World Journal of Biology Pharmacy and Health Sciences
eISSN: 2582-5542
Cross Ref DOI: 10.30574/wjbphs
Journal homepage: https://wjbphs.com/

(RESEARCH ARTICLE)

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The Effect of Zinc as Adjunct Therapy in the Treatment of Pneumonia in Hospitalized Children

Heba Yehia Mosa Alsunbuly [1], Basim Hadi Sahib [1], Alaa Kamal Hussein [1], Mustafa Jawad Talib [1] and Alaa Jumaah Manji Nasrawi [2,*]

[1] *Paediatrician in Al-Zahraa teaching hospital for maternity and children in Al-Najaf city, Iraq.*
[2] *Professor, Department of Paediatrics, University of Kufa, Faculty of Medicine, Najaf, Iraq.*

World Journal of Biology Pharmacy and Health Sciences, 2025, 24(01), 502-507

Publication history: Received on 17 September 2025; revised on 25 October 2025; accepted on 27 October 2025

Article DOI: https://doi.org/10.30574/wjbphs.2025.24.1.0923

Abstract

Background: Pneumonia, an inflammation of the parenchyma of the lungs, is a significant cause of morbidity and mortality in childhood globally, rivaling diarrhea as a cause of death in developing countries.

Objective: To determine the effect of zinc as adjunct therapy in treating pneumonia in hospitalized children.

Patients and Methods: Clinical trial randomized study conducted in pediatric word at AL-Zahraa teaching hospital between 1st of January of 2024 through 10th of March 2025, 124 children aged 6-36 months with diagnosis of pneumonia according to WHO were randomly assigned into two groups control group (84 patients) who receive only antibiotic and study group (40 patients) who receive (10 mg orally for children age 6-12month and 20 mg orally for older) until discharge or maximum 14 days plus standard antibiotic treatment, respiratory rate, pulse oximetry, temperature and CXR(if suspected complication) done in both groups.

Result: The study revealed that there is a significant association between zinc administration and decreased risk of treatment failure (so only 5% failure of treatment among the study group, while 19% in the control group), with a p value (0.038 (secondary outcome). The zinc recipient has a shorter period of IV fluid and earlier improvement in feeding and oral fluid intake with p-value (0.006). Also, zinc recipient has a shorter period of hospitalization and recover faster. Still, this difference is not statistically significant (primary outcome).

Conclusion: Using zinc as adjunct therapy reduces the risk of treatment failure in hospitalized children diagnosed with pneumonia and a period of IV fluid therapy, with more rapid improvement in milk feeding and oral fluid intake.

Keywords: Zinc; Pneumonia; Adjuvant Therapy; Pediatrics

1. Introduction

The World Health Organization has defined pneumonia in children clinically based on either a cough or difficulty breathing and (a rapid respiratory rate, chest indrawing, or a decreased level of consciousness. (1) The epidemiological pattern of pneumonia is constantly altering because of altered immune mechanisms and changes in medical practice; there is an increasing level of resistance to antibiotics by the more common pathogens, such as S. pneumoniae (2). For these reasons accurate identification and treatment of the etiological agent causing pneumonia is important(.3) WHO is estimated that more than 150 million episodes of pneumonia occur every year among children under five in developing countries, reaching for more than 95 per cent of all new cases worldwide, between 11 million and 20 million children

* Corresponding author: Alaa Jumaah Manji Nasrawi

with pneumonia required hospitalization, and more than 2 million died from the disease, it is also important to note that incidence of pneumonia among children decreases with age. (4,5) Although microorganisms cause most cases of pneumonia, noninfectious causes include aspiration of food or gastric acid, foreign bodies, hydrocarbons, and lipoid substances, hypersensitivity reactions, and drug or radiation-induced pneumonitis. (6) Identification of the responsible organism is challenging because of difficulty obtaining adequate samples, lack of reliable diagnostic methods, and difficulty differentiating infection from colonization. (7) Zinc is the active center of about 300 enzymes, an essential human trace element. It has been noted that the amount of zinc ingested per day may be insufficient relative to the daily requirement in some groups of individuals. (8) Zinc is necessary for the normal function of the immune system (9,10). The number of granulocytes is shown to be decreased during zinc deficiency (11). Zinc-deficient children are at increased risk of restricted growth and developing diarrheal diseases, as well as respiratory tract infections, such as acute lower respiratory tract infections. (12, 13) Some research studies have suggested that zinc supplementation may decrease the number of episodes and severity of bronchiolitis and pneumonia cases (14, 15). Zinc is thought to help reduce susceptibility to acute lower respiratory tract infections by regulating various immune functions, including protecting the health and integrity of the respiratory cells during lung inflammation or injury (16).

