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Original Research Article

# Study of Effect of Zinc on the Diarrhea among Breast Feeding Babies of Maharashtra: A Study from Central India

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## Abstract

**Background:** Zinc deficiency can have a significant impact on general immune function, increasing susceptibility to diarrhea-causing organisms such as parasites, bacteria, and viruses. Aims & objectives: To investigate the effects of zinc on diarrhoea in Maharashtra's breast-fed babies.

**Method:** 180 diarrhea-affected breast-feeding babies aged 6 months to 2 years were studied and compared to 180 control breast-feeding babies of the same age. The babies were given a zinc supplement in the form of an oral syrup containing 10 mg of zinc per day (2.5 ml once daily), while the control group was given a placebo. Three follow-ups (at 6, 9, and 12 months) were completed, and the results from each follow-up were compared in both groups.

**Results:** The interventional group had 176 (3.8) total episodes between 6 and 9 months, while the control group had 130 (4.8). Similar to the comparison between 9-12 months between two groups, the t test was 36.7 and the p value was very significant. The intervention group's mean value was 172 (3.4), while the control group's was 122 (4.5), with a t test of 42.05 and a p0.000 value.

**Conclusion:** Zinc is also important for the maintenance of gut mucosal cells, according to this study. Zinc supplementation dramatically lowers the morbidity associated with diarrhea in breast-fed neonates by blocking baso-lateral potassium (k+) channels, inhibiting CAMP, inducing chloride-dependent fluid production, and maintaining mineral normality in the body.

**Keywords:** Zinc Gluconate, Anthropometry, Breast Feeding, Diarrhea, Malnutrition



## Introduction

Diarrhea is defined as the passage of three or more loose or watery stools in a 24-hour period during a period of at least two days, with a change in stool consistency [1]. An episode of diarrhea was defined as the occurrence of at least one day of diarrhea, with the final day of the episode being the day when the diarrhea criterion was met and at least 48 hours went by without diarrhea. Diarrhea sickness is predicted to kill 2 million children under the age of 5 each year and contribute significantly to malnutrition in

those who survive [2,3]. Zinc is the human body's second most abundant trace mineral. It serves as a cofactor for hundreds of enzymes, affects the activity of peptide hormones and neurotransmitters, and plays critical roles in gene regulation and immune system development [4].

Zinc production in human milk causes newborns to develop immunity. Early observational studies found an association between diarrhea-related morbidity and zinc intake, with increased fecal zinc loss, negative zinc balance, and low tissue zinc concentrations among children with diarrhea. Conservative estimates suggest that at least 25% of the world's population is at risk of zinc deficiency [5-7]. Zinc shortage is common in underdeveloped nations due to insufficient dietary consumption, a lack of animal foods, and/or lower Zn bioavailability due to a high phylate:zinc ratio in the diet. The negative effects of zinc deficiency on the immune response are expected to enhance children's susceptibility to infections diarrhea, and chronic or persistent diarrhea worsens zinc status due to increased fecal zinc losses during diarrhea episodes. As a result, researchers are attempting to analyze the reduction of episodes in breast-feeding babies aged 6 months to 2 years.

## Aims and Objectives

To investigate the effects of zinc on diarrhoea in Maharashtra's breast-fed babies.

## Material and Method

The study looked at 180 breast-feeding babies aged 6 months to 2 years who visited the paediatric OPD of a Medical Institute and Research in Central Maharashtra on a regular basis. The babies who were clinically diagnosed with diarrhea due to a zinc deficiency were chosen for the study.

Babies who were more than two years old and who were not breastfed were excluded from the study.

## Method

180 breast-feeding babies with diarrhea and 180 breast-feeding babies of the same age group who were free of sickness, i.e. the control group, were chosen for the study. After recording baseline anthropometry, the research intervention was started at six months of age (weight, length and head circumference).

The interventional group received zinc supplement (zinc gluconate) in the form of oral syrup at a dose of 10 mg/day (2-5 ml once day), while the control group received placebo at a dose of 2-5 ml/day. The placebo was a sugar syrup made by a reputable pharmaceutical company that looked, tasted, and looked like the zinc supplement. Mothers were told to give the dose in the morning, one hour before feeding, using a measuring cup. Mothers were given a calendar to mark each day that the medicine was administered on in order to track drug compliance.

During the monthly appointments, these calendars were inspected, and the number of days that drug dosages were missed was documented. Mothers were also urged to return the bottles once a month to allow for the measurement of any unused amount. In both groups, the intervention was continued for a total of 12 months.

Mothers were requested to keep a full daily diet record of the quantity (using standard household measures) of non-breakfast milk food and fluids ingested and to record the date when a new complimentary meal was introduced on the calendar provided. During the trial, three follow-ups were conducted (at six, nine, and twelve months). Anthropometric measurements were taken, as well as data on morbidity based on the number of diarrhea cases.

Infants were also evaluated for drug compliance in terms of the number of missed doses and the reasons for those missed doses. During these appointments, any co-incidental

delivery of other supplements (multi vitamins, iron, and calcium) by the physician was also noted. Mothers were instructed to record any signs of illness on a calendar throughout the trial, using standardized rules for describing symptoms as well as diagnoses made by medical clinicians. In both groups, the number of occurrences of diarrhea was used to conduct the analysis. The study lasted from July 2010 to June 2021.

