

# Serum Zinc Level in Children Admitted with Pneumonia at Tertiary Care Children's Hospital

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## Abstract

**Introduction:** Zinc is an essential micronutrient in humans. Worldwide, pneumonia accounts for 18% of under-five mortality and it is the leading infectious cause of childhood mortality. There is greater risk of diarrhea, pneumonia, and growth failure in zinc-deficient population.

**Purpose:** The purpose of this study is to compare serum zinc level in children with severe pneumonia with age, sex, and nutritional matched controls.

**Materials and Methods:** Serum zinc level in 50 children admitted with severe pneumonia was compared with the matched controls.

**Results:** The mean serum zinc level in children with pneumonia (60.98) is significantly lower than that of controls (73.124) with ( $P = 0.001$ ).

**Conclusion:** Serum zinc levels are significantly low in children with severe pneumonia compared with age, sex, and nutritionally matched controls.

**Key words:** Children, Micronutrient, Pneumonia, Under-five, Zinc

## INTRODUCTION

Zinc is an essential micronutrient in humans. In human being, zinc is 2<sup>nd</sup> only to iron in quantity.<sup>1-3</sup> There are more than 70 zinc-containing enzymes in human being. Zinc is critical for functioning of biomembranes. Zinc protects from the oxidative damage by competing for binding sites with redox metals. Zinc has both acute and chronic antioxidant action.<sup>4-7</sup> Zinc is needed for thymulin, and it is possible zinc is involved in the genesis of hematopoietic stem cells in the thymus microenvironment. Zinc deficiency increasing the inflammatory pathology in the respiratory tract with increasing damage to the cells is a proposed mechanism.<sup>8</sup>

Zinc also prevents the recruitment of white blood cells and release of cytokines from them and effectiveness of zinc said to increase with increase in the severity of pneumonia.<sup>9</sup>

Studies suggest that there is greater risk of diarrhea, pneumonia, and growth failure in zinc-deficient population.<sup>10-12</sup> The effectiveness of zinc supplementation in early recovery and reduction of severity of pneumonia has been shown by a number of studies. Effectiveness of zinc supplementation in early recovery and reduction of severity of pneumonia has been shown by number of studies.<sup>13,14</sup>

Although zinc supplementation is specifically recommended for developing countries,<sup>3</sup> there is no study available demonstrating the serum zinc level in children with pneumonia in South India. There is a need to demonstrate the zinc level in children with pneumonia for further recommendations. This study is designed to compare the serum zinc level in children admitted with pneumonia to the matched controls.

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## MATERIALS AND METHODS

This study was done at a tertiary care children's hospital in South India. The study population included children admitted with severe pneumonia according to the World Health Organization (WHO) classification clinically and showing radiological evidence of pneumonia. The age group included was between 3 months and 5 years. Any child on zinc supplementation, children with aspiration pneumonia, chemical pneumonia, persistent pneumonia, severe acute malnutrition, and coexisting illness were excluded.

All children admitted with pneumonia are examined and recruited as per inclusion and exclusion criteria. 50 such children were recruited to the study after obtaining informed consent from the parents. Weight for length/weight for height was calculated. According to the WHO chart, the nutritional status classified. Children having Z-score between  $-3$  and  $-2$  were classified as moderate acute malnutrition and having Z-score more than  $-2$  were classified as normal nutrition.

Controls with similar age (adjusted for 2 months), sex, and nutritional status were recruited equal number for cases.

For both cases and control group, 2 ml of blood drawn. Serum separated after centrifuging the clotted sample. In the separated serum, zinc level is obtained using photometry. The mean serum zinc between two groups is compared using independent *t*-test.

## RESULTS

The study population consists of 100 children with 50 cases and 50 controls. The age distribution was as per Table 1. Of the 50 children recruited with pneumonia, there are 36 male children and 24 female children. Nutritional status in the total study group is given in Table 2. Mean serum zinc level in children with pneumonia is compared with that of the control group. There is a significant difference between children with pneumonia and controls in serum zinc levels. Mean serum zinc level in children with pneumonia is 60.982 mg/dl. The mean serum zinc level in age, sex, and nutrition matched controls is 73.124 mg/dl. Mean serum zinc level is significantly lower in children with pneumonia than their matched controls ( $P = 0.001$ ) Table 3.

## DISCUSSION

There is no significant difference between the mean serum zinc levels between the different age groups of children admitted with pneumonia ( $P = 0.826$ ). Studies done in

**Table 1: Age distribution**

Age	Case	Control	Total frequency
≤12 months	18	18	36
13-24 months	20	20	40
25-60 months	12	12	24
Total	50	50	100

**Table 2: Nutritional status**

Status	Case	Control	Frequency	Percent	Valid percent	Cumulative percent
Normal	34	34	68	68.0	68.0	68.0
MAM*	16	16	32	32.0	32.0	100.0
Total	50	50	100	100.0	100.0	

\*MAM: Moderate acute malnutrition

**Table 3: Zinc level in cases and control**

Type	N	Mean zinc level*	Standard deviation	P value
Case	50	60.982	18.8926	0.001
Control	50	73.124	17.1420	

\*Mean serum zinc level expressed in mg/dl

serum zinc level in pneumonia, diarrhea showed similar results that age is not a confounding factor in serum zinc in pneumonia.<sup>15,16</sup> Comparison of mean serum zinc level between male and female children recruited in this study does not show any significant difference like other published data.<sup>15-17</sup> Analysis within pneumonia group also shows that the mean serum zinc level in children with moderate acute malnutrition is significantly low than children with normal nutrition ( $P = 0.02$ ). Low mean serum zinc level in children in moderate acute malnutrition may be due to poor intake leading to zinc deficiency associated with other micronutrient deficiency. Similar finding was found in study done by Kumar *et al.*<sup>15</sup>

Mean serum zinc level is significantly lower in children with severe pneumonia than the matched controls ( $P = 0.001$ ). This is similar to the finding of the Kumar *et al.*,<sup>15</sup> Arica *et al.*,<sup>16</sup> and Pushpa and Memon.<sup>17</sup> Main proposed cause for having low mean serum zinc level is already existing zinc deficiency which increases the susceptibility of the child to get pneumonia by impairing child's immunity.<sup>18</sup> Other explanation for low serum zinc level is a shift of zinc from plasma to liver.

Deficiency of zinc, due to inadequate intake of food-containing zinc or decreased absorption, is more commonly seen in developing countries.<sup>19</sup> It is one of the 10 important factors leading to increased illness in children in developing countries.<sup>20</sup>

Supplementation of zinc in children decreasing the morbidity and fatality in infections was shown by trials.<sup>9,13</sup>

Pneumonia being the leading killer infectious disease in children, effect of zinc supplementation has been extensively studied in pneumonia.<sup>13,14</sup>

The benefit of zinc supplement to prevent and decrease the severity of pneumonia is mainly due to correction of zinc deficiency. The finding of low mean serum zinc level in children with severe pneumonia favors this. There is need for further studies to recommend routine supplementation of zinc for children to prevent pneumonia and for the therapeutic use of zinc in severe pneumonia. The main limitation of this study is follow-up with zinc supplementation, and its effectiveness is not demonstrated.

## CONCLUSION

Serum zinc levels are significantly low in children with severe pneumonia compared with age, sex, and nutritionally matched controls. Low serum zinc level found in children with pneumonia probably due to zinc deficiency highlights the importance of inclusion of food item-containing good qualitative (absorbable) and quantitative amount of zinc in children's diet.

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