Objective of the study

This study aims to evaluate the role of zinc as adjunct therapy in treating pneumonia in hospitalized children.

2. Methods and Patients

This study was randomized control clinical trial study conducted between 1st of January 2024 to10th March 2025 at pediatric department in Al Zahraa a teaching hospital, the inpatient 124 child aged between 6 months and 36month were assessed and considered eligible for enrollment in study if they fulfilled WHO criteria for diagnosis of pneumonia. The age, sex, detailed history of child illness, physical examination, type of feeding (breast, bottle, mixed, and weaned), axillary temperature, and respiratory rate were calculated over one minute when the child was not crying. We calculated weight for height (WFH) and height for age (HFA) to exclude wasted and stunted children, respectively, in both groups, using the 2006 WHO Child Growth Standards. (17) CXR was taken for patients.

The exclusion criteria that applied include: documented pulmonary TB, concomitant diarrhea with dehydration, signs of systemic illness (sepsis or hemodynamic instability), recurrent wheezing, patient has cardiac disease or renal disease, signs of severe malnutrition, Complicated pneumonia (empyema, abscess).

The cases randomly assigned were divided into zinc-supplemented and control groups. 10 mg zinc sulfate was given to children younger than 12 months and 20 mg was given to children older than 12 months within 1st 24 hrs. of admission as a single daily dose until discharge or for a maximum of 14 days, for young children zinc tablet was dissolved in 5 cc distilled water, for children who vomited in the first 15 minutes, another dose was given. During hospitalization, the children were assessed at first every 12 hours by measuring temperature, oxygen saturation, and evaluating the severity of pneumonia. Statistical analysis was done using SPSS (Statistical Package for Social Sciences) version 20, using the chi-square test for categorical data and the independent sample T-test for numerical data, and setting P value ≤0.05 as significant.

3. Results

The study included 131 patients who were randomly assigned and divided into two groups: the study group (45 cases) to receive zinc in addition to the antibiotic was excluded, as they fulfilled exclusion criteria, and the control group, 86, to receive only the antibiotic, two of them were excluded. The gender distribution of the studied group is shown in Figure 1. In zinc zinc-supplemented group, there were 19 (47.5%) males and 21 (52.5%) females. While in the control group, there were 40 (47.6%) males and 44 (52.4%) females, with no significant difference between groups.

