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**Original Research Article**

# Serum zinc levels in children aged two months to five years in hospitalized children with pneumonia

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## ABSTRACT

**Background:** Pneumonia is the infection of the lung parenchyma which is one the leading cause of morbidity and mortality among under five age group. The prime aim of this study is to identify the severity and to supplement the children with factors that reduce the mortality caused by pneumonia, zincbeing one of the major factors in the immune defense mechanism in reducing the severity and mortality. Our study estimates the amount of zinc in severe pneumonia child thereby to arrive at arationale to supplement zinc among Pneumonia children to reduce the course of illness. The core objective of this study is to compare serum zinc level in children with severe pneumonia among different age and sex.
**Methods:** A prospective case-control study was carried out with 50 cases and 50 controls in age group of 2 months to 5 years admitted in Government Cuddalore Medical College, Chidambaram. The study period ranges from December 2020 to December 2022. The cases are identified as per history thorough clinical examination and radiological evidence based on IMNCI criteria. All the children in both case andcontrol group were subjected to serum-zinc level analysis after obtaining informed consent fromthe Parents. Zinc level in both groups were compared and analyzed. Statistical package for the social sciences (SPSS) version-16 was used as a statistical tool. Ethical clearance has been obtained.
**Results:** The mean serum zinc level in children admitted with pneumonia is 55.126 and the mean serum zinc level in controlled growth is 78.803. Zinc level is significantly lower in children with pneumonia.
**Conclusions:** The estimated mean serum zinc levels in pneumonia group children confirms that there is a relative zinc deficiency in children with pneumonia and may play a role in the severity progression. Our study supports the need for zinc supplementation in pneumonia children to boost their immune defense mechanism which in turn reduces the severity and the progression of pneumonia. It tends to curtail the case fatality rate of pneumonia.

**Keywords:** Pneumonia, Zinc, Immune defense mechanism, IMNCI

## INTRODUCTION

Pneumonia is one of the global health burden and major cause of mortality in under five age group.[1] In developing countries like India pneumonia is the third most leading cause of under 5 mortality next only to prematurity and birth asphyxia.

Pneumonia is defined as an inflammation of lung parenchyma following infection manifesting as respiratory distress. Pneumonia accounts for one of the major reasons off under 5 mortalities throughout the world but most common and more accountable in South Asia and sub-Saharan region.[2]

Zinc plays a crucial role in immune defense mechanism from development of skin barrier to variousother immune cell adaptations. Zinc is essential for gene regulation inside lymphocytes and macrophages. It plays a lead role in development of acquired immunity, immunoglobulin

production intercellular killing cytokine release and phagocytosis. Thus, zinc plays an essential role in acquiring immunity and limiting infection acquired by children.[2]

The core objective of this study is to compare serum zinc level in children with severe pneumonia among different age and sex.

## METHODS

This prospective case control study was conducted in Government Cuddalore Medical College, Chidambaram. The Study period ranges from December 2020 to December 2022. 50 cases of pneumonia and 50 controls of age 2 months to 2 years were enrolled in the study after following inclusion and exclusion criteria with proper informed consent from the parents. Statistical package for the social sciences (SPSS) version-16 was used as a statistical tool. Ethical clearance has been obtained.

### *Inclusion criteria*

All children with clinical and radiological evidence of pneumonia in the age group of 2 months to 5 years admitted in study period.

Clinical evidence: severe pneumonia according to IMNCI classification.

Radiological evidence: chest x ray reported as pneumonia in children with clinicalevidence.

### *Exclusion criteria*

Any child on zinc supplementation, aspiration pneumonia, chemical pneumonia, persistent pneumonia, neonates, severe acute malnutrition, co-existing illness, and chronic history/immunocompromised children were excluded.

Children in age group of two months oh five years but clinical picture and radiological evidence of pneumonia were recruited as per IMNCI criteria as cases and children with sane age group without pneumonia were recruited us controls.[3] Proper history clinical examination and radiological investigation were carried out. Blood for estimation of serum zinc levels were taken from both groups with proper informed consent from the parents.

