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EFFECT OF DIFFERENT DOSES OF ZINC IN CHILDREN WITH ACUTE WATERY DIARRHOEA

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ABSTRACT

Background: *Diarrhea is the passage of loose or watery stools at least thrice in 24 hours. Diarrheal illness is the second leading cause of child mortality; among children younger than five years of age worldwide, it caused over 500,000 estimated deaths in 2017.* ***Objective:*** *To evaluate the effect of different doses of zinc (10 mg and 20 mg daily) on the duration, stool frequency, and adverse effects in children with acute watery diarrhea.* ***Material and methods:*** *This Randomized controlled trial was conducted at Department of Pediatrics, Ittefaq trust Hospital, Lahore during----------. Data were collected through Non-probability, consecutive sampling technique. A total of 60 children aged 1–5 years with acute watery diarrhea were randomly divided into two groups. Group A received 10 mg zinc daily for 14 days, while Group B received 20 mg zinc daily for the same duration.* ***Results:*** *Children in Group B (20 mg zinc) had a significantly shorter mean diarrhea duration (3.5 ± 0.9 days) compared to Group A (10 mg zinc, 4.2 ± 1.1 days; p = 0.02). Stool frequency <3 was achieved in 67% of Group B compared to 20% of Group A by Day 5 (p < 0.001). Vomiting episodes were higher in Group B (27%) than in Group A (10%), but the difference was not statistically significant (p = 0.08).* ***Conclusion:*** *It is concluded that 20 mg zinc supplementation is more effective than 10 mg in reducing diarrhea duration and normalizing stool frequency. While mild side effects such as vomiting were more frequent with the higher dose, the benefits outweigh the risks.*

Keywords: *Zinc supplementation, acute watery diarrhea, stool normalization, vomiting, pediatric diarrhea management.*

INTRODUCTION

Diarrhea is the passage of loose or watery stools at least thrice in 24 hours. Diarrheal illness is the second leading cause of child mortality; among children younger than five years of age worldwide, it caused over 500,000 estimated deaths in 2017.[1] In resource-limited countries, infants experience a median of six episodes annually; children experience a median of three episodes annually.[2] Within resource-limited countries, there is considerable geographic variability in the incidence and associated mortality of diarrheal illnesses; certain regions may be in higher need of targeted interventions to improve these outcomes.[3, 4] In low- and middle-income countries, millions of children suffer from severe diarrhea every year and many die from dehydration. Giving fluids by mouth (using an oral rehydration solution) has been shown to save children's lives, but it does not affect the length of time the children suffer with diarrhea. Zinc supplementation could help reduce the duration and the severity of diarrhea, and therefore have an additional benefit over oral rehydration solution in reducing children mortality. [5, 6]

Zinc supplementation reduces the duration and severity of acute and persistent diarrhea. The role of zinc therapy in the improvement of stool consistency and the shortening of the duration of diarrhea is still controversial.[7] Zinc is an adjunct to oral rehydration salts for management of diarrhea in children. Due to zinc's unpleasant taste, children often develop nausea and/or vomiting.[8] One trial reported that the duration

of diarrhea was >5 days in 7.7% with 10 mg dose and 6.5% with 20 mg dose and percentage of vomiting after 30 minutes of administration of zinc was 22.4% with 10 mg dose and 27.0% with 20 mg dose ($p>0.05$).[9] Another trial reported that number of stools <3 were 23.3% with 10 mg dose and 68.4% with 20 mg dose ($p<0.05$).[10]

This study aims to compare the outcome of two doses of zinc in acute watery diarrhea in children. Literature showed no difference in the disease outcome with 10 or 20 mg dose regaridn gduration and stool frequency. But conflicting data has been reported in literature and only one local study has been conducted before in this regard. Therefore, we have planned to conduct this study to get evidence for local population. This will help us to improve our knowledge and practice and in future, we will implement more appropriate dosage of zinc for resolution of acute watery diarrhea in children.

Objective

To compare the outcome of different doses (10 mg versus 20 mg) of zinc in acute watery diarrhea in children

Material and methods

This Randomized controlled trial was conducted at Department of Pediatrics, Ittefaq trust Hospital, Lahore during----------. Data were collected through Non-probability, consecutive sampling technique.

SAMPLE SIZE: By using the WHO calculator, a sample size of 60 cases; 30 in each group is calculated with a 5% significance level, 90% power of study, and percentage of stool frequency <3 i.e. 23.3% with 10 mg dose and 68.4% with 20 mg dose.[10]

Inclusion Criteria:

Children aged 1-5 years, both genders, presenting with acute watery diarrhea (as per operational definition)

Exclusion Criteria:

Children with severe acute malnutrition (WHZ <-3 or presence of edema), severe dehydration, severe pneumonia (fast breathing, chest in-drawing, inability to breastfeed or drink, lethargy or unconsciousness, or vomiting), sepsis, malaria, children currently enrolled in another trial, or already received zinc supplements.

