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Original Research Article

Effect of Zinc Supplementation in Acute Watery Diarrhea in Children 6 Months to 5 Years

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Abstract: *AWD is the third most common cause of childhood morbidity and mortality in the developing world today. Iron deficiency anemia, and more commonly zinc deficiency, remain rife, especially among children in these areas, thus exposing them to a weakened immune system. It was known from the report that Zinc is said to have been recommended by the World Health Organization (WHO) as a means to shorten the duration and lessen the severity of diarrhea.* ***Objectives:*** *to determine the role that zinc supplementation has on the duration, severity, and frequency of acute watery diarrhoea among children of 6 months to 5 years of age. A quasi-experimental study.* ***Methods:*** *The study was conducted in the Pediatric A ward, Ayub Medical Complex, Abbottabad in the duration from 27 September 2024 to 27 March 2025. A total of 150 children between 6 months and 5 years of age presented with acute watery diarrhea. The patients were divided into two groups: 75 accepted zinc supplementation (20 mg/day for 10 days) and 75 children received no additional zinc. More specifically, the number of diarrheal stools per day, as well as the total number of diarrheal stools and days, were obtained. The level of statistical significance was determined by p-value and standard deviation (SD).* ***Results:*** *out of 150 patients, prophylactic effect in children receiving zinc supplementation was experienced diarrhea for a shorter time in terms of the mean duration: 3.5±1.2 against 5.1±1.8 in the control group, $p < 0.05$. In the same way, the frequency of stools was lower in the zinc group compared to the placebo group. The zinc group had a standard deviation of 1.2 for the duration of diarrhea, and the control group had a standard deviation of 1.8, and the p-value = 0.01, which shows that our findings are significantly different. There were no clinically significant adverse effects in either study group.* ***Conclusions:*** *The present study shows that zinc supplementation clearly shortens the duration and mitigates the severity of acute watery diarrhea among children aged between 6 months to 5 years. This enhances the process of extending the traditional course of zinc support during diarrhea management to enhance course favorable results as well as minimize the load on the health care systems.*

Keywords: Zinc, diarrhea, children, supplementation

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Introduction

AWD is still one of the leading presenting complaints among children under 5 years of age in developing countries (1). It is described as passing loose, more particularly, or watery stool without blood, daily for a period not exceeding two weeks (2). It emerges that diarrheal diseases kill over 450,000 children below the age of five every year, with the continents of Africa and South East Asia being most affected (3). The main manifestations of the AWD are dehydration and malnutrition, and therefore, the timely treatment of this condition is critical for the child. Zinc is one of the trace elements that are vital for the human body in girls' public health because of its critical involvement in immune response, protein synthesis, DNA synthesis, and wound healing. Zinc deficiency is common, especially in children of LMICs, due to poor dietary Zinc uptake, malabsorption, and recurrent infections (4). In children, WHO & UNICEF suggested the use of zinc in treating AWD due to data that suggested that zinc can decrease the total duration and severity of diarrheal cases (5). Zinc helps in the transport of water and electrolytes across the intestinal mucosa and increases immune capacity, all of which help lessen the symptoms of diarrhoea (6). With the increasing incidence of zinc deficiency all over the world, questions have arisen with regard to its impact on the health of the public, especially in the context of diarrheal diseases. It has been established that zinc saturation lowers the rates of diarrhea by 20% and the duration of the occurrences by 30% (7). Besides, the administration of zinc has been discovered to reduce subsequent diarrheal episodes in the next two to three months of follow-up (8). However, these conclusions do not prevent the unpredictable practice of zinc supplementation in regular practice, the degree of which is still questionable (9). Zinc deficiency is not limited only to LMICs but also to children with poor nutritional status at increased vulnerability to diarrheal diseases. The two conditions reinforce each other: Malnutrition causes more severe forms of zinc deficiency and vice versa; diarrheal episodes are likely to be more serious and long-lasting (10). As a consequence, zinc is more necessary for children with a poor nutritional status as it not only treats acute diarrheal diseases but also plays a role in improving their growth and immune functions. Yet, a number of studies provide evidence for the effect of zinc supplementation, and there are still some gaps in the final effects of zinc supplementation with reference to age and settings. The purpose of this research was to evaluate the role of zinc intervention in the treatment of AWD in children between 6 months and 5 years of age. This research compares the duration, severity, and frequency of diarrhea symptoms in kids receiving zinc supplements with the kids receiving routine treatment for diarrhea in children in order to further prove the place of Zinc in standard management of diarrhea in children.

