

## “Effect of Zinc Supplement on Acute LRTI in Children in a Tertiary Care Hospital, Dhaka, Bangladesh”

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### Abstract:

**Introduction:** Acute Lower Respiratory tract Infection (ALRTI) remains an important cause of morbidity in both the developing and the developed world. In Bangladesh, ALRTI is a major cause of death among young children. As a matter of fact, childhood mortality can be reduced by 50% with detection and early treatment of illness with antibiotics and immunization. Zinc plays an important role in the optimal function of the immune system by reducing the risk, severity and duration of infectious diseases. Zinc supplementation improves health and cell mediated immunity.

**Aim of the study:** The aim of this study was to evaluate the effects of zinc supplement in children with acute lower respiratory tract infections (ALRTI) in Bangladesh.

**Method and Materials:** This was comparative observational prospective study which was conducted in the Department of Paediatric Medicine, Dr. MR Khan Shishu Hospital & Institute of Child Health, Dhaka, Bangladesh during the period from July 2017 to December 2017. The children aged 12 to 60 months were selected randomly for comparison of effect of Zinc supplement and without zinc supplement on acute LRTI. In total 220 children attended and diagnosed as acute LRTI patients were finalized as the study population. The total study population was divided into two equal groups. In each group there were 110 participants. Zinc supplement Group was designated as Group I and without zinc supplement Group as Group II. All results were analyzed by using Statistical Package for Social Science (IBM SPSS v 22.0). Chi-square test was done for qualitative variables and t-test was used for quantitative variables.  $P < 0.05$  was considered as statistically significant.

**Result:** Among the total 220 study population, male were 113 and female were 107 and mean age of the participants was  $31 \pm 2.5$  months. It was found that 81% children completed immunization as per EPI schedule whereas the rest 19% were partially immunized. It also found that 27% children had family history of Atopy. There was no association of ALRTI with sex. In this study there was statistically significant and clinically important reduction of episodes of ALRI in Zinc supplement Group.

**Conclusion:** This finding strongly suggests that oral supplement of Zinc reduces the episodes of ALRTI in children. This finding may be helpful for treatment professionals in treating children with acute LRTI as well as for the further similar studies.

**Key words:** ALRTI, Pneumonia, Childhood mortality, Zinc-supplement.

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### I. Introduction

Acute lower respiratory tract infections (ALRTI) are the most common illnesses in children of the world. Surprisingly, ALRTI comprises of as much as 50% of all illnesses in children less than 5 years old. It also comprises of 30% of all illnesses in children aged 5-12 years. Acute lower respiratory tract infection predominantly pneumonia is a substantial cause of morbidity and mortality<sup>1</sup> It is the leading cause of mortality and a common cause of morbidity in children below five years of age. In developing countries an estimated 146-159 million new episodes of pneumonia are observed per year<sup>2</sup>. Out of nearly 12.9 million deaths under 5 children about 4 million deaths annually are attributable to Acute Lower Respiratory Infection (ALRI) in the

world and in developing countries they are associated with a third of all deaths in childhood<sup>3,4</sup>. In Bangladesh, ALRTI are a major cause of death among young children. About 25% of the under 5 years old childhood deaths are attributable to ALRI<sup>5</sup>. On the other hand, Community-based trials have documented that, this childhood mortality can be reduced by 50% with detection and early treatment of illness with antibiotics and immunization against measles and pertussis as carried according to immunization schedule<sup>6,7</sup>. Zinc plays an important role in the optimal function of the immune system by reducing the risk, severity and duration of ALRTI diseases<sup>8</sup>. The effect of zinc supplement decreases the risk of respiratory infections and ensures a better gut barrier, which protects against infections<sup>9</sup>. In another study they stated, the effect of Zinc supplementation improves child health and improved cell mediated immune status<sup>10,11</sup>. It is an essential element for health. Because of Zinc's fundamental roles in cell growth and differentiation, the young growing organism is especially vulnerable to adverse effects from inadequate zinc<sup>12</sup>. So plasma zinc is used as a predictor of diarrhoeal and respiratory morbidity in children<sup>13</sup>. Therefore supplementation of zinc in deficient population especially preschool (under 5 years old) children should substantially reduce serious morbidity<sup>10,14</sup>. The objective of this study was to evaluate the effects of zinc supplement in children with Acute Lower Respiratory Tract Infection in Bangladesh.

## II. Objective

### a) General objective:

- To evaluate the effects of zinc supplement in children with acute lower respiratory tract infections in Bangladesh

### b) Specific Objectives:

- To assess the role of immunization of children in preventing acute lower respiratory tract infections.