### Statistical Analysis

The incidences of diarrhea episodes in both groups from 6 to 9 months and 9 to 12 months were statistically compared using the z test. SPSS software was used to conduct the statistical analysis. The male to female infant ratio was 2:1. The Ethical Committee has approved this research article.

### Observation and Results

Table 1: Comparison of incidences of diarrhea episodes from 6 to 9 month interventional and controlled in groups. Mean value 116 ±2.3 in interventional, 52 ±1.5 in controlled group t test was 110 and p<0.00 (p value was highly significant). Once episodes has 60 ± 1.2 mean values in interventional, 70 ±2.1 in controlled group, t test 19.6 and p value p < 0.00 (p value was highly significant). In comparison 176 ±3.5 in interventional group, 130 ±4.8 in controlled group, t test was 36.7 and p value p < 0.00 (p value was highly significant).

**Table 1: Comparison of incidences of diarrhea in interventional and controlled groups from babies 6 to 9 months**

| No. of Episodes | Interventional group 180 babies Mean value (±SD) | Controlled group 180 babies Mean value (±SD) | t test | p value |
|---|---|---|---|---|
| Nil | 116 (± 2.3) | 52 (±15) | 110 | P<0.00 |
| Once | 60 (± 1.20) | 70 (± 2.1) | 19.6 | P<0.00 |
| 2 > episode | 00 | 8 (± 1.2) | -- | -- |
| Total | 176 (± 3.5) | 130 (± 4.8) | 36.7 | P<0.00 |

Table 2: Comparison of incidences of diarrhea from 9 + 12 months in interventional and controlled group mean value 78±1.8 in interventional group, 50 ±2.3 in controlled group t test was 90.9 and p value highly significant (p<0.00). Once episode had 8 ±1.6 in interventional group, 11 ±2.2 in controlled group t test was 10.4 and p <0.00 p value was highly significant. In total result of comparison of interventional group mean value was 86 ±3.4 and in controlled group 61 ±4.5,t test was 42.05 and p value was highly significant (p<0.00).

**Table 2**

| No. of Episodes | Interventional group 180 babies Mean value (±SD) | Controlled group 180 babies Mean value (±SD) | t test | p value |
|---|---|---|---|---|
| Nil | 146 (± 1.8) | 100 (± 2.3) | 90.9 | P<0.00 |
| Once | 26 (± 1.6) | 22 (± 2.2) | 10.4 | P<0.00 |
| 2 > episode | 00 | 00 | -- | -- |
| Total | 172 (± 3.4) | 122 (± 4.5) | 42.05 | P<0.00 |

**Table 3: Comparison reduction of diarrhea cases with previous workers**

| Workers | Year | Incidence of reduction of diarrhea cases |
|---|---|---|
| Sazawal | 1998 | 16 |
| Penny | 1999 | 24 |
| Brooks | 2005 | 32 |
| Present study | 2021 | 18 |

## Discussion

The current study looks at the impact of zinc on diarrhea in Maharashtra's breast-feeding babies. In a study of 9-12 month newborns, the mean value of diarrhea episodes in the interventional and control groups was 116.3% in the interventional group and 52.5% in the control group, with a t test of 110 and p0.00. Once follow up (episode), interventional group mean value 601.2 and 702.1 in controls group t test 19.6 and p0.00.

In total follow up in 6 to 9 month kids, 176 3.5 in interventional group, 1304.8 in controlled group, t test 36.7 and p0.00 (Table 1), similarly in 9-12 month babies mean value of interventional group was 156 1.8, 100 2.3 in controlled group, t test 90.9 and p0.00 (Table 2). Once (first follow up), the interventional group's mean value was 8 to 1.6, while the control group's was 11 to 2.2, with a t test of 10.4 and p0.00. Total follow-up in 9-12 month babies was 172.34 in the interventional group and 122.45 in the control group, with a t test of 84.05 and p0.00 (Table-2).

These findings are mostly in line with earlier research. Zinc deficiency in children is linked to stunted growth and an increased risk of diarrhea and pneumonia [8]. Current zinc intake recommendations for infants are based on the assumption that breastfed babies meet their zinc requirements during the first six months of life and that zinc status is likely to deteriorate after that.

Zinc deficiency, a common condition among young children in developing countries, is linked to decreased immune function and an increased risk of serious infectious diseases [9]. The benefit of zinc treatment for diarrhea in older children has also been reported, but not in premature infants. The effects of zinc may fluctuate depending on the pathogen, and the relative relevance of pathogens varies with age. Zinc, for example, has been found to block ion release induced by cholera toxin but not by the heat stable toxin of Escherichia coli [10]. It is unknown how zinc affects recovery from diarrhea caused by rotavirus or other infections that are prevalent in the research age range.

Another possible distinction between young infants and older children is the immune protection mechanism. Young infants benefit significantly from immune factors found in breast milk, whereas older children must rely on acquired immunity from diet and a quick response to infection when diarrhea appears [11]. Thus, the immunological impairment associated with zinc deficiency could potentially have more serious repercussions in an age group that relies on active rather than passive immune components to recover from disease.

## Summary and Conclusion

The current investigation of the effects of zinc on diarrhea has confirmed that zinc supplementation dramatically reduced diarrhea episodes in breast-fed babies, implying that zinc supplementation boosts immunity and should be given during pregnancy in all developing nations. So that new born newborns are immune to infections such as diarrhea and vomiting, however this study calls for more nutritional, pathophysiological, genetic, and pharmacological research because the mechanism(s) through which zinc may work as an enteroprotective have yet to be discovered.

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