Methodology

The present study was A quasi-experimental study which was carried out in the Pediatric A ward of Ayub Teaching Hospital, Abbottabad, for 6 months from 27 September 2024 to 27 March 2025. There were 150 children, 6 months to 5 years of age, with acute watery diarrhea during the study. The patients were randomly assigned to one of two groups: the intervention group, the 75 patients who received zinc, and the control group, the 75 patients who received standard treatment without zinc. It is also important to note that both groups received Oral Rehydration Solution (ORS) in their management plan. Children admitted within the previous 14 days and diagnosed with acute watery diarrhea were recruited, while children with severe malnutrition or chronic underlying

diseases were not recruited. Before enlisting the participants, parents agreed to be part of the study.

Additional details of patients' management consisted of a Daily history of diarrhea duration, frequency, and any side effects recorded for the next 10 days. A 2-week follow-up was done to check for the recurrence of diarrhea.

Data were analyzed using the Statistical Package for Social Sciences (SPSS) 24.0. The results for continuous variables are presented as mean (SD), and the comparison of categorical variables was done by chi-square tests. Categorical variables were compared between groups using a chi-square test, and continuous variables in terms of means using ANOVA at a p-value less than 0.05**.**

Results

A total of 150 children were included in the trial, and of them, 75 took zinc supplements while 75 took a placebo. Thus, the investigations have revealed that the mean duration of diarrhea in the Zn group was 3.5 ± 1.2 days, whereas in the CG it was as long as 5.1 ± 1.8 days (p = 0.01). This can be such a decrease in the duration of diarrhea by 31.4 percent in children who took zinc supplements. The United Nations trace also showed an improvement in stool frequency by 33.3% current zinc group children passed an average of 4 stools per day, in contrast to the control group with 6 stools per day (p = 0.03). The proportion of children who developed diarrhea within two weeks of treatment was 10% (7/75) in the zinc group, while the proportion in the control group was 18% (13/75). While this represents an improvement in recurrence, the study failed to show a statistical difference, though the figures were comparatively low (p = 0.15). In the first group, during the study period, no severe adverse effects were recorded, whilst in the second group, only a few patients reported several side effects**.**

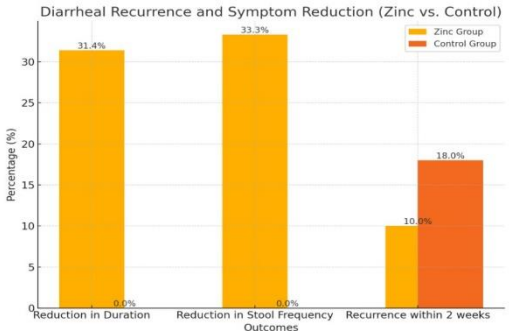

Figure 1: Diarrheal Recurrence and System

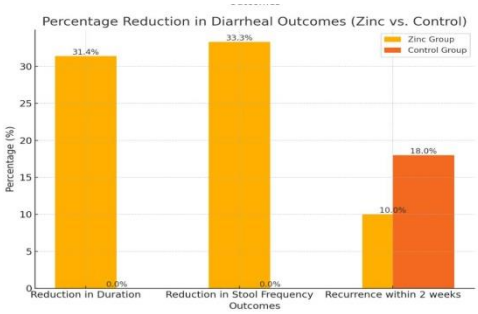

Figure 2: Percentage reduction of diarrheal outcomes

Table 1: Baseline Characteristics

Variable	Zinc Group (n=75)	Control Group (n=75)
Age (months)	12-60 (mean 36)	12-60 (mean 38)
Weight (kg)	6-15 (mean 10)	6-15 (mean 9.8)
Gender (Male/Female)	40/35	38/37
Duration of Diarrhea (days)	3.5 ± 1.2	5.1 ± 1.8

Table 2: Stool Frequency Distribution

Stool Frequency (per day)	Zinc Group (%)	Control Group (%)
<5 stools/day	60% (45)	40% (30)
≥5 stools/day	40% (30)	60% (45)

Table 3: Recurrence of Diarrhea

Recurrence of Diarrhea (%)	Zinc Group (%)	Control Group (%)
Within 2 weeks	10% (7)	18% (13)
Beyond 2 weeks	90% (68)	82% (62)