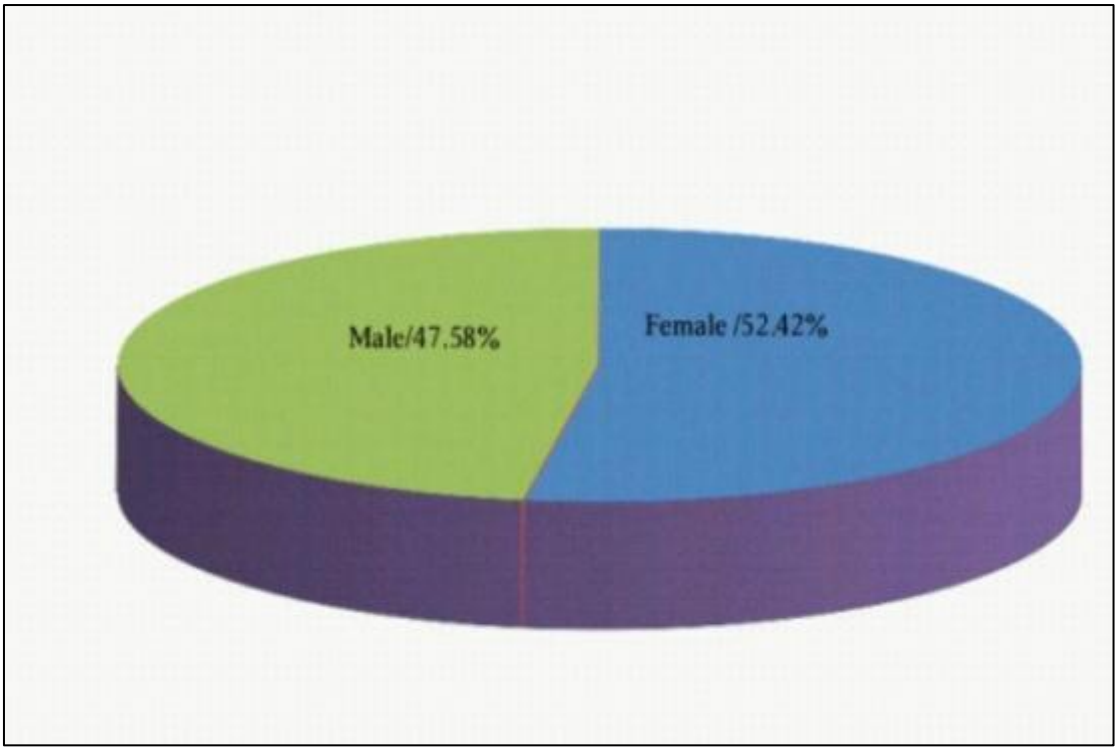

Figure 1 gender distribution of the studied patients

Table 1 compares the zinc and control groups regarding specific parameters

Parameter	**Study group (n=40)**	**Control group (n=84)**	**P value**
	Mean ± SD	Mean ± SD	
Age (months)	14.5 ± 8.23	13.5 ± 6.9	0.481
R.R. at the admission of children ≤ 12 months old	56.95 ± 3.34	57.4 ± 3.4	0.606
Mean RR/minute at admission in children> 12 months. old age	49.75 ± 5.47	49.17 ± 3.01	0.634
Time of recovery in hrs.	27 ± 9.8	32 ± 12.89	0.075
Mean Temp. at admission in C^0	38.12 ± 0.29	38.11 ± 0.17	0.167
Mean Temp. at discharge in C0	37.09 ± 0.29	37.02 ± 0.12	0.097
Pulse oximetry at admission /SpO2 on room air	93.02 ± 1.65	92.88 ± 1.94	0.694
Period of hospitalization/hours	77.87 ± 38.49	88.76 ± 57.42	0.284
Times of O2 need in hrs.	18.48 ± 17.28	21.6 ± 10.56	0.326
Days of IV fluid need	1.12 ± 0.33	1.38 ± 0.53	0.006

In Table 1, there was no significant difference in all parameters, except for the days of IV fluid needs, which were greater in the control group, indicating difficulties with feeding (less than 50% of the usual daily milk intake and oral fluid intake).