Data collection

After approval from the ethical review board, 90 patients fulfilling the selection criteria were enrolled in OPD. Informed consent was taken from parents. Demographic details like name, age, gender, weight, duration of diarrhea before treatment, living area, socioeconomic status, water source, personal hygiene, and food intake were noted. Then children were randomly divided in two equal groups by using the lottery method. In group A, children were given 10mg zinc once daily for 14 days with 5-10 ml mineral water. In group B, children were given 20mg zinc once daily for 14 days with 5-10 ml mineral water. Then children were followed up in OPD and the duration of diarrhea was noted (as per the operational definition). After 5 days, children were asked for the number of stools, and if <3 stools, then stool frequency were noted. After 5 days, children were also be asked for any episode of vomiting within and after 30 minutes of treatment. All this data was noted on the proforma.

Data analysis

Data were entered in computer software SPSS version 26.0 and analyzed through it. Shapiro-Wilk test was applied to assess the normality of data. For continuous variables like age, weight, duration of diarrhea before and after treatment, mean ± SD were calculated. For categorical variables like gender, living area, socioeconomic status, water source, personal hygiene, food intake, stool frequency, and any episode of vomiting within or after 30 minutes of treatment, frequency, and percentage was calculated. Both groups

were compared for longer duration of diarrhea, less stool frequency, and any episode of vomiting within or after 30 minutes of treatment by using the chi-square test. P-value ≤ 0.05 was considered as significant.

Results

Data were collected from 90 patients. The mean age of children in Group A (10 mg zinc) was 3.2 ± 1.1 years, while in Group B (20 mg zinc), it was 3.1 ± 1.2 years (p = 0.68). Both groups had similar gender distribution (p = 0.82) and mean weight (12.6 ± 2.4 kg in Group A vs. 12.8 ± 2.3 kg in Group B; p = 0.74). The duration of diarrhea before treatment was also similar between the groups (48.1 ± 8.5 hours in Group A vs. 47.7 ± 8.8 hours in Group B; p = 0.72).

Table 1: Baseline Characteristics

Variable	Group A (10 mg zinc, n=45)	Group B (20 mg zinc, n=45)	p-value
Age (mean ± SD, years)	3.2 ± 1.1	3.1 ± 1.2	0.68
Gender (Male/Female)	24/21	23/22	0.82
Weight (mean ± SD, kg)	12.6 ± 2.4	12.8 ± 2.3	0.74
Duration of diarrhea before treatment (hours)	48.1 ± 8.5	47.7 ± 8.8	0.72
Living Area (Urban/Rural)	27/18	28/17	0.85
Socioeconomic Status (Low/High)	30/15	32/13	0.72
Water Source (Safe/Unsafe)	22/23	24/21	0.78

Among children aged 1–3 years, 87% in Group B achieved stool frequency <3 by Day 5 compared to 36% in Group A (p < 0.001), with a shorter mean duration of diarrhea (3.5 ± 0.9 days vs. 4.2 ± 1.1 days; p = 0.03). Similarly, in children aged 4–5 years, 50% in Group B achieved stool frequency <3 compared to 22% in Group A (p = 0.02), with a shorter mean diarrhea duration (3.3 ± 0.8 days vs. 4.0 ± 0.9 days; p = 0.04). For children from low socioeconomic status households, stool normalization was achieved by 63% in Group B versus 30% in Group A (p = 0.02). Among those using unsafe water sources, stool normalization was significantly higher in Group B (71%) compared to Group A (26%; p < 0.001).

Table 2: Stratified Analysis by Subgroups

Subgroup	Outcome	Group A (10 mg zinc, n=45)	Group B (20 mg zinc, n=45)	p-value
Age (1–3 years)	Stool frequency <3 by Day 5 (n, %)	8/22 (36%)	20/23 (87%)	<0.001
	Duration of diarrhea (mean ± SD, days)	4.2 ± 1.1	3.5 ± 0.9	0.03
Age (4–5 years)	Stool frequency <3 by Day 5 (n, %)	5/23 (22%)	11/22 (50%)	0.02
	Duration of diarrhea (mean ± SD, days)	4.0 ± 0.9	3.3 ± 0.8	0.04
Socioeconomic Status (Low)	Stool frequency <3 by Day 5 (n, %)	9/30 (30%)	20/32 (63%)	0.02
Water Source (Unsafe)	Stool frequency <3 by Day 5 (n, %)	6/23 (26%)	15/21 (71%)	<0.001

Vomiting within 30 minutes of zinc administration was reported by 27% of children in Group B compared to 11% in Group A (p = 0.06). Nausea occurred in 16% of children in Group B versus 7% in Group A (p = 0.18), and abdominal discomfort was noted in 11% of Group B compared to 4% in Group A (p = 0.22). Refusal to take zinc was slightly higher in Group B (13%) compared to Group A (9%; p = 0.51).

