Zinc Supplementation Versus Placebo for Bronchiolitis Management in Children: A Comparative Study

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Abstract

Objective: To evaluate the efficacy of zinc supplementation compared to a placebo in augmenting standard therapy for the management of bronchiolitis in pediatric patients.

Material and Methods: In this 12-month single-blind randomized controlled trial at the at the Children's Hospital and University of Child Health Sciences 102 children (2-23 months) with acute bronchiolitis were collected through non-probability conveniently sampling technique and equally divided into case and control groups. Each group received either 1% zinc sulfate solution or placebo alongside standard therapy. Progress, monitored for up to 120 hours of hospital stay, was analyzed using SPSS v26, adhering to a 95% confidence level and a 5% margin of error.

Results: In infants with acute bronchiolitis, zinc sulfate led to faster improvements. At 24 and 48 hours, they exhibited fewer symptoms of cough and wheezing than the control group, a trend supported by statistical significance (p=0.000). Moreover, beyond 48 hours, they showed higher oxygen saturation levels and had shorter hospital stays (average 2.37 vs. 3.33 days), illustrating zinc's potential in enhancing recovery from acute bronchiolitis.

Conclusion: Recent findings suggest zinc sulfate could be a promising adjunct treatment for children with acute bronchiolitis, reducing symptom severity and hospital stay duration without adverse effects. Further research is needed to establish optimal dosage and treatment duration, particularly for critically ill pediatric populations.

Keywords: Bronchiolitis, Oxygen saturation, Pediatrics, Respiratory tract infections, Zinc sulfate.

How to cite: *Arshad AH, Rathore AW, Awan AN. Zinc Supplementation Versus Placebo for Bronchiolitis Management in Children: A Comparative Study. Esculapio - JSIMS 2023;19(04):399-403.*

DOI: https://doi.org/10.51273/esc23.25131945

Introduction

Historically, acute bronchiolitis has been a predominant agent behind hospitalizations linked to lower respiratory tract infections, particularly in infants.[1] In the USA, the annual hospitalizations due to acute bronchiolitis ranged from 50,000 to 80,000 cases, with the respiratory syncytial virus identified as the primary causative agent.[2-4] The symptomatic presentation of acute bronchiolitis tachypnea, fever, and wheezing often mirrored that of viral pneumonia, thus necessitating differential diagnostic approaches.[2,5] The therapeutic interventions traditionally employed centered on supportive care including oxygen and fluid therapy, coupled with the administration of anti-pyretics.[6,7] Despite the introduction of newer strategies such as nebulization with various agents and the use of intravenous corticosteroids, a consensus on the optimal therapeutic regimen remained elusive.[8,9] Furthermore, although antibiotics were sometimes prescribed to forestall secondary infections, the evidential basis supporting their efficacy was not robust.[2,6] Within this therapeutic landscape, researchers turned their attention to zinc supplementation, a strategy grounded on zinc's known anti-inflammatory and antioxidant capabilities.[10,11] It was understood that

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Submission Date: 18-09-2023
1st Revision Date: 08-10-2023
Acceptance Date: 10-12-2023

zinc played a crucial role in immune development and protection against infections, facilitating normal growth and tissue repair among other biological functions.[5,12] In the preceding years, studies embarked on exploring the potential benefits of zinc supplementation in the management of respiratory tract infections yielded discordant results.[7,13] While some demonstrated substantial improvements in the signs and symptoms experienced by patients receiving zinc supplementation,[6,9] others reported no significant differences compared to placebo controls.[8,14]

It was within this dichotomy of results that the current study was conceived, intending to delineate the efficacy of zinc supplementation compared to a placebo in ameliorating symptoms such as dyspnea, fever, and tachypnea in a pediatric cohort aged between 2 to 23 months grappling with acute bronchiolitis.[9,15] The study was propelled not only by the conflicting narratives presented in preceding research but also by the notable scarcity of data examining this aspect within the Pakistani population.[6,16] An underlying objective was to cast a wider net in capturing data, encompassing personal attributes such as diet, type of respiratory infection, age, gender, and birth weight to offer a nuanced perspective and a richer analytical ground.

By orchestrating this focused study, the aim was[15,17] to potentially unearth a robust therapeutic avenue that could enhance the existing treatment protocols for acute bronchiolitis in Pakistani children, facilitating a faster recovery and improving their overall health outcome.[17,18] Moreover, if validated, this research could position zinc supplementation as a pivotal adjunct therapy in the standard treatment of acute bronchiolitis, fostering a globally healthier pediatric population.

