# EFFECTS OF DAILY ZINC SUPPLEMENTS ON ACUTE RESPIRATORY INFECTIONS IN CHILDREN

Shahid Mahmood[1]


## ABSTRACT

**Background:** Zinc deficiency is common in children from developing countries. Zinc has a fundamental role in cellular metabolism, with profound effects on the immune system and the mucosa. **Objective:**To determine the effect of daily zinc supplements on number of episodes and severity of acute respiratory infections in children. **Patients & Methods:** Study design: Quasi experimental study. Place and Duration of Study: The study was conducted from 1st March, 2011 to 31st August, 2012, in Children Hospital, Lahore. A total of 220 children of 6 months to 5 years of age, with cough and fever, were included in this study. Every child was followed up for next one year. Number of episodes and days with acute lower respiratory infection, which was defined as having a cough and (1) raised respiratory rate or (2) temperature ≥101°F or the presence of lower chest indrawing, were calculated. The patients were divided in two groups A and B, having 110 patients in each group. Patients included in the group A, were given oral zinc supplementation for the duration of three months, with the dose of 10mg/day and the patients included in group B were not given oral zinc supplementation. Every child in both groups was given conventional treatment in the hospital whenever there was severe acute respiratory tract infection (severe chest indrawing and child is not taking orally), including intravenous fluid, oxygen and antibiotics that is, ceftriaxone and amikacin. A child with mild to moderate acute respiratory tract infection (only raised respiratory rate and the child is taking orally) was given oral antibiotics at home and was followed up daily for three days. Number of episodes of acute respiratory tract infection in one year was calculated in both groups and compared with each other. During each episode, duration of illness and mortality was also analysed among both groups. **Results:** Mean duration of illness in group A (oral zinc) was, 3.4±0.113 days, while mean duration of illness in group B (oral zinc not given) was, 5.1±0.254 days. Total number of episodes of acute respiratory infection were 34, in group A (oral zinc) and total number of episodes of acute respiratory infection were 78, in group B (oral zinc not given). All the patients recovered and no death occurred in the study. **Conclusions**: Oral zinc supplementation decreases number of episodes of acute respiratory tract infection in children and oral zinc supplementation also decreases duration of illness in children hospitalized with acute respiratory tract infection.


**Keywords**: Zinc, Acute respiratory infections, Children

## INTRODUCTION

Pneumonia is an inflammation of the parenchyma of the lungs. Most of the cases of pneumonia are caused by microorganisms. Pneumonia is a substantial cause of mortality and morbidity in children less than five years of age. In developing countries an estimated 146-159 million per year new episodes of pneumonia are observed.[1,2]

Zinc deficiency is common in children from developing countries due to lack of intake of animal foods, high dietary phytate contents, inadequate food intake and increased fecal losses during diarrhea. Zinc has a fundamental role in cellular metabolism, with profound effects on the immune system and the intestinal mucosa.[3]

In Bangladesh, zinc supplementation resulted in 30% reduction in duration of severe pneumonia and significant shorter duration of individual markers of disease severity such as fast breathing, chest indrawing and hypoxia. There was a reduction of 25% in hospital stay.[4] Similarly, trials in India have demonstrated a decrease in the incidence of respiratory infection in children who received zinc supplements.[5] Adjuvant treatment with 20 mg zinc per day accelerates recovery from severe pneumonia in children.[6] A lower rate of pneumonia infection was found in the zinc-supplemented groups. Studies to evaluate the effect of zinc supplementation on mortality are under way, but a recently published study from India identified a 68% reduction in mortality in small-for-gestational-age term infants that were supplemented with zinc from 1 to 9 months of age.[7] Patients with pneumonia have been found to have lower blood zinc levels as compared to uninfected children.[8,9,10]

It has been reported that routine zinc supplementation for more than three months does have a positive effect on reducing the duration of acute lower respiratory tract infections among children in developing countries.[11-16]

A range of supplementation doses have also been assessed, from 15 mg to 140 mg per week, with the upper range exceeding the recommended daily

1. Children Hospital Lahore. University of Health Sciences, Lahore.

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Dr. Shahid Mahmood, Senior Registrar,
Children Hospital, Lahore.