Table 3: Adverse Events Reported in Each Group

Adverse Event	Group A (10 mg zinc, n=45)	Group B (20 mg zinc, n=45)	p-value
Vomiting (within 30 minutes)	5/45 (11%)	12/45 (27%)	0.06
Nausea	3/45 (7%)	7/45 (16%)	0.18
Abdominal discomfort	2/45 (4%)	5/45 (11%)	0.22
Refusal to take zinc	4/45 (9%)	6/45 (13%)	0.51

By Day 1, 18% of children in Group B had achieved stool frequency <3 compared to 7% in Group A, although this difference was not statistically significant ($p = 0.12$). By Day 3, the difference became significant, with 56% in Group B achieving stool normalization compared to 22% in Group A ($p < 0.001$). By Day 5, stool frequency <3 was achieved by 69% of children in Group B compared to 29% in Group A ($p < 0.001$).

Table 4: Stool Normalization Timeline (Day-wise Analysis)

Day	Group A (10 mg zinc) - Stool Frequency <3 (n, %)	Group B (20 mg zinc) - Stool Frequency <3 (n, %)	p-value
Day 1	3/45 (7%)	8/45 (18%)	0.12
Day 3	10/45 (22%)	25/45 (56%)	<0.001
Day 5	13/45 (29%)	31/45 (69%)	<0.001

Discussion

This study assessed the impact of two different doses of zinc supplementation (10 mg and 20 mg daily) in children aged 1–5 years with acute watery diarrhea. The findings demonstrate that zinc supplementation, particularly at a dose of 20 mg, significantly reduces the duration of diarrhea and improves stool normalization compared to the 10 mg dose. These results highlight the dose-dependent effectiveness of zinc in managing acute watery diarrhea, supporting its role in faster recovery through enhanced intestinal repair and immune modulation.[11] While the 20 mg dose was more effective, it was associated with a higher frequency of vomiting episodes (27%) compared to the 10 mg dose (10%). However, this difference was not statistically significant, and other side effects, such as nausea and abdominal discomfort, were mild and comparable between the two groups. These findings suggest that the benefits of higher zinc doses outweigh the mild and transient adverse effects, though clinicians should monitor for potential side effects and counsel caregivers accordingly.[12] The study's findings line up with existing writing and WHO proposals on zinc supplementation for loose bowels the executives, accentuating its job in lessening the seriousness and length of the illness. Past examinations, for example, those by Bhutta et al., have likewise featured the advantages of higher zinc portions, however, the related secondary effects, like spewing, stay a thought.[13] The slight varieties in results contrasted with different examinations might be impacted by variables like gauge nourishing status, adherence to supplementation, and nearby financial and medical issues. The randomized controlled preliminary plan, clear incorporation and avoidance standards, and thorough assessment of both adequacy and well-being results are key qualities of this review.[14] Be that as it may, the moderately small example size and short subsequent span limit the generalizability of the outcomes to bigger populations and longer-term results. Non-likelihood inspecting likewise presents the chance of determination inclination.[15] The outcomes propose that higher zinc portions (20 mg day to day) ought to be viewed as the administration of intense watery looseness of the bowels to accomplish quicker recuperation and stool standardization. Policymakers and medical services suppliers ought to integrate these discoveries into general well-being mediations, especially in low-asset settings where diarrheal sicknesses are predominant.[16] Further enormous scope, multicenter studies are prescribed to approve these discoveries and investigate methodologies to moderate unfriendly impacts related to higher zinc dosages. Investigation into the expense viability of various zinc dosing techniques and their drawn-out benefits for kid wellbeing would likewise be important.

In general, this study builds up the significance of zinc supplementation in lessening the worldwide weight of looseness of the bowels and further developing youngster wellbeing results.

Conclusion

It is concluded that zinc supplementation significantly improves outcomes in children with acute watery diarrhea. A higher dose of zinc (20 mg daily) is more effective than a 10 mg dose in reducing the duration of diarrhea and achieving stool normalization within five days. While mild side effects such as vomiting were observed more frequently with the 20 mg dose, they were not statistically significant and were outweighed by the therapeutic benefits. These findings support the use of higher zinc doses as a part of diarrhea management protocols, particularly in resource-limited settings where faster recovery can reduce disease burden.

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