**Table 1: IMNCI – integrated management of neonatal and childhood illnesses criteria.**

| Signs | Classify as | Identify treatment (urgent pre-referral treatments are in bold print) |
|---|---|---|
| **Any general danger sign or chest indrawirig or Stridor in calm child** | Severe pneumonia, or very severe disease | Give first dose of injectable chloramphenicol (if not possible give oral amoxycillin), >refer urgently to hospital* |
| **Fast breathing** | Pneumonia | Give amoxycillin for 5 days; soothe the throat and relieve the cough with a safe remedy if child is 6 months or older; advise mother when to return immediately; follow-up in 2 days |
| **No signs of pneumonia or very severe disease** | No pneumonia: cough or cold | If coughing more than 30 days, refer for assessment; soothe the throat and relieve the cough with a safe home remedy if child is 6 months or older; advise mother when to return immediately; follow-up in 5 days if not improving |

## RESULTS

Among the 50 cases, 20 children belong to age group of 2 to 12 months whereas the rest 30 children belong to age group of 12 to 60 months. Among the 50 control, 19 children belong to 2 to 12 months age group whereas the rest 31 children belong to age group of 12 to 60 months (Table 2).

There are 52 male children and 48 female children who are recruited as cases and controls for the study (Table 3).

The mean serum zinc level in children admitted with pneumonia is 55.126 and the mean serum zinc level in control group is 78.803 (Table 4). Comparing the serum zinc levels among case and control group revealed a significant reduction of zinc levels among cases and there is no significant difference in age specific sub category (Table 5). Also, it shows no significant variation among different gender as well.

**Table 2: Age distribution.**

| Age (months) | Case | Control | Total frequency | Percent | Valid percent | Cumulative percent |
|---|---|---|---|---|---|---|
| **≤12** | 20 | 19 | 39 | 39.0 | 39.0 | 39.0 |
| **12-60** | 30 | 31 | 61 | 61.0 | 61.0 | 100.0 |
| **Total** | 50 | 50 | 100 | 100.0 | 100.0 | |

**Table 3: Sex distribution.**

| Sex | Case | Control | Total frequency | Percent | Valid percent | Cumulative percent | P value |
|---|---|---|---|---|---|---|---|
| **Male** | 26 | 26 | 52 | 52.0 | 52.0 | 52.0 | |
| **Female** | 24 | 24 | 48 | 48.0 | 48.0 | 100.0 | P>0.001 |
| **Total** | 50 | 50 | 100 | 100.0 | 100.0 | | |

NS – Not significant

**Table 4: Zinc level in cases and control.**

| Type | N | Mean zinc level* | Std. deviation | P value |
|---|---|---|---|---|
| **Case** | 50 | 55.126 | 13.5957 | 0.001 |
| **Control** | 50 | 78.803 | 13.5515 | |

*Mean serum zinc level expressed in microgram/decilitre

**Table 5: Zinc level different age group in children admitted with pneumonia.**

| Age (months) | N | Mean zinc level* | Std. deviation | P value |
|---|---|---|---|---|
| **≤12** | 39 | 65.400 | 19.0721 | 0.001 |
| **12-60** | 61 | 67.965 | 17.3645 | |

*Mean serum zinc level expressed in microgram/decilitre

## DISCUSSION

Serum zinc levels are relatively low in children with severe pneumonia. In addition, malnourished children who are already deficient in essential minerals and other micronutrients, they are more prone for pneumonia and severity of pneumonia is increased is these population.

In our study there is significant reduction in serum zinc levels in children with pneumonia compared to control groups which was similar to the study conducted by Hamed et al, which concluded there is a negative correlation between serum zinc levels and degree of respiratory distress in pneumonia.[4]

A study conducted by Skalny et al, high incidence of pneumonia in developing countries has been considered as the consequence of zinc deficiency in the population.[5] The incidence of low serum zinc in children with severe pneumonia was 80%. Correspondingly, a 2-fold lower level of serum zinc was observed in pediatric acute lower respiratory infection patients. Generally, indications of low zinc status in children with pneumonia provide a rationale for preventive zinc supplementation which supports our study.

A study by Lassi et al, randomized controlled trials (RCTs) evaluating zinc supplementation for the prevention of pneumonia in children aged from 2 months to 59 months.[6] They found that zinc reduced the incidence of pneumonia defined by specific clinical criteria by 21% (i.e. confirmation by chest examination or chest radiograph) (fixed effect RR 0.79; 95% CI 0.0.71 to 0.88, four studies, n=3261). Zinc supplementation in children is associated with a reduction in the incidence and prevalence of pneumonia supplementing zinc has a beneficial effectin reducing the severity of disease.

***Limitations***

Cases are recruited as per clinical and radiological evidence without etiological analysis due to poor yield in culture in pneumonia which is partially overcame by taking only severe pneumonia cases.

## CONCLUSION

Our study depicts significant reduction in serum zinc levels in children with pneumonia. There is a positive correlation between low serum zinc levels and severity of pneumonia. Zinc acts an immunomodulator by boosting our immune defence mechanism and hence supplementing zinc inchildren will reduce the severity and progression of the illness.

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