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**Email:** shahid233@hotmail.com
**Phone:** 0336674146

intake (RDI) for children of 2 mg per day for children less than one year of age and up to 7 mg per day for children between 1 to 3 years.[17,18] This study was planned to determine the effect of daily zinc supplements on number of episodes and severity of acute respiratory infection in children.

## PATIENTS AND METHODS

This Quasi experimental study was conducted from 1st march, 2011 to 31st August, 2012 in Children Hospital, Lahore. A total of 220 children diagnosed clinically of having acute respiratory infection 110 in each group, were taken and sampling technique was Convenience sampling. Children of 6 months to 5 years of age with cough and fever, were included in the study. Every child was followed up for next one year. Number of episodes and days with acute lower respiratory infection, which was defined as having a cough and (i) raised respiratory rate or (ii) temperature ≥101°F (38.3°C) or the presence of lower chest indrawing, were calculated. All the children with known congenital disease like cystic fibrosis, congenital heart disease, skeletal deformities, cerebral palsy were excluded from the study. Effect of zinc was noted on clinical improvement of the patient like reduction in fever, fast breathing, chest indrawing and crepitations on auscultation. Patients included in the group A, were given oral zinc supplementation for the duration of three months, with the dose of 10mg/day and the patients included in group B were not given oral zinc supplementation. Every child in both groups was given conventional treatment in the hospital whenever there was severe acute respiratory tract infection including intravenous fluid, oxygen and antibiotics that is ceftriaxone and amikacin. A child with mild to moderate acute respiratory tract infection was given oral antibiotics at home and was followed daily for three days.

Number of episodes of acute respiratory tract infection in one year was calculated in both groups and compared with each other. During each episode, duration of illness and mortality was also analysed for both groups. Duration of illness was taken as duration of fast breathing and/or chest indrawing after start of treatment. Fast breathing was labeled when there was a respiratory rate more than fifty per minute in children less than one year and forty per minute in children more than one year. Informed consent was taken from the parents or attendants. The demographic information including name, age, sex and address was recorded. History of present illness was inquired with regard to symptoms, their severity and duration. All the consecutive children having acute respiratory infection were included in the study and randomly selected into two groups, A and B. After a child had been included in group A, next consecutive child was enrolled in group B. Oral zinc was given to group A and group B was not given oral zinc. Both groups were given similar conventional treatment for episode of acute respiratory infection. Mean and standard deviation were calculated for age and days of illness in each episode of acute respiratory illness, whereas percentages were calculated for sex, nutritional status. During data analysis two groups A and B were compared with each other with respect to age, sex, days of illness before hospitalization in each episode of illness, nutritional status and severity of illness. T test was used to compare the mean whereas, chi-square test was used to compare the categoral variables like sex, in both groups. A P-value of <0.05 was taken significant. The data was entered and analyzed by using SPSS 15.

## RESULTS

A total of 220 patients were included in this study, and this study determined the effect of oral zinc supplementation in children on number of episodes of acute respiratory tract infection and severity of illness during each episode of illness. 110 patients of group A, were given oral zinc supplementation for three months whereas, 110 patients of group B, were not given oral zinc supplementation. Mean duration of illness in group A, was 3.4±0.113 days, while mean duration of illness in group B, was 5.1±0.254 days.

**Table No. I: Summary of effect of zinc in children with acute respiratory infection. (N = 220)**

| | Group A (Oral zinc given) (n=110) | Group B (no oral zinc given) (n=110) | P-Value |
|---|---|---|---|
| **Duration of illness** | **3.4 days** | **5.1 days** | **0.001** |
| Need to change antibiotics | 3 (2.7%) | 18 (16%) | - |
| Complications | 2 (1.8%) | 13 (11.8%) | - |
| Deaths | 0% | 0% | - |

Total number of episodes of acute respiratory infection were 34 in group A (oral zinc given) and total number of episodes of acute respiratory infection were 78 in group B (oral zinc not given). (Table II). All the patients recovered and no death was observed in both groups. Out of 220 patients, 164 (74.5%) were males and 56 (25.4%) were females. (Table III).