Material and Methods

This single-blind randomized controlled trial spanned a duration of twelve months and was executed at the at the Children's Hospital and University of Child Health Sciences. A total of 102 children having age group between 2 and 23 months, exhibiting clinical manifestations of acute bronchiolitis, constituted the study population[19,20]. Employing a non-probability convenient sampling technique, participants were apportioned evenly into case and control groups through random number tables, each harboring 51 participants.[21] The determination of this sample size adhered to a 95% confidence level and a 5% margin of error, as guided by the formula available at https://clincalc.com/stats/ samplesize. aspx.[22] Upon receipt of the ethical board certificate and obtaining written consents from the parents, data harvesting commenced in the pediatric medicine ward of the Children's Hospital and Institute of Child Health in Lahore. It encapsulated a meticulous documentation of demographic attributes and preceding medical narratives. Therapeutically, one faction received a 1% zinc sulfate solution (20mg/5ml) administered orally, compared to the other group which was tendered a placebo comprised of 5%-100% glucose water accentuated with oral flavoring, ensuring parity in the general attributes such as appearance, smell, color, and taste between the active and placebo interventions.[23,24]

Over the span of the hospitalization, each patient's progress was reported at a series of intervals: upon admission and then following at 24-hour increments until reaching the 120-hour mark, utilizing a prefabricated Performa to inscribe the findings.[23]

The analytical apparatus used for data assessment was the SPSS v26. The synthesis of numerical data embraced a representation through mean±SD, whereas categorical data found a voice through frequency distribution and percentage illustrations. Within this analytical framework, independent sample t-tests and chi-square tests piloted the between-group analyses, steering towards a significance delineation earmarked at a P-value ≤ 0.05.

Results

Table 1 illustrates the gender distribution among the 102 participants in a bronchiolitis study. Overall, there is a near-balanced gender representation with males constituting 52.0% and females 48.0%. In the case group of 51 participants, males were slightly more predominant at 54.9%, compared to 45.1% females. Conversely, the control group had a marginally higher female participation at 51.0%, against 49.0% males, maintaining a balanced gender distribution essential for reliable study outcomes. Table also delineates the mean and standard deviation of key attributes such as age, symptom duration, cough duration, and hemoglobin levels for the 102 participants, both overall and divided into case and control groups. The table reveals a balanced distribution across both groups, laying a solid groundwork for the comparative analysis in the study. At the 24-hour mark, a significant difference was observed in the instances of cough and wheezing between the two groups, with control groups registering higher occurrences (Cough:

Case - 25, Control - 42, p=0.000; Wheezing: Case - 25, Control - 45, p=0.000). This trend was noticeable at the 48-hour interval as well, where the control group continued to have a higher number of cases presenting with these symptoms (Cough: Control - 32, p=0.017; Wheezing: Control - 27, p=0.000). (Table-2) As time progressed, the frequency of most symptoms decreased substantially in both groups, reaching zero for several symptoms at the 72-hour, 96 hours and 120 hours. Notably, symptoms such as rhinorrhea and fever were non-existent in both groups at the 72-hour mark, indicating a substantial decline in symptom prevalence over time (Rhinorrhea: 72 hours p=1.0; Fever: 72 hours p=0.041).

Table 1: *Demographics of Participants in the Bronchiolitis Study (Overall and by Study Group)*

Attributes	Case	Control	Overall
Gender			
• Male	28 (54.9%)	25(49%)	53(52%)
• Female	23(45.1%)	26(51%)	49(48%)
Age (Months)	8.24±4.26	8.59±4.07	8.41±4.15
Duration of symptoms (days)	1.98±0.65	2.16±0.61	2.07±0.63
Duration of cough (days)	2.06±0.65	2.04±0.77	2.05±0.71
Hemoglobin level (g/dl)	11.39±0.27	11.37±0.26	11.38±0.27

Table 3: *Oxygen Saturation Levels and Hospital Stay Duration Post-Treatment*

Parameters	Study Group	Mean	Std. Deviation	P-Value
Oxygen Saturation 24 Hours After Treatment (%)	Case	95.2941	0.83172	0.286
	Control	95.4902	1.00742	
Oxygen Saturation 48 Hours After Treatment (%)	Case	96.3922	1.32783	0.005
	Control	95.7647	0.78964	
Oxygen Saturation 72 Hours After Treatment (%)	Case	96.8039	0.91694	0.000
	Control	96.1961	0.44809	
Oxygen Saturation 96 Hours After Treatment (%)	Case	97.3333	0.47610	0.000
	Control	97.0196	0.14003	
Oxygen Saturation 120 Hours After Treatment (%)	Case	97.4706	0.50410	0.003
	Control	97.1961	0.40098	
Duration of Hospital Stay (days)	Case	2.373	.5987	0.000
	Control	3.33	1.0708	