## III. Methodology & Materials

This was comparative observational prospective study which was conducted in the Department of Paediatric Medicine, Dr. MR Khan Shishu Hospital & Institute of Child Health, Dhaka, Bangladesh during the period from July 2017 to December 2017. The total study population of this study was 220 who were children aged 12 to 60 months selected randomly for comparison of effects of Zinc supplement and without zinc supplement on acute LRTI. The total study population was divided into two equal groups. In each group there were 110 participants. Zinc supplement Group was designated as Group I and without zinc supplement Group was designated as Group II. The ethical committee of the mentioned hospital had approved the study protocol and the informed consent form previously. Prior to enrolment in the study informed consent of child's care taker was obtained. It is noted that, the children having chronic illness like chronic renal disease, congenital or acquired heart disease and chronic neurological diseases like cerebral palsy were excluded from the study. Very sick unable to take oral zinc supplementation were also excluded. A semi-structured questionnaire was prepared which included nutritional status, baseline ALRI and immunization status. In regard of immunization, complete immunization indicate children were immunized according to age as per EPI schedule and partially immunized indicate those children who could not complete immunization though they have passed normal age of EPI schedule. ALRTI were defined according to WHO criteria 20. Pneumonia and bronchiolitis were put under diagnosis of ALRTI. Zinc Group was coded as Group I and control (without zinc) Group was coded as Group II. A fixed dose of 2 mg Zinc supplement per Kg body-weight per child was given daily for 2 months to all enrolled children. Children with baseline ALRTI included in the study. After 2 months supplementation, patients were reviewed at COPD once a month during 6 months for episodes of ALRTI. All statistical procedures were performed using SPSS v 22.0. All results were expressed as number (percentage) or Mean, Standard Deviation (SD)/median (range) as appropriate. The result were measured in terms of significance of association at 95% confidence level i.e. “p” value less than 0.05.

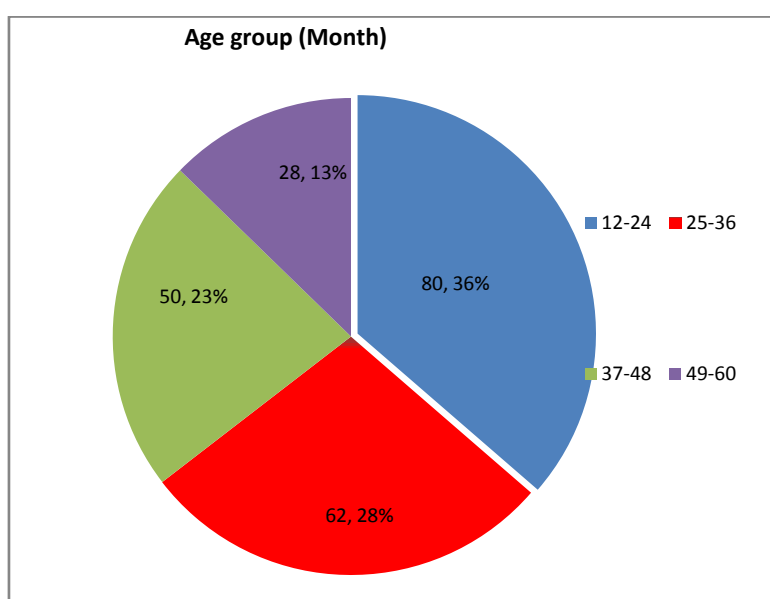
## IV. Result

In this study, the total study population was 220 in number and the participants were children aged within 12 to 60 months. Among them male were 113 (51.36%), female were 107 (48.64%) and mean age was 31±2.5 months. The study population was selected randomly for comparison of effects of Zinc supplement and without zinc supplement on acute LRTI in children. Zinc supplement group was designated as Group I and without zinc supplement group was designated as Group II. In Group I male was 56 (51%) and female were 54 (49%). In Group II male were 57 (52%) and female were 53 (48%). In this study the highest number of children were found from 12 to 24 months age group which was 80 (36%) in number followed by 62 (28%) from 25 to 36 months age group, 50 (23%) from 37 to 48 months age group and the lowest number, 28 (13%) was found from 49 to 60 months age group. In this study we found majority (81%) of children with completed immunization as per EPI schedule, while 19% children were partially immunized. In Group I, 89% children, against 72.73% of Group II children had completed immunization as per EPI schedule and the difference was not statistically ( $p > 0.05$ ) significant. The study we showed the number of episodes of acute lower respiratory

tract infection (ALRTI) during 6 months follow-up period. In Group I, 21 (19%) children suffered from one or more times from ALRTI. In this group suffered for one time 15.45%, suffered for two times 1.8% and suffered for three times 1.8% also. In Group II, 44 (40%) children suffered from one or more times from ALRTI. Among suffered for one time 17.27%, suffered for two times 20% and suffered for three times 2.73% children from ALRTI. The results showed that, the effect of Zinc supplement is better than Group II for reducing the sufferings and reducing the episodes of acute lower respiratory tract infections. Zinc is thought to decrease susceptibility to Acute Lower Respiratory Tract Infection by regulating various immune functions including protecting the health and integrity of respiratory cells during lung inflammation and injury. Supplementation of zinc could reduce the risk of pneumonia and the risk and duration of diarrhea, dysentery and malaria deaths among all infectious diseases. In this study we also found that, after intervention there were 19% recurrent and non-recurrent 81% cases in Group I (Zinc supplement group). On the other hand, in Group II there were recurrent cases 60% and non-recurrent cases were 40%. Noted that, the burden of acute lower respiratory tract infections is 2 to 10 times more common in developing than in developed countries<sup>15</sup>.

