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EFFECT OF ZINC SUPPLEMENT ON DURATION OF ACUTE DIARRHEA FORM 6 MONTHS TO 5 YEARS OF AGE IN A TERTIARY CARE HOSPITAL.

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Abstract

Background: *Acute watery diarrhoea is among the major causes of death in children under five globally. Zinc supplementation, recommended by WHO and UNICEF as an adjunct to oral rehydration solutions (ORS), is believed to improve recovery outcomes. However, evidence from real-world tertiary care settings in Pakistan remains limited.*

Objective: *The objective of our study was to determine the effect of zinc supplementation on the duration of acute diarrhoea in children aged between 6 and 5 years admitted to a tertiary care hospital in Swabi, Pakistan.*

Methods: *A randomized controlled trial was conducted among 74 children (37 per group) admitted with acute diarrhoea. The Zinc group received zinc supplementation in addition to standard treatment, whereas the control group received standard treatment alone. Primary outcome was duration of diarrhoea. Data analysis was done by using SPSS version 27 applying independent t-tests for mean comparison; $p < 0.05$ was considered statistically significant.*

Results: *Children in the zinc group experienced a shorter mean time to resolution of diarrhoea compared with controls (3.94 ± 0.97 vs. 4.38 ± 1.09 days), with a mean difference of 0.44 days. Although this difference favored zinc supplementation, it did not reach statistical significance ($p = 0.072$; 95% CI: −0.04 to 0.92). Baseline characteristics between groups were comparable.*

Conclusion: *Zinc supplementation was associated with a trend toward shorter diarrhoeal duration in children, consistent with international evidence, though statistical significance was not achieved in this study. Findings highlight the need for larger multicenter trials in Pakistan to strengthen evidence and support broader implementation of zinc in paediatric diarrhoeal management.*

INTRODUCTION

Acute diarrhoea is among one of the major causes of deaths in children under five worldwide. The World Health Organization (WHO) estimated that diarrhoeal diseases accounted for more than 400,000 deaths in children under five years of age in 2021, ranking among the top contributors to preventable child mortality(1). Oral Rehydration Solution (ORS) remains the cornerstone of management, effectively preventing dehydration and related mortality(2, 3). However, micronutrient deficiencies, particularly zinc deficiency, worsen diarrhoeal outcomes by impairing mucosal

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integrity, intestinal absorption, and immune defense(4, 5).

Zinc is an essential trace element involved in cellular metabolism, repair of intestinal epithelium, and immune modulation(6). Supplementation during diarrhoeal episodes has been shown to reduce stool frequency, shorten disease duration, and lower the risk of recurrence(7, 8). Accordingly, WHO and UNICEF recommend zinc supplementation alongside ORS—20 mg daily for 10–14 days in children older than six months, and 10 mg daily in younger infants(9, 10).

Recently done high evidence studies such Systematic review and meta-analysis and randomized controlled trials (RCTs) provide significant evidence for the effectiveness of zinc in acute diarrhoea. A 2024 systematic review of 38 RCTs reported that zinc significantly increased recovery rates (RR = 1.07, 95% CI 1.03–1.10) and reduced diarrhoea duration by 13.3 hours on average compared with placebo or standard care(11). Another large RCT from 2020 demonstrated that a lower zinc dose was non-inferior to the standard 20 mg dose, while causing less vomiting(12). Additionally, studies combining zinc with probiotics have shown enhanced clinical recovery compared to probiotics alone(13).

In South Asia, where diarrhoeal burden remains high, zinc supplementation has been widely studied. Evidence from Bangladesh indicates that zinc reduces hospitalization rates and diarrhoea-related mortality(14). A recent Bangladeshi trial confirmed significant reductions in duration and frequency of stools with zinc plus ORS compared to ORS alone(15). Similarly, an Ethiopian study in 2025 reported that zinc use was associated with shorter illness episodes among under-five children presenting with diarrhoea, although uptake remained variable(16).

