



P-ISSN: 2664-3685

E-ISSN: 2664-3693

www.paediatricjournal.com

IJPG 2019; 2(2): 175-178

Received: 05-11-2019

Accepted: 22-11-2019

Dr. Kalyan Kunchapudi

Assistant Professor,
Department of Paediatrics,
Tagore Medical College,
Chennai, Tamil Nadu, India

Dr. Kiran Karthik Veeranki

Assistant Professor,
Department of Paediatrics,
RVS Institute of Medical
Science, Chittore, Andhra
Pradesh, India

Examining the blood zinc levels of children with acute respiratory tract infections, aged six months to five years

Dr. Kalyan Kunchapudi and Dr. Kiran Karthik Veeranki

DOI: <https://doi.org/10.33545/26643685.2019.v2.i2c.244>

Abstract

Background and Objectives: Acute respiratory tract infections are a prominent cause of mortality and morbidity in children residing in poor countries. This inquiry focuses on the serum levels of zinc in patients with acute lower respiratory tract infections. This is linked to the severity of acute lower respiratory tract infection, the need for intravenous antibiotics, and the pattern of recovery.

Material and Methods: This study is a case-control inquiry conducted at the Department of Paediatrics, RVS Institute of Medical Science, Chittore, Andhra Pradesh, India. The study was conducted from October 2018 to September 2019. The study's sample included 70 cases of Acute lower respiratory tract infection, as well as 70 children who were selected as controls based on their matching sex, age, and nutritional condition.

Results: An extended duration of hospitalization was linked to a decrease in the average concentration of zinc in the blood. The mean zinc concentration declined within the range of typical zinc levels in children who were hospitalized for a duration of less than 7 days. Furthermore, there was a greater occurrence of zinc insufficiency detected when comparing patients to controls. A higher percentage of children with bronchiolitis showed a normal zinc level. A greater percentage of children with pneumonia, namely lobar pneumonia, displayed a zinc deficit. Furthermore, a higher percentage of children with severe acute lower respiratory tract infections demonstrated zinc insufficiency in comparison to those with mild and moderate acute lower respiratory tract infections.

Conclusion: Severe acute lower respiratory tract infections exhibited a significant reduction in serum zinc levels when compared to mild and moderate acute lower respiratory tract infections. In addition, it was noted that children who needed to stay in the hospital for a longer period of time had lower amounts of zinc in their blood.

Keywords: Zinc level, children, acute respiratory tract infections, antibiotics, therapy

Introduction

Acute lower respiratory tract infections, or ALRTIs, are the primary cause of illness and mortality in children under the age of five worldwide. ALRTI is thought to be the cause of about 19% of these children's mortality (19 million deaths annually). Over 90% of these deaths occur in developing nations, and two thirds occur during infancy. Intravenous antibiotics, oxygen, or (in extreme situations) assisted ventilation are used in the therapy of ALRTI. The main obstacles to lowering the death rate from ALRTI include the rise in antibiotic resistance, poor access to medical facilities, and the inability to widely distribute vaccinations against *Haemophilus influenzae* and *Streptococcus pneumoniae* in the majority of developing nations^[1, 2].

According to a recent meta-analysis of randomised controlled trials (RCTs), habitual oral zinc supplementation given daily or weekly for at least three months significantly reduced the occurrence of lower respiratory tract infections (LRTIs) among children under five in developing nations. With varying degrees of success, several studies have evaluated the usefulness of short-term zinc use in addition to supportive care and antibiotics for the treatment of juvenile pneumonia. Further confusing the situation regarding zinc's involvement in treating pneumonia in young children is the fact that certain textbooks have begun to discuss the advantages of zinc in the treatment of pneumonia^[3, 4].

In order to determine if short-term zinc supplementation during an acute pneumonia episode has any bearing on the treatment of children under the age of five who are hospitalized with severe ALRTI, the current meta-analysis was designed. Seminal fluid contains a higher proportion of zinc. Iron is a vital constituent of numerous enzymes, including as superoxide dismutase, carbonic anhydrase, alkaline phosphatase, DNA and RNA polymerase, and

Corresponding Author:

Dr. Kiran Karthik Veeranki

Assistant Professor,
Department of Paediatrics,
RVS Institute of Medical
Science, Chittore, Andhra
Pradesh, India

reverse transcriptase. It fulfills various physiological functions. Both cell division and DNA replication are dependent on it. Preserving cell integrity and immunity is crucial in cells that have a high turnover rate. Therefore, it is crucial for maintaining infection control and preventing the spread of illnesses [5, 6].