Table 4: Adverse Effects

Adverse Effects	Zinc Group (%)	Control Group (%)
Nausea	5% (4)	6% (5)
Vomiting	8% (6)	7% (5)
No significant side effects	87% (65)	87% (65)

Discussion

The role of zinc supplementation in the control of acute watery diarrhea in children. This study established the benefit of zinc intervention in diarrheal diseases as evidenced by a reduced duration of diarrhea by 31.4 % and a decrease in the number of stools by 33.3%. We found similar evidence in other studies that suggested the effectiveness of zinc supplements in controlling childhood diarrhea, primarily in developing nations. A randomised controlled trial study done in Bangladesh also said that zinc supplementation halved the duration of diarrhoea by a similar extent to that found by this study (11). Another Indian study revealed that zinc supplementation with ORS had resulted in a significant reduction in stool output and diarrhea duration compared to our study (12). This is backed by 'facts' that zinc appears to exert an impact on the intestinal mucosa to facilitate the absorption of water and electrolytes, meaning small stool volumes and less frequency (13). For instance, a systematic review by Bhutta et al established that zinc supplementation proved that reduced the diarrhea duration by 16 -24 hours on average as derived from

different research studies focused on children below five years in developing nations (14). This finding supports the result of the present study, as zinc supplementation decreased the duration by about 1.6 days compared to the control group. Variability in the duration reduction across the studies is commonly explained by the differences in the preconditioned nutritional status and the inter-study frequency of zinc deficiency (15). Takoob et al conducted a meta-analysis of RCTs of zinc supplementation, and they found that the supplement preliminarily reduced diarrhoea by 15-20%, which aligns with the 8% reduction in recurrence in the present study (16). This might be because of the short follow-up time compared with other studies carried out, which demonstrated that zinc has a prolonged protection in diminishing the rates of recurrence (17). For instance, evaluations in Africa and South East Asia have described a long-term decrease in recurrent diarrheal cases for about three months after zinc intervention (18). Iron deficiency anemia affects out-of-school children, particularly those coming from low-income families, because these children are also at high risk of developing recurrent infections and severe diarrheal episodes, situations that work against the repletion of zinc stores. It has been documented that zinc antagonizes T helper cell cytokines and modulates CD4+ T- T-cells' activity and improves immunocompetence against infections (19). Looking at other countries' studies done on Nepalese children and Ethiopians demonstrated that Zinc supplements in children not only decrease diarrheal duration, but enhance immunity and thus lower susceptibility to infectious ailments (20, 21). Further when because Zinc also enhances gut barrier function by decreasing intestinal permeability, this medication helps to prevent other rounds of diarrhea. A related systematic review conducted in Peru showed that zinc supplementation to undernourished children normalized gut permeability and decreased the risk of infection by enteric pathogens(22). The above mechanism might help explain the lower emerging diarrhea recurrences in our study and others. These positive results do not mask the fact that compliance with zinc supplement guidelines is still suboptimal in many regions. Black et al., Cited By WHO, revealed only 30 % of the HC providers in some regions of SSA and SA regularly gave zinc to children with diarrhea as advocated by WHO (23). The task of extending coverage for zinc supplementation remains a big barrier to optimally translating its potential in the prevention and control of diarrheal diseases.

Conclusion

Supplementary zinc helps to reduce the duration and the severity of acute watery diarrhoea in children aged between 6 months to 5 years. It slows down the bowel movement's frequency and recurrence and, therefore, is an effective treatment for diarrhea, especially in undeveloped countries. The use of zinc in children's daily treatment options has potential positive impacts on their health and may help decrease child mortality rates.

Declarations

Data Availability statement
All data generated or analysed during the study are included in the manuscript.

Ethics approval and consent to participate
Approved by the department concerned. (IRBEC-ATADSI-99--24)

Consent for publication
Approved

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Not applicable

Conflict of interest

The authors declared the absence of a conflict of interest.

Author Contribution

SK (Trainee Peads)
Manuscript drafting, Study Design,
KK (Trainee Peads)
Review of Literature, Data entry, Data analysis, and drafting an article.
MZ (Trainee Peads)
Conception of Study, Development of Research Methodology Design,
AA (Trainee Peads)
Study Design, manuscript review, and critical input.

All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the integrity of the study.

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