Zinc Levels Among Preterm Infants

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Abstract

Background: To determine the mean serum zinc levels in preterm infants 1-6 months of age and to compare the mean serum zinc levels in breast fed versus Formula Fed preterm infants.

Methods: In this descriptive study 222 preterm infants of 1-6 months of age were included. Blood samples were taken from each participant for serum zinc analysis.

Results: The mean age of all preterm infants was 2.22 ± 1.52 months. There were total 141 (63.5%) male while 81 (36.5%) were female. Mean zinc level among all the preterm infants was observed as 9.71±0.71 g/dL. The mean zinc level in breast-fed infants was observed as 9.45±0.70 g/dL while in Formula fed infants, it was 9.96±0.63 g/dL. The difference of mean zinc level between both infant groups was statistically significant. (p-value = 0.000).

Conclusion: In preterm infants breast feeding should be supplemented with Zinc.

Key Words: Zinc level, premature infant, breast feed, bottle feed,

Introduction

Zinc was discovered in 1869 by Raulin as an essential nutrient. First reported study was published in 1961 in Iran that highlighted its significance.1 Zinc is a trace element that is essential for the protein structure and enzymatic catalysis for multiple body metabolisms. Now-a-days, prevalence of zinc deficiency worldwide has been estimated up to 20.5 to 62.6% approximately.2,6 Premature infants are more vulnerable to develop zinc deficiency because maximum zinc is stored in the last trimester in pregnancy. It results in the clinical signs and symptoms after birth which are frequently misdiagnosed and treated as a skin disease like eczema and impetigo. Oral zinc supplementation of preterm breast fed babies should be considered when they reach a gestational age of 40 weeks.3 Zinc deficiency results in poor immunity, delayed healing and neurological problems. Preterm infants may have low zinc levels therefore they suffer more from zinc deficiency.4 It has been found that breast milk has low levels of zinc approximately 5.7µmol/l which is not sufficient to fulfill the requirement in preterm infants who already have deficient storage of zinc. In these patients zinc deficiency becomes symptomatic and they develop anorexia, skin lesions with delayed wound healing, hair loss, diarrhea, defective protein synthesis and Immune function resulting in growth failure. All of these factors ultimately worsen zinc deficiency. Therefore correction of low zinc levels with oral zinc supplements in the dose of 50µmol/kg/day for at least 07 months duration will normalize the zinc levels.5

Patients and Methods

In this descriptive case series, 222 premature infants were included according to calculated sample size. The study was conducted at Department of Pediatrics, Holy Family Hospital Rawalpindi for the period of 6 months. On the basis of consecutive sampling, infants of age 1-6 months of life, who were born before 37 weeks of gestation, of either gender were included. Written informed consent was taken from each participant’s guardian. Demographic details were obtained. Type of feed was mentioned by taking history from parents. Blood samples were taken from each participant for serum zinc analysis. Samples were analyzed by fully automated clinical chemistry analyzer. Independent sample t-test was applied to determine the significance between breast fed and bottle fed babies. p-value ≤ 0.05 was considered statistically significant.

Results

There were total 222 preterm infants. The mean age of all preterm infants was 2.22±1.52 months. Age range was from 1-6 months. The mean age in breast-fed preterm infant group was observed as 1.93±1.3 months while in bottle-fed preterm infant group, the mean age was 2.52±1.66 months. The minimum and maximum age of infants in both preterm infant groups was same with same age range (5 months). Majority (n=141; 63.5%) were male while 81 (36.5%) were female. In breast-fed group, there were 74 male and 37 female infants while in bottle-fed group, there were 67 male and 44 female infants. (Table 1). Mean zinc level
among all the preterm infants was observed as 9.71±0.71 g/dL. The minimum level of zinc was 8.06 while maximum zinc level was 11.04 g/dL. (Table 2). The mean zinc level in breast-fed preterm infants was observed as 9.45±0.70 g/dL with minimum and maximum level as 8.06 g/dL and 10.92g/dL respectively. While in bottle-fed preterm infants, the mean zinc level was observed as 9.96±0.63 g/dL with minimum and maximum level as 8.06 g/dL and 11.04 g/dL respectively. The difference of mean zinc level between both feeding groups was statistically significant. (p-value = 0.000). (Table 3)

