Letter to Editor

Correlates of zinc deficiency among children in age group of six to sixty months belonging to the low-income group

Sir,

We would like to share our research findings on "Correlates of Zinc Deficiency in Children in Age Group of 6-60 Months Belonging to families with Low Income" with readers of the Journal of Family and Community Medicine.

Zinc deficiency is a major public health problem in many developing countries. The adverse consequences of zinc deficiency includes (i) impaired immune-competence and increased prevalence and incidence of childhood infections, such as diarrhea and pneumonia, resulting in increased rates of mortality; (ii) impaired growth and development of infants, children, and adolescents; and (iii) impaired maternal health and pregnancy outcomes. Although, many factors contribute to the development of zinc deficiency, inadequate dietary intake of absorbable zinc is the most common cause.[1,2]

Scientific data on the prevalence of zinc deficiency in children aged 6-60 months in India is limited. A large community-based cross-sectional study conducted in five regions of the country namely-Northern (Uttar Pradesh), Southern (Karnataka), Eastern (Orissa), Western (Gujarat), and Central (Madhya Pradesh) was published earlier.[3] A total of 1,827 children aged from 6 to 60 months residing in the areas selected for the study were initially enrolled and a total of 1,655 were included in the final statistical analysis. We documented the prevalence of zinc deficiency, in children aged 6-60 months in the states of Gujarat (44.2%), Karnataka (36.2%), Madhya Pradesh (38.9%), Orissa (51.3%), and Uttar Pradesh (48.1%) states in India [Table 1]. The aim of the research study was to share the correlates of zinc deficiency in children aged 6-60 months belonging to different socio-economic groups as per Standard of Living Index (SLI). The SLI was created by assigning scores to a range of 30 household goods and assets, including the type of house and toilet facilities, fuel used for cooking, and ownership of durable goods.[4] Index scores of 0-14 indicate a Low Income Group (LIG); 15-24 indicate Middle Income Group (MIG); and 25-67 indicate High Income Group (HIG). Social castes were classified as Scheduled Caste (SC), Scheduled Tribe (ST), Other Backward Class (OBC), and other caste.[5]

Table 1: Percentage distribution of children according to their serum zinc level <65 µg/dl

State	Serum zinc levels <65 µg/dl (%)
Gujarat (*n*=353)	44.2
Karnataka (*n*=356)	36.2
Madhya Pradesh (*n*=285)	38.9
Orissa (*n*=345)	51.3
Uttar Pradesh (*n*=316)	48.1
Total (*n*=1655)	43.8

The standard atomic absorption spectrophotometry was used to assess serum zinc concentration. Serum zinc concentration was used as a valid indicator of zinc deficiency because it reflects dietary zinc intake and responds consistently to zinc supplementation. Reference data is available for most age and sex groups. The serum levels of zinc were categorized according to standard cut-offs for zinc deficiency, which was 65 µg/dl as recommended by IZINCG for non-fasting blood samples of children.[6] Mean and standard deviation were calculated for the zinc values.

We collected data on socio-demographic profiles of the children, educational status of mothers (of children), type of family, standard of living, religion, caste, dietary habits of the family, breast-feeding practices, infant feeding practices, dietary patterns, frequency of consumption of food items, history of chronic diseases, morbidity status in the last 15 days, history of any chronic disease (in the last 6 months), clinical health examination of the child, nutritional deficiency diseases, anthropometry, and serum zinc levels.

Univariate analysis was done to assess the relative risk of different variables associated with zinc deficiency. Frequency distribution was carried out for all the categorical variables. Mean and standard deviation were calculated for all the continuous variables. Univariate logistic regression analysis was used to calculate relative risk and CI at 95% for all the independent variables of the zinc. The univariate analysis revealed that children belonging to extended families were 1.16 times (95% CI: 0.956-1.42; $P < 0.13$) more likely to have zinc deficiency compared to children belonging to

nuclear families. The children belonging to OBC caste were found to have 1.89 times (95% CI: 1.373-2.600; $P < 0.000$) higher risk compared to the children belonging to ST caste. The children belonging to MIG were 6.5 times more likely to have zinc deficiency compared to children belonging to HIG. Children who consumed a higher amount of roots and tubers (4-7 times/week) were 1.44 times more likely to be associated with (95% CI: 1.122-1.846, $P < 0.001$) higher risk of zinc deficiency compared to children who never took roots and tubers. Similarly, children who never consumed milk were 1.57 times (95% CI: 0.61-1.92; $P < 0.01$) more likely to have zinc deficiency compared to those who consumed milk 1-3 times/week. Children who consumed fats and oils (4-7 times/week) were found to have 35.6% (RR: 1.356, 95% CI: 1.005-1.831; $P < 0.01$) more risk of having zinc deficiency compared to children who never had fats and oils. Children who consumed sugar and jaggery 4-7 times/week were twice at risk of zinc deficiency as those children who ate sugar and jaggery 1-3 times/week.

For the Multivariate Logistic Regression (MLR) Analysis, the variables that were highly correlated amongst each other (in a group of related variables) as found by the Univariate logistic regression analysis were included for the analysis. MLR was applied by "Forward LR" to identify the significant factors associated with the zinc deficiency. The results of MLR Analysis showed that state, caste, poverty, low consumption of non-vegetarian foods, consumption of roots and tubers and sugar and jaggery were significantly associated with zinc deficiency. Roots and tubers contain anti-nutritional factors which inhibit the absorption of zinc further leading to zinc deficiency. A statistically significant association between the zinc status of children and their caste was found in all states except Karnataka. The states were Gujarat ($P < 0.001$), Madhya Pradesh ($P < 0.009$), Orissa ($P < 0.01$), and Uttar Pradesh ($P < 0.001$). OBC caste had the highest zinc deficiency compared to other castes (SC, ST, and other caste).

Children whose frequency of consuming roots and tubers was high were more likely to be associated with higher risk of zinc deficiency compared to children who never had roots and tubers.

The findings of the present study revealed a high prevalence of zinc deficiency in children in India aged 6-60 months.

Dietary modification such as the consumption of animal products (non-vegetarian foods and milk) and reduction in the consumption of foods (roots and tubers, jaggery, fats, and oils) that interfere with zinc absorption are needed to address the problem of dietary zinc insufficiency.

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