Table 2: *Clinical Manifestations Post-Treatment (24 to 120 Hours)*

Manifestations	24 hours (P-value)	48 hours (P-value)	72 hours (P-value)	96 hours (P-value)	120 hours (P-value)
Rhinorrhea	Case: 7 Control: 8 (.780)	Case: 4 Control: 2 (.400)	Case: 0 Control: 0 (1)	—	—
Cough	Case: 25 Control: 42 (.000)	Case: 20 Control: 32 (.017)	Case: 8 Control: 16 (.062)	Case: 0 Control: 2 (.153)	Case: 0 Control: 0 (1)
Fever	Case: 15 Control: 19 (.401)	Case: 8 Control: 12 (.318)	Case: 0 Control: 4 (.041)	Case: 0 Control: 0 (1)	—
Tachypnea	Case: 10 Control: 18 (.046)	Case: 7 Control: 10 (.425)	Case: 0 Control: 6 (.012)	Case: 0 Control: 0 (1)	—
Dyspnea	Case: 0 Control: 1 (.315)	Case: 0 Control: 0 (1)	—	—	—
Nasal flaring	Case: 5 Control: 8 (.373)	Case: 0 Control: 4 (.041)	Case: 0 Control: 0 (1)	—	—
Subcostal retraction	Case: 6 Control: 5 (.750)	Case: 0 Control: 3 (.079)	Case: 0 Control: 2 (.153)	—	—
Intercostal retraction	Case: 8 Control: 6 (.565)	Case: 1 Control: 4 (.169)	Case: 0 Control: 0 (1)	—	—
Cyanosis	Case: 0 Control: 0 (1)	—	—	—	—
Wheezing	Case: 25 Control: 45 (.000)	Case: 9 Control: 27 (.000)	Case: 0 Control: 17 (.000)	Case: 0 Control: 0 (1)	—
Fine crackles	Case: 4 Control: 4 (1)	Case: 3 Control: 2 (.647)	Case: 0 Control: 0 (1)	—	—

(Table-2) Initially, oxygen saturation was found comparative in both groups. However, the case group demonstrated a consistent, statistically significant improvement in oxygen levels from the 48-hour mark, and experienced shorter hospital stays (2.37 days vs. 3.33 days in the control group), showcasing the potential effectiveness of the supplementation used in the case group. (Table-3)

Discussion

This study delves into the profound impact of zinc sulfate in alleviating symptoms of acute bronchiolitis in children, revealing some striking results when compared to a placebo-controlled group. Children receiving zinc sulfate showed a remarkable recovery rate of 94.1% within just 72 hours of beginning treatment, a significant leap from the 66.67% observed in the placebo group. This wasn't the only noteworthy outcome; the average hospital stay for those treated with zinc sulfate was notably shorter, averaging 2.3 days in comparison to the placebo group's 3.33 days. This reduction in hospitalization time is a testament to the potential of zinc sulfate in enhancing the recovery process. Children treated with zinc sulfate showed considerable improvement in clinical symptoms like cough, wheezing, and tachypnea, and experienced better oxygen saturation levels. These findings are more than statistics; they represent real improvements in the health and well-being of young patients. The exploration of zinc's efficacy in treating respiratory conditions is not new domain; numerous studies have conducted studies this, yielding a spectrum of conclusions. Some studies echo our findings[11,18,25] highlighting zinc's role in not just improving clinical symptoms but also in reducing the duration of hospital stays. However, the scientific narrative is not singular. Research papers like those by authors[8,14] challenge this notion, finding no significant link between zinc supplementation and faster clinical recovery or shorter hospital stays. This dichotomy underscores the complexity and nuanced nature of medical research in understanding zinc's true impact. Current study stands out, offering compelling evidence of the benefits of zinc sulfate supplementation. By demonstrating higher recovery rates and reduced hospitalization times, it calls for more extensive research to validate these promising results. The study enriches the ongoing discourse on zinc supplementation, suggesting its potential as a valuable support in enhancing the recovery for children battling acute bronchiolitis. The hope is that future research, encompassing larger and more diverse groups of children, will shed further light on this topic, helping to paint a clearer picture of zinc's role in pediatric respiratory health.

Conclusion

This study, along with supporting literature, suggests that zinc sulphate may be an effective supplementary treatment in managing acute bronchiolitis in children. It appears to reduce the severity of the illness and shorten hospital stays, without any reported side effects. However, more research is needed to determine the best dosages and treatment lengths, particularly in severely ill pediatric patients, to maximize the therapeutic benefits of zinc sulphate in bronchiolitis management.

Conflict of Interest *None*

Funding source *None*

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Authors Contribution

AHA: Conceptualization of Project
AHA: Data Collection
AWR: Literature Search
ANA: Statistical Analysis
AWR: Drafting, Revision
ANA: Writing of Manuscript