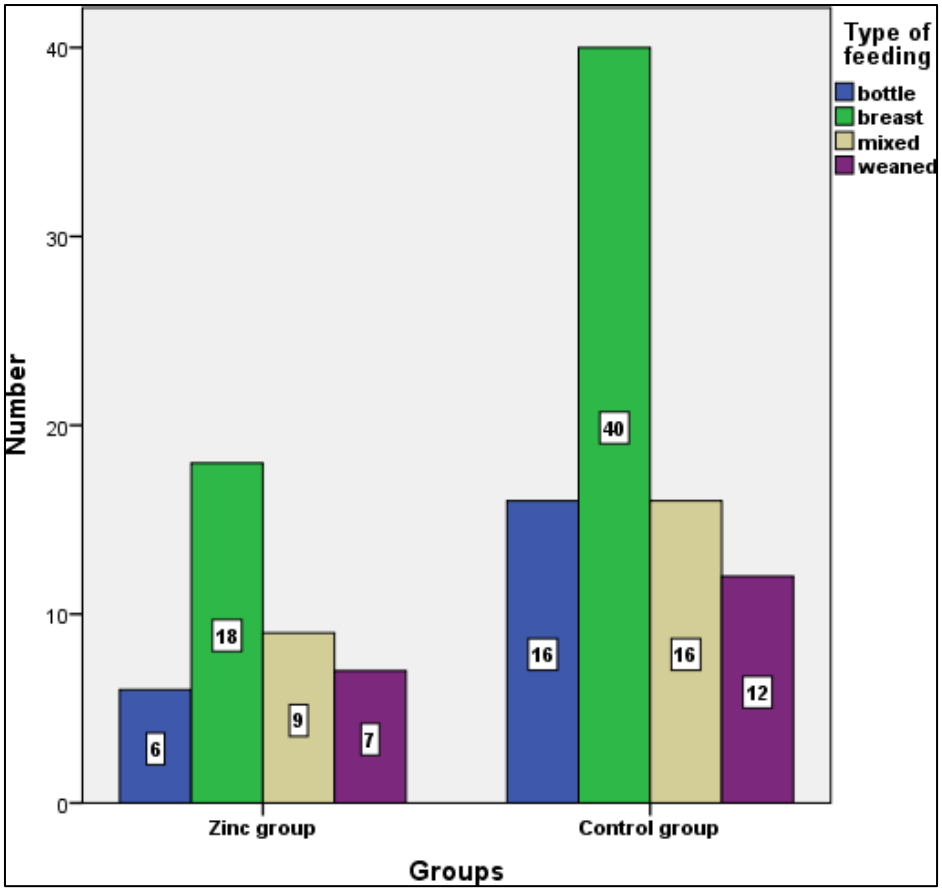

Figure 2 Relation between type of feeding and the studied groups

Table 2 Relation between the use of zinc and the failure of treatment among patients with pneumonia

	Failure of treatment		Total	P value
	Yes	No		
Study group	2 (5%)	38 (95%)	40 (100%)	0.038
Control group	16 (19%)	68 (81%)	84 (100%)	
Total	18 (14.5%)	106 (85.5%)	124	

In Table 2, there was a significant association between treatment success and the administration of zinc, so only 5% of the study group failed, while 19% of the control group failed.

4. Discussion

This study on the effect of zinc as adjunct therapy in treatment of pneumonia in hospitalized children in addition to standard antibiotic therapy shows that the study group recover faster and has less period of hospitalization than control group(primary outcome) but the results were non statistically significant differences as shown in table (1) time to recovery in study group means in hours was(27±9.8) versus (32±12.89)in control group with p value (0.075) this similar to two studies one done in INDIA by Basnet S with p value(0.22)(18) and another done in Nepal by Shah G S (19)in addition to the period of admission in study groups means in hours was (77.87) in study groups versus (88.76) in control groups with p value (0.284) this result is agree with trial that done by Shah G S (19) with p value was (0.193) regarding time of hospital stay in hours , and the time of O2 need in study group (mean in hrs. 18.48) while (21.6) in control group with p value (0.326) this agree with study of Shah G S (19) with p value (0.6). The result of our research

not agree with outcome of the study that conducted in India by Mahala Nabis (20) which suggested significantly shorten duration of pneumonia and period of stay in hospital with p value (0.004), the different in outcome in various studies could be better explain if pre and post treatment plasma zinc level measurement has been done as such benefit could be expected if children in Zn deficient state.

In our study there is statistically significant decrease the need of IV fluid (earlier proper feeding>50% of usual milk and oral fluid intake) in study group (mean 1.12) days versus (mean1.38) days in control group with p value(0.006), this result is agree with the study done by Brooks (21)but not agree with study done by Shah G S (19) with p value (0.2) for duration IV fluid, this difference may be due to variation in clinical condition of Patient and ability to tolerate oral intake.

In table (2) there was significant association between decrease the rate of treatment failure and zinc administration(secondary outcome) so only 5% failure treatment among study group while 19% failure of treatment among control group with p value(0.038) this is agree with the result of Two studies, Brooks (21)and another done by Mahala Nabis in India (20), showed that(the children who received zinc were less likely to need a change in the AB being use), this could have significant implication for reducing AB - resistant infection by decreasing AB exposure). In contrast, a study by Basnet S (18) shows that the risk of treatment failure was slightly but not significantly lower in those who received zinc. The observed reduction in treatment failure with zinc supplementation aligns with broader efforts at Al-Zahraa Teaching Hospital to improve pediatric outcomes through adjunct therapies. (22-23)

5. Conclusion

Zinc sulfate is effective as an adjunct therapy for treating pneumonia in children aged 6 to 36 months. It reduces the rate of treatment failure and the duration of IV fluid necessity, allowing for earlier milk or oral fluid intake on average. However, the use of zinc wasn't found to be statistically significant in reducing the period of hospitalization, shortening the recovery period, or decreasing the duration of O2 need.

Recommendation

Use oral zinc in hospitalized children diagnosed with pneumonia to reduce treatment failure and promote earlier milk feeding and oral fluid intake. Assess zinc levels in children more prone to zinc deficiency (more than once) to explore the potential benefit of introducing a higher dose or extending the duration for these children.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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