Several trials from Pakistan confirm the benefit of zinc. A randomized controlled trial in Besham, Khyber Pakhtunkhwa, showed that zinc supplementation significantly reduced diarrhoeal duration compared with ORS alone(17). Another study in Mardan reported that zinc reduced stool frequency and improved stool consistency in children aged 6 months to 5 years(18). Despite inclusion in national guidelines, zinc uptake in Pakistan has been low: coverage surveys show use rising from ~2% in 2013 to only ~8% by 2018(19).

Although global and regional studies support zinc supplementation, important gaps remain in Pakistan. The effectiveness of zinc in real-world tertiary hospital practice has not been sufficiently documented, and adherence to supplementation remains inconsistent. Given the continued burden of childhood diarrhoea, there is an urgent requirement to assess how zinc supplementation influences outcomes in local healthcare contexts. Accordingly, this research explores its effect on the duration of acute diarrhea among children aged 6 months to 5 years who present to a tertiary hospital in Pakistan.

Objectives

The objective of our research study was to assess the effect of zinc supplementation on the duration of acute diarrhea in children aged 6 months to 5 years admitted to the pediatric ward of Bacha Khan Medical Complex, Gajju Khan Medical College, Swabi, Pakistan.

Operational Definitions

- **Acute Diarrhea:** Acute diarrhea is defined as the occurrence of three or more loose or watery bowel movements within a 24-hour period, lasting fewer than 14 days, in children aged 6 months to 5 years.
- **Zinc Supplementation:** Administration of oral zinc in the form of zinc sulfate at a recommended dosage of 20 mg/day for children above 6 months and 10 mg/day for infants below 6 months, given orally for 10–14 days during the diarrheal episode.
- **Duration of Diarrhea:** Total number of days from the onset of loose stools until cessation, defined as the absence of loose stools for at least 24 consecutive hours.
- **Standard Treatment:** Routine management of acute diarrhea according to hospital protocols, including oral rehydration solution (ORS) and adjunct therapies (such as antibiotics or antidiarrheal medications) where clinically indicated.

Materials and Methods

Study Design & Setting: This randomized controlled trial was conducted in the Peadiatric Ward of Bacha Khan Medical Complex, District

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Sawabi of Khyber Pakhtunkhwa Province, Pakistan.

Study Duration: Six months following ethical approval.

Study Population: Children aged 6 months to 5 years presenting with acute diarrhea and admitted to the pediatric ward.

Sample Size: A sample size of 74 participants (37 in each arm) was calculated using OpenEpi, based on an expected mean duration of 4.58 days in the control group and 3.88 days in the zinc group, with a 95% confidence level and 80% power.

Sampling Technique: Eligible participants were enrolled through convenience sampling and then randomly allocated into intervention (zinc supplementation + standard treatment) and control (standard treatment only) groups using an OpenEpi randomization tool.

Inclusion Criteria:

- Children aged 6 months to 5 years.
- Diagnosis of acute diarrhea (≥3 loose stools in the preceding 24 hours).
- Presentation within 72 hours of symptom onset.

Exclusion Criteria:

- Children with chronic illnesses (e.g., celiac disease, severe malnutrition).
- Children with congenital anomalies (e.g., congenital heart or renal disease).
- Prior treatment for acute diarrhea within the past 7 days.
- Prior zinc supplementation within the past 7 days.

Data Collection: Written informed consent was signed from parents/guardians, demographic and clinical information (age, sex, duration since onset of diarrhea, stool frequency, and dehydration status) was collected using a structured questionnaire. Group A was given zinc in addition to the routine management, whereas Group B was managed with routine (standard) care alone.

Data Analysis: Data were analyzed using SPSS v27. Continuous variables (such as demographic and clinical characteristics) were expressed as mean values with their standard deviations following a normality assessment using the Shapiro-Wilk Test and compared between groups using independent t-tests ($P < 0.05$). Frequencies and percentages were used to describe Categorical variables.