**Table I:** Sex distribution of participants of Group I and Group II (N=220)

Gender	Group I		Group II		Total	
	n	%	n	%	n	%
Male	56	51%	57	52%	113	51.36
Female	54	49%	53	48%	107	48.64
Total	110	100%	110	100%	220	100.00



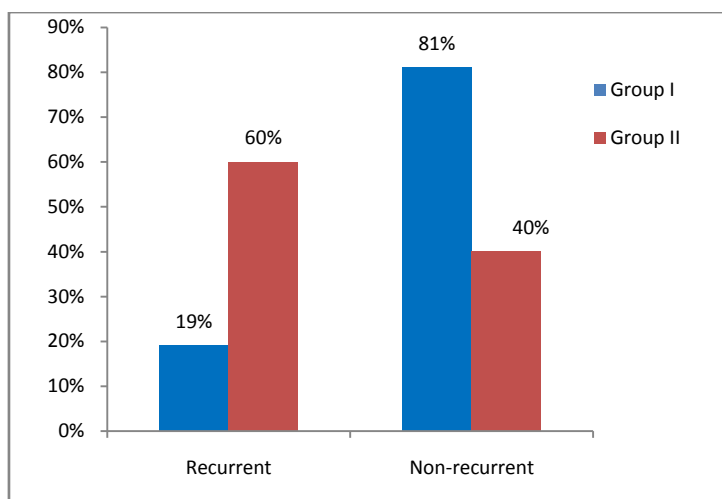
**Figure I:** Age distribution of participants (N=220)

**Table II:** Immunization status of children (N=220)

Immunization on status	Number of Patients		Total
	Group I	Group II	
Complete	98 (89.09%)	80 (72.73%)	178 (81%)
Partial	12 (10.91%)	30 (27.27%)	42 (19%)
Total	110	110	220

**Table III:** Number of episodes of ALRTI during 6 months follow-up

Number of episode	Number of patients					
	Group I			Group II		
No	89 (80.91%)			66 (60%)		
One	17	15.45%	21 (19%)	19	17.27%	44 (40%)
Two	2	1.82%		22	20%	
Three	2	1.82%		3	2.73%	



**Figure II:** Association of recurrent attack of ALRTI in Group I or Group II

### V. Discussion

This was comparative observational prospective study which was conducted during the period from July 2017 to December 2017. The total study population of this study was 220 who were children aged 12 to 60 months selected randomly for comparison of effects of Zinc supplement and without zinc supplement on acute LRTI. The total study population was divided into two equal groups. In each group there were 110 participants. Zinc supplement group was designated as Group I and without zinc supplement group as Group II. Among all the study populations male were 113 (51.36%) and female were 107(48.64%). In Group I male was 51% and female was 49%. In Group II male was 52% and female was 48%. In this study we found the highest number of children was from 12 to 24 month age group which was 36% and the lowest number of children was from 49 to 60 month age group and that was 13%. The majority children 81% had been completed immunization as per EPI schedule, and rest of 19% were partially immunized in Group I. Pursuant to data published by World Health Organization, 10.5 million children under the age of 2 across the world lose their lives due to preventable and curable 5 diseases every year. Lower respiratory tract infections are responsible for 28% of all these deaths<sup>16</sup>. In our study we showed the number of episodes of acute lower respiratory tract infection (ALRTI) during 6 months follow-up. In (Zinc supplement) Group I 21 (19%) children suffered from one or more times against 44 (40%) in Group II. Zaman et al found that total was 16%.<sup>17</sup> In Group II one time suffered 17.27%, two times suffered 20% and three times suffered 2.73% children from ALRTI. The burden of acute lower respiratory tract infections is 2 to 10 times more common in developing than in developed countries<sup>15</sup>. Zinc is thought to decrease susceptibility to Acute Lower Respiratory Tract Infection (ALRTI) by regulating various immune functions including protecting the health and integrity of respiratory cells during lung inflammation and injury. Supplementation of zinc could reduce the risk of pneumonia and the risk and duration of diarrhea, dysentery and malaria deaths among all infectious diseases, and they accounted for 3.9 million deaths worldwide.<sup>18</sup> In this study Zinc supplement group (Group I) had recurrent attack in 19% children whereas in Group II recurrent cases were in 60% children. On the other hand, in Group I non recurrent cases were 81% whereas in Group II it was 40%. So the results of recurrent attack showed that there is a strong association of ALRTI with Group II than Group I. Therefore the effect of zinc supplementation had significantly reduced the recurrence of ALRTI in this our study. Further Meeks-Gardner J et al have shown a positive Zinc supplementation in these patients<sup>20</sup>. This study supports these findings.

### Limitations of the study

This was a single centered study with a small sized sample. So the findings of this study may not reflect the exact scenario of the whole country.

### VI. Conclusion and recommendations

In our present study, we found some positive effects of Zinc supplement on children with acute lower respiratory tract infection.

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