stunting. Because of the likely high prevalence of zinc deficiency and the serious range of complications that can be induced by this condition, public health programs are urgently needed to prevent low zinc intake and poor absorption of zinc.

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