Results

74 children were enrolled, with 37 in each study arm. **Table 1** provides a summary of the descriptive measures for scale variables such as Mean ± SD. The mean weight of participants showed comparable values between the control group (12.99 ± 2.53 kg) and the zinc group (13.53 ± 3.17 kg). The children receiving zinc had a shorter duration of diarrhea (1.96 ± 0.64 days) compared with controls (2.36 ± 0.62 days). Similarly, both the time to resolution of diarrhea and the total duration of illness were lower in the zinc group (3.94 ± 0.97 days) than in the control group (4.38 ± 1.09 days). The Shapiro–Wilk test suggested that majority variables were normally distributed.

Table 2 outlines the demographic and clinical profile of participants. The majority of children were between 1–3 years of age, with a greater percentage of children older than 4 years in the zinc group (21.6%) compared to the control group (5.4%). There was a slight female predominance across both groups. At presentation, mild dehydration was the most frequent clinical status in both groups, though severe dehydration was more common in controls (16.2% vs. 5.4% in zinc). Stool frequency of more than five episodes per day was reported by nearly half of the participants in both groups. The presence of blood or mucus in stool, vomiting, and abdominal pain showed comparable distributions, while fever was somewhat less common in the zinc group (18.9% vs. 29.7% in controls). The majority of children received oral rehydration therapy and antibiotics, while the use of intravenous fluids was higher in the zinc group (16.2%) than in controls (5.4%). Overall, baseline characteristics were broadly comparable between study arms.

Independent samples t-test results for the primary outcome are summarized in **Table 3**. Children in the zinc group experienced a shorter mean time to resolution of diarrhea (3.94 ± 0.97 days) compared with controls (4.38 ± 1.09 days), with a mean difference of 0.44 days. However, this reduction did not reach statistical significance ($p = 0.072$; 95% CI: −0.04 to 0.92). Although zinc supplementation was associated

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with a trend toward faster recovery, the difference was not statistically significant.

Table 1: Continuous Variables in Both Arms (Mean ± SD and Shapiro–Wilk p-value)

Variable	Control (No Zinc) n=37		Zinc Group n=37	
	Mean ± SD	Shapiro–Wilk P-Value	Mean ± SD	Shapiro–Wilk P-Value
Weight (kg)	12.99 ± 2.53	0.860	13.53 ± 3.17	0.104
Duration since onset (days)	2.36 ± 0.62	0.641	1.96 ± 0.64	0.208
Time till resolution (days)	4.38 ± 1.09	0.005	3.94 ± 0.97	0.924
Total duration (days)	4.38 ± 1.09	0.005	3.94 ± 0.97	0.924

Table 2: Frequency and Percentages of Clinical and Demographic Characteristics

		Control n(%) Total = 38	Zinc n(%) Total = 38
Age Group	6–11 months	2 (5.4)	4 (10.8)
	1–2 years	12 (32.4)	6 (16.2)
	2–3 years	11 (29.7)	9 (24.3)
	3–4 years	10 (27.0)	10 (27.0)
	>4 years	2 (5.4)	8 (21.6)
Sex	Male	17 (45.9)	16 (43.2)
	Female	20 (54.1)	21 (56.8)
Dehydration Severity	None	4 (10.8)	9 (24.3)
	Mild	19 (51.4)	16 (43.2)
	Moderate	8 (21.6)	10 (27.0)
	Severe	6 (16.2)	2 (5.4)
Stool Frequency	<3/day	3 (8.1)	1 (2.7)
	3–5/day	16 (43.2)	18 (48.6)
	>5/day	18 (48.6)	18 (48.6)
Blood/mucus in Stool	Yes	6 (16.2)	7 (18.9)
	No	31 (83.8)	30 (81.1)
Vomiting	Yes	17 (45.9)	14 (37.8)
	No	20 (54.1)	23 (62.2)
Fever	Yes	11 (29.7)	7 (18.9)
	No	26 (70.3)	30 (81.1)
Abdominal Pain	Yes	11 (29.7)	11 (29.7)
	No	26 (70.3)	26 (70.3)
ORS given	Yes	10 (27.0)	13 (35.1)
	No	27 (73.0)	24 (64.9)
Antibiotics	Yes	32 (86.5)	34 (91.9)
	No	5 (13.5)	3 (8.1)
Anti-diarrhial given	Yes	9 (24.3)	10 (27.0)
	No	28 (75.7)	27 (73.0)
IV Fluids	Yes	2 (5.4)	6 (16.2)
	No	35 (94.6)	31 (83.8)