The body does not store zinc, despite its numerous use. Zinc is a vital nutrient that cannot be stored in the body like iron. Therefore, it must be ingested regularly to maintain adequate levels. Foods such as nuts, cereals, seafood, dairy, red meat, and other animal proteins contain zinc. Due to the presence of phytate, a compound that forms complexes with zinc and inhibits its absorption, the majority of vegetables are not considered to be substantial sources of zinc. Extensive research has confirmed the importance of zinc in treating diarrhoea. Numerous studies have demonstrated that zinc supplementation can effectively decrease the severity, duration, and frequency of diarrhoea. Therefore, it is advisable to take zinc supplements when experiencing diarrhoea [7-10].

Several studies have established a correlation between zinc deficiency and a higher risk of acute lower respiratory tract infections. Additionally, the administration of zinc supplements has been proven to reduce the frequency of these illnesses. Trials showed a decrease in the occurrence of acute lower respiratory tract infections when individuals with pneumonia were given zinc supplementation. Furthermore, the inclusion of zinc in antibiotic treatment has not demonstrated any therapeutic benefit in clinical trials. This inquiry focuses on the serum levels of zinc in patients with acute lower respiratory tract infections. This is linked to the severity of acute lower respiratory tract infection, the need for intravenous antibiotics, and the pattern of recovery [11-13].

Materials and Methods

This study is a case-control inquiry undertaken at the Department of Paediatrics, RVS Institute of Medical Science, Chittore, Andhra Pradesh, India. The study was conducted from October 2018 to September 2019. The study included a total of 70 cases of acute lower respiratory tract infection, along with a control group of 70 children who were selected to have similar characteristics in terms of sex, age, and nutritional condition.

Inclusion Criteria

Severe acute lower respiratory tract infection was diagnosed based on symptoms such as tachypnea, chest retractions, high temperature, convulsions, extreme lethargy, or inability to suck or drink.

Exclusion Criteria

- Children who had experienced episodes of diarrhea within the past three months were excluded from the research.
- Additionally, children who were currently receiving zinc supplements were also unable to participate.

Results

A comprehensive analysis was conducted on a total of 70 instances of acute lower respiratory tract infections, where they were classified according to age, gender, and nutritional condition. Age and nutritional status were aligned within a 3-month period, and weight for age was

assessed to guarantee compatibility. Since the children in both the cases and controls were matched based on age and sex, the number of children in each age group and the number of boys and females in both cases and controls were exactly the same.

Table 1: Patient distribution based on gender

| Sr. No. | Gender | Number | % |
|---------|--------|--------|-----|
| 1. | Male | 43 | 62 |
| 2. | Female | 27 | 38 |
| | Total | 70 | 100 |

Table 2: Patient distribution based on age

| Sr. No. | Age | Number | % |
|---------|-----------|--------|-----|
| 1. | <1 year | 33 | 47 |
| 2. | 1-3 years | 14 | 20 |
| 3. | 3-5 years | 23 | 33 |
| | Total | 70 | 100 |

Table 4: Zinc Deficiency

| Sr. No. | Serum Zinc average | Case | % |
|---------|--------------------|------|-----|
| 1. | < 60 | 40 | 57% |
| 2. | > 60 | 30 | 43% |
| | Total | 70 | 100 |

Table 5: Level of serum zinc and antibiotics

| Sr. No. | Antibiotic | Number | Mean of Serum Zinc |
|---------|------------|--------|--------------------|
| 1. | Not given | 20 | 79.43 |
| 2. | IV | 25 | 55.72 |
| 3. | Oral | 25 | 62.87 |
| | Total | 70 | 61.54 |

Discussion

Acute lower respiratory tract infections are a major cause of mortality and morbidity in children below the age of 5. Therefore, it is crucial to adopt measures that are designed to prevent and reduce the severity of respiratory tract infections. Various risk factors contribute to the onset of acute lower respiratory tract infections. Various risk factors have been identified, such as a lack of education, low social and economic status, external influences, poor living conditions, limited access to healthcare, low rates of immunization, malnutrition, deficiencies in important micronutrients, and demographic factors [14, 15].

Zinc, a micronutrient, has been recognized as a possible factor in the development of acute lower respiratory tract infections. It can either have a direct impact on the respiratory tract or contribute to the body's immune system. Furthermore, it demonstrates antioxidant properties. This intervention has the ability to reduce inflammation in the respiratory tract, hence promoting healing and speeding up recovery from numerous illnesses. The high occurrence of zinc shortage in developing countries might be ascribed to either insufficient intake of zinc-rich food or the presence of phytate in dietary items, which impedes zinc absorption. Additionally, the reduced zinc level in soil could potentially contribute to the diminished zinc content observed in food [16-18].