All the patients were having cough, fever and respiratory distress. Only 02 (1.8%) patients got complications of acute respiratory infection and into sepsis after five days of treatment, these patients were from group A. (Table I) Only 13 (11.8%) patients got complications of acute

respiratory infection and went into sepsis after four days of treatment, these patients were from group B. (Table I)
Ceftriaxone and Amikacin was given to all of the patients included in the study, during each episode of acute respiratory infection. Antibiotics had to be changed in 21patients. Three patients were from group A and 18 patients were in group B. (Table I)

**Table II: Effect of zinc on episodes of acute respiratory infection. (N=220)**

| | Group A (Oral zinc given) (n=110) | Group B (no oral zinc given) (n=110) | P-Value |
|---|---|---|---|
| Total no. of episodes of acute respiratory infection during one year. | 34 | 78 | 0.02 |
| Total no. of admissions in hospital during one year | 6 (5.4%) | 33 (30.9%) | - |

**Table III: Comparison of both groups (N=220)**

| | Group A (Oral zinc given) (n=110) | Group B (no oral zinc given) (n=110) |
|---|---|---|
| Males | 82(74.5%) | 82(74.5%) |
| Females | 28(25.4%) | 28(25.4%) |
| Mean age | 1.2 years | 1.2 years |
| **Clinical features during episode of acute respiratory infection** | | |
| Fast breathing | 100% | 100% |
| **Nutritional status** | | |
| Cough | 100% | 100% |
| Malnourished | 0% | 0% |
| Antibiotics used | 100% | 100% |

## DISCUSSION

This study showed that oral zinc supplementation has a significant beneficial effect in children suffering from acute respiratory infection. It decreased the total duration of illness and decreased the total duration of treatment and duration of hospitalization. It also decreased the number of episodes of acute respiratory tract infection in children. There is a mean reduction of 1.7 days in duration of illness in group A. (oral zinc given).
Total number of episodes of acute respiratory infection were 34 in group A (oral zinc given) and total number of episodes of acute respiratory infection were 78 in group B (oral zinc not given).
Age of the patients, presentation of the patients and nutritional status of the patients were similar in both groups. Different studies in India ,Bangladesh and Europian countries have shown the beneficial effects of oral zinc in pneumonia. In a study, describing zinc levels in India in 2004, has shown lower blood zinc levels in children with severe pneumonia.[3]
Brooks, has shown early reversal of severity of signs of pneumonia like chest indrawing, hypoxia, and tachypnoea in children treated with oral zinc supplementation. Brooks has also shown that adjuvant treatment with 20 mg zinc per day accelerates recovery from severe pneumonia in children.[6]
Black, has shown that zinc supplementation has beneficial effect on body, resulting in increased growth, improved immunity, and decreased morbidity and mortality in children suffering from pneumonia.[7]
Mahalanabis, has shown that oral zinc supplementation along with antibiotics has decreased the duration of illness. There was a mean reduction of 25% in hospital stay in children suffering from pneumonia.[4]
Theodore, reported that oral zinc supplementation enhanced the immunity of the patient against the microorganisms which causes pneumonia in children.[1]
Khan F and colleagues had shown that zinc supplementation increased the efficacy of antibiotic against the lethal microorganisms which causes pneumonia in children because Zn salt increases activity of an antibiotic. In this way low dose of antibiotics helps the children in recovery from severe pneumonia.[13]

Bhatnagar, has shown that oral zinc supplementation enhances the immunity of the patient, so it will prevent further infection by the lethal microorganisms, so it also decreased the chances of second attack of pneumonia in children.[9]

Sazawal, has shown that zinc supplementation reduces the incidence of acute lower respiratory tract infections in infants and preschool children.[10] Some studies has also shown that chances of complications are much decreased, because of better immunity against infections in children supplemented with oral zinc.[11,12,19]

## CONCLUSION

Oral zinc supplementation decreases the number of episodes of acute respiratory tract infection in children, additionally, it decreases the duration of illness in hospitalized children.

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