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Table 3: Independent Samples t-test for Primary Outcomes

Outcome	Control Mean ± SD	Zinc Mean ± SD	Mean Difference	95% CI of Difference	P-value
Time till resolution (days)	4.38 ± 1.09	3.94 ± 0.97	0.44	−0.04 to 0.92	0.072

Discussion

In this randomized controlled trial of 74 children aged 6 months to 5 years, zinc supplementation plus standard treatment resulted in a shorter mean time to resolution of diarrhea compared with standard treatment alone (3.94 ± 0.97 vs. 4.38 ± 1.09 days), though this difference of 0.44 days did not reach statistical significance (p = 0.072; 95% CI −0.04 to 0.92). Baseline characteristics were comparable, supporting internal validity.

Our findings are consistent with evidence that zinc reduces the duration of acute diarrhea, though the effect size in this study was smaller and not statistically significant. A 2024 systematic review of 38 RCTs by Ali et al. reported that zinc supplementation significantly increased recovery rates (RR = 1.07; 95% CI 1.03–1.10) and reduced diarrhoea duration by 13.3 hours (95% CI −17.7 to −8.9) compared to placebo or standard care(11). Similarly, a large multicenter RCT by Dhingra et al. in 2020 demonstrated that zinc significantly shortened diarrhoeal duration, with both standard and lower-dose regimens effective(20). Regional data also support the benefit of zinc. A Bangladeshi trial reported significant reductions in diarrhoeal duration and frequency when zinc was given alongside ORS compared with ORS alone(21). Another 2023 Bangladeshi study demonstrated that zinc supplementation lowered hospitalization rates and improved recovery outcomes(14). In Ethiopia, Degefa et al. (2025) observed that zinc use was associated with shorter illness episodes, though uptake remained inconsistent(16). Nationally, several Pakistani studies corroborate the positive impact of zinc. Shah et al. (2021) reported a significant reduction in diarrhoea duration with zinc supplementation compared to standard treatment(17). More recently, Sadiq et al. (2023) demonstrated improvements in stool frequency and consistency with zinc, although the reduction in total duration was less pronounced(22). Despite inclusion in national guidelines, zinc uptake in Pakistan remains low, with coverage estimates of only ~8% by 2018(23).

Our observed reduction of 0.44 days did not achieve statistical significance. This may be due to limited sample size, modest baseline differences, or the fact that diarrhoea outcomes can be influenced by nutritional status, dehydration severity, and adherence to supplementation(9, 24). Nevertheless, even a reduction of less than half a day can be clinically relevant in resource-limited settings, by decreasing risk of dehydration, hospital stay, and healthcare costs.

Conclusion

This randomized controlled trial found that zinc supplementation in addition to standard treatment was associated with a shorter mean duration of acute diarrhoea in children aged 6 months to 5 years, although the observed difference did not reach statistical significance. The findings align with international and regional evidence supporting zinc as an effective adjunct therapy, while also highlighting the variability of outcomes in different settings. Given the persistent burden of childhood diarrhoea and the low uptake of zinc supplementation in Pakistan, these results underscore the importance of strengthening guideline-based implementation. Larger, multicenter studies are warranted to confirm effectiveness in routine clinical practice and to inform strategies that can improve adherence and scale-up of zinc use in paediatric diarrhoeal management.

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