Hence, it may be important to administer zinc supplements in order to attenuate and minimize the intensity of acute lower respiratory tract infections. Numerous studies have demonstrated the efficacy of zinc supplementation in reducing the incidence of acute lower respiratory tract

infections. Zinc deficiency or a diminished zinc status has been observed in certain research pertaining to acute lower respiratory tract infections or pneumonia. There were 33 males and 17 females in this study. The results of this study suggest that children diagnosed with acute lower respiratory tract infections had lower levels of zinc in their blood compared to a control group that was similar in terms of age, sex, and nutritional status.

Children diagnosed with bronchiolitis exhibited the greatest mean serum zinc levels, whereas children diagnosed with lobar pneumonia displayed the lowest mean levels^[19, 20].

An inverse correlation was found between the average blood zinc concentration and the severity of acute lower respiratory tract infections, suggesting that as the severity grew, the zinc level declined. The cases that necessitated intravenous antibiotics showed the lowest average serum zinc level. No significant difference in zinc levels was identified between children who needed oxygen and those who did not. An extended duration of hospitalization was linked to a decrease in the average concentration of zinc in the blood. The average zinc concentration declined within the range of normal zinc levels in children who were hospitalized for a duration of less than 7 days^[21-22].

Zinc deficiency was identified in 76% of patients and 19% of controls. 33.3% of children diagnosed with bronchiolitis exhibited a zinc deficiency. Out of the children diagnosed with pneumonia, 80.4% were found to have a zinc deficit. Similarly, in cases of acute lower respiratory infection without any abnormalities seen on radiological scans, 90.4% of children tested positive for zinc insufficiency. Of the people with moderate acute lower respiratory infection (ALRI), 71.8% had a lack of zinc. 70.4% of individuals with mild ALRI exhibited zinc deficit, whereas 91.6% of those with severe ALRI displayed zinc deficiency. Among ALRI cases where antibiotics were not provided, 26.6% exhibited zinc deficiency. Zinc deficit was identified in 81.4% of children who were taken oral antibiotics, but 86.2% of children who received intravenous antibiotics displayed zinc shortage. Zinc shortage was discovered in 82.5% of cases with a hospital stay ranging from 7 to 14 days, however in cases where the hospital stay surpassed 14 days, zinc insufficiency was found in 100% of cases^[23-25].

Conclusion

All children who stayed in the hospital for more than 14 days had a deficiency of zinc. In 82.5% of children who stayed in the hospital for 7 to 14 days, and in 48.8% of cases where the hospital stay was less than 7 days, zinc deficiency was also found. Children with acute lower respiratory tract infections had lower levels of zinc in their blood compared to healthy children. Malnutrition was linked to low levels of zinc in the blood. Children with protein-energy malnutrition and acute otitis media infections also had decreased levels of zinc in their blood. The severity and duration of acute lower respiratory tract infections were also associated with lower levels of zinc in the blood. Severe cases of acute lower respiratory tract infections had significantly lower levels of zinc in the blood compared to moderate and mild cases. Furthermore, children who needed a longer hospital stay had low levels of zinc in their blood.