Table 1:Gender distribution of preterm infants with respect to feeding group

<table>
<thead>
<tr>
<th>Gender</th>
<th>Breast-fed</th>
<th>Bottle-fed</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>74</td>
<td>67</td>
<td>141</td>
</tr>
<tr>
<td>Female</td>
<td>37</td>
<td>44</td>
<td>81</td>
</tr>
<tr>
<td>Total</td>
<td>111</td>
<td>111</td>
<td>222</td>
</tr>
</tbody>
</table>

Table 2: Zinc levels in preterm infants (n=222)

<table>
<thead>
<tr>
<th>Zinc levels (g/dl)</th>
<th>Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.71±0.7 (8.06-11.0 g/dl)</td>
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</tr>
</tbody>
</table>

Table 3: Zinc levels of preterm infants in both feeding groups

<table>
<thead>
<tr>
<th>Zinc levels (g/dl)</th>
<th>Breast fed</th>
<th>Bottle fed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean ± SD</td>
<td>9.47 ± 0.7 (8.0 - 10.92)</td>
<td>9.96 ± 0.63 (8.06 - 11.04)</td>
</tr>
</tbody>
</table>

Discussion

Zinc has a unique and extensive role in biological processes. Since the discovery of this element as an essential nutrient for living, many diverse biochemical roles for it have been identified. These include roles in enzyme function, nucleic acid metabolism, cell signaling and apoptosis. Zinc is essential for physiological processes like growth and development, lipid metabolism, brain and immune function. Zinc is often limited in diets of deprived populations. Therefore, infants can be born with low body stores of zinc if maternal stores of zinc are low. Zinc-deficient infants have poor growth. Feeding human milk to premature infants may have mitigated the development of zinc deficiency, because the bioavailability of zinc is greater in human milk than in cow’s milk. Indeed, milk from zinc sufficient women provides the zinc required for growth in the first 4 to 6 months of life. Severe zinc deficiency leads to B-cell deficiency and hence to a paucity of plasma cells, It is doubtful that zinc deficiency is responsible for the T-cell deficiencies.

Previous studies that have been conducted in exclusively breast fed preterm infants who are less than four months of age reveal mean serum zinc levels of 9.1µmol/L with S.D. of ±1.9 and in those who are less than six months mean serum zinc values are 9.4 µmol/L with S.D. of ± 2.3. While Normal Serum Zinc values are 10.71-17.59 µmol/L (70 - 115 µg/dl). After this, infants are capable to take normal diet that contains sufficient zinc quantity so zinc deficiency does not occur. The recent increase in the use of human milk in feeding low birth weight (LBW) preterm infants has stimulated new research questions in infant nutrition, especially with regard to the nutritional adequacy and nutrient composition of milk from mothers of mature and preterm infants. Symptomatic zinc deficiency was observed in exclusively breast-fed preterm infants. A rapid healing of peri-orofacial and acral eczematoid lesions occurred after zinc supplementation. The clinical features resemble those of acrodermatitis enteropathica. Oral zinc supplementation is required until weaning. But in another study, the mean zinc level in breast fed infants was observed as 71.15 µg/dL and in formula-fed or bottle-fed infants the mean zinc level was observed as 62.2 g/dL. According to the results of this study zinc status of infants on mother’s milk is better as compared to formula-fed infants. Another study reported a breast-fed preterm infant (31 weeks gestation) who developed nutritional zinc deficiency 13 weeks post delivery. Serial samples of his mother breast milk from early lactation (2 weeks post delivery) contained a very low zinc concentration, although her serum zinc and sweat zinc concentrations were normal. Following the birth of her second baby at 38 weeks gestation, her breast milk contained normal amount of zinc. It was concluded that the low breast milk zinc values obtained following the first pregnancy may have been due to immaturity of the milk. Paediatric Departments who feed very low birth
weight babies, preterm milk should be check for zinc concentration or at least have a high index of suspicion for this nutritional deficiency. Dauncey reported negative zinc balance in preterm infants who were fed iron fortified pooled breast milk.

**Conclusion**

Preterm breast fed babies should be supplemented with zinc and if there is deficiency in mother’s milk then mothers should be advised to take zinc supplements as well.

**References**