Funding

None

Conflict of Interest

None

References

1. Nair BT *et al.* Role of zinc supplementation in acute respiratory tract infections in children aged 2 to 60 months. *Int J Contemp Pediatr.* 2017 Sep; 4(5):1758-1762
2. Hussain A, Saldanha P, Sharma D, Pandita A, Yachha M, Tariq M. Estimation of zinc levels in children with lower respiratory tract infections: A prospective observational study from India. *Pediatric, Neonatal Nurse Open J.* 2016 Apr 18;2(3):91-98.
3. Chasapis CT, Loutsidou AC, Spiliopoulou CA, Stefanidou ME. Zinc and human health: an update. *Archives of Toxicology* November 2011; 86(4):521-534
4. Singh T, Sharma S, Nagesh S. Socio-economic status scales updated for 2017. *Int J Res Med Sci.* 2017 Jul;5(7):3264-3267.
5. Johnsen Ø, Eliasson R. Evaluation of a commercially available kit for the colorimetric determination of zinc in human seminal plasma. *International Journal of Andrology.* 1987 Apr 1; 10(2):435-440.
6. Borkar SR, Damke S, Meshram R. Estimation of Zinc levels in children with acute lower respiratory tract infection: A case control study. *Journal of the Pediatrics Association of India.* 2019 Apr 1;8(2):6-15.
7. Shakur S, Malek MA, Bano N, Islam K. Zinc Status in Well Nourished Bangladeshi Children Suffering from Acute Lower Respiratory Infection. *Indian Pediatrics.* 2004 p. 4.
8. Mahmood S. Effects of daily zinc supplements on of acute respiratory infections in children. *Journal of Sheikh Zayed Medical College [JSZMC].* 2013;4(3):466-469.
9. Rady HI, Rabie WA, Rasslan HA, El Ayadi AA. Blood zinc levels in children hospitalized with pneumonia: A cross sectional study. *Egyptian Journal of Chest Diseases and Tuberculosis.* 2013 Oct 1; 62(4):697-700.
10. Fathima M, Pandey S. Serum Zinc Status of Children Suffering from Diarrhea and Acute Respiratory Infection. *Int J Health Sci.* 2017, 1(5).
11. Shaheen MY, Aly HA, Esmael NF, Hendawy WT. Serum Zinc Level in Children with Acute Lower Respiratory Tract Infection. *The Egyptian Journal of Hospital Medicine (July 2018).* 2018 Jul 1;72(1):3835-3838.
12. Brooks WA, Yunus M, Santosham M, Wahed M, Nahar K, Yeasmin S, *et al.* Zinc for severe pneumonia in very young children: double-blind placebocontrolled trial. *The Lancet.* 2004 May 22; 363(9422):1683-1688.
13. Islam SN, Kamal MM, Rahmatullah R, Sadi SK, Ahsan M. Serum zinc levels in children with acute respiratory infections: Association with sociodemography and nutritional status. *Clinical Nutrition Experimental.* 2018 Dec 1;22:11-18.
14. Yuan X, Qian S-Y, Li Z, Zhang Z-Z. Effect of zinc supplementation on infants with severe pneumonia. *World Journal of Pediatrics.* 2016 May; 12(2):1669.
15. Shivalingaiah M, Ramaraj SM. Serum zinc levels in children hospitalized with pneumonia—A cross-sectional study. *Indian Journal of Child Health.* 2019;6(10):545-547.

16. Basnet S, Shrestha PS, Sharma A, Mathisen M, Prasai R, Bhandari N, *et al.* A Randomized Controlled Trial of Zinc as Adjuvant Therapy for Severe Pneumonia in Young Children. *Pediatrics*. 2012 Apr 1; 129(4):701-708
17. Borkar SR, Damke S, Meshram R. Estimation of Zinc levels in children with acute lower respiratory tract infection: A case control study. *Journal of the Pediatrics Association of India*. 2019 Apr 1;8(2):6-15.
18. Shakur MS, Malek MA, Bano N, Islam K. Zinc status in well nourished Bangladeshi children suffering from acute lower respiratory infection. *Age (mo)*. 2004;32(6.52):30-36.
19. Soleimani GR, Abtahi S. Evaluation of serum Zinc status in hospitalized children aged 1-4 years with Pneumonia and gastroenteritis in Zahedan. *Zahedan Journal of Research in Medical Sciences*. 2005, 7(4).
20. Nair BT, Bhunia R, Sharma KK. Role of zinc supplementation in acute respiratory tract infections in children aged 2 to 60 months. *International Journal of Contemporary Pediatrics*. 2017 Sep;4(5):1758.
21. Adhikari DD, Das S. Role of zinc supplementation in the outcome of repeated acute respiratory infections in Indian children: a randomized double blind placebo-controlled clinical trial. *Research Journal of Pharmacy and Technology*. 2016;9(4):457-458.
22. Kaur P, Gupta PK, Singh V. Serum zinc levels in children with severe community acquired Pneumonia. *Journal of Pediatric Critical Care*. 2019 Jul 1;6(4):15-19.
23. Javed F, Asghar A, Sheikh S, Butt MA, Hashmat N, Malik BA. Comparison of serum zinc levels between healthy and malnourished children. *Annals of Punjab Medical College (APMC)*. 2009 Dec 12;3(2):139-143.
24. Rerksuppaphol S, Rerksuppaphol L. A randomized controlled trial of zinc supplementation in the treatment of acute respiratory tract infection in Thai children. *Pediatric reports*. 2019 May 23;11(2):7954.
25. Barak M, Shamshirgaran S, Amani F, Mohammadi S, Fazli B. Effect of Zinc Supplementation on the Growth of acute respiratory infections and diahrea in Low Birth Weight Infants. *Journal of Ardabil University of Medical Sciences*. 2007 Jun 10;7(2):122-131.