

SERUM ZINC LEVELS IN MALNOURISHED CHILDREN OF PRE-SCHOOL AGE ATTENDING THE JOS UNIVERSITY TEACHING HOSPITAL, JOS, PLATEAU STATE, NIGERIA

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**SUMMARY**

*This study evaluated the serum level of zinc in 30-malnourished children admitted in the paediatric ward of the Jos University Teaching Hospital Jos from January to March 1998.*

*The children aged 0-5 years, were classified as 15 kwashiorkor, 9 marasmus and 6 marasmic kwashiorkor, with a male : female ration of 2:3. Thirty well-nourished and apparently healthy children from Paediatric Out-patient department matched for age and sex ratio, were also recruited as a control group.*

*The mean level of zinc (0.9Ug/ml) for the malnourished children was slightly lower than that of the control (0.99Ug/ml). This difference was, however, not statistically significant ( $p > 0.05$ ).*

*The mean levels of zinc for children with kwashiorkor, marasmus and marasmic kwashiorkor were 0.85Ug/ml, 1.02 Ug/ml and 1.09ug/ml, respectively. The level was lowest in children with kwashiorkor. However, there were statistically significant differences ( $p < 0.05$ ) between the mean values for the control and kwashiorkor, and also for the control and marasmic kwashiorkor children only. We therefore recommend that it is necessary to consider introducing routine zinc supplementation in malnourished children particularly those with kwashiorkor.*

**INTRODUCTION**

Protein energy malnutrition (PEM) and micronutrient malnutrition affect a large number of people in developing countries and constitute a major public health problem in the tropical and subtropical regions of the world<sup>1,2</sup>.

Malnutrition is a complex situation as the low intake of calorie and protein in addition to a decreased intake of micronutrients are implicated factors. This is often associated with repeated episodes of vomiting and diarrhoea resulting in a risk of impaired physiologic function, and an associated increased morbidity and mortality among children<sup>3-5</sup>.

The association of deficiencies of minerals and vitamins in PEM has been established.<sup>6-8</sup> Much more has been learnt about the vital importance of zinc (zn) in human nutrition in the past 3 decades, yet there is still no reliable indicator of Zn deficiency. The deficiency of Zn is associated with anorexia, failure to thrive, chronic diarrhoea, poor immune response and

severe skin lesion<sup>9</sup>. While severe Zn-deficiency is easily recognized as a result of its clinical manifestation, detecting subclinical deficiency states in humans is yet to receive a similar attention among clinicians. Early detection of low Zn level in the serum is important.

The nature and types of foods used during weaning and the low level of Zn in breast milk may also contribute to the low level of Zn in malnourished children.<sup>10</sup>

Zinc is the most abundant trace metal inside most cells, with exception of red blood cells<sup>11</sup>. Some macro-elements such as calcium has been found to be less abundant than Zn in all other cells except in the bone. Also, Zn is not limited to a few functions in the body as compared to calcium and iron. Zn is a functionally essential component of more than 200 enzymes, pervading all metabolic pathways in the body metabolism. The role of zinc in such enzymes can be either structural and/or catalytical. It is believed that Zn also helps to stabilize membrane structures by protecting their integrity through

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reduction of free radical formation, thus preventing lipid peroxidation.<sup>11</sup> Another paramount importance of Zn to an organism is in multiplicative cell growth<sup>12</sup>. Zn has a fundamental role in gene replication, activation and repression. It is critical for transcription, and affects nucleic acid metabolism<sup>12</sup>.

This study, therefore, attempts to assess the level of this critical element in malnourished children in our centre.

## PATIENTS AND METHODS

This study was carried out at the Jos University Teaching Hospital in children aged 0.5-5 years, between January to March, 1998. The patients included 30 children admitted into the Paediatric Ward with PEM based on their clinical findings and anthropometric measurements. 30 well-nourished and apparently healthy children attending the outpatient follow-up clinic were recruited as controls. These were matched for age and gender with the cases.

Data collected included: age, gender weight, height, mid-arm-circumference (MAC), and occipitofrontal circumference (OFC). The children were then classified into states of kwashiorkor, marasmus and marasmic kwashiorkor using the Welcome Classification<sup>13</sup>.

5ml of venous blood was collected from each child by aseptic procedure. The serum was separated and stored in cryovials at -20°C until ready for analysis. Zn was determined by the atomic absorption spectrophotometer (AAS)<sup>14</sup>.

All data generated were subjected to statistical analysis for mean (x), standard deviation (SD), coefficient of variation (CV) and standard error of mean (SEM) as appropriate. The level of significance was determined using student's "t" test. Confidence limit was set at 95% ( $p < 0.05$ ).

## RESULTS

The mean level of Zn in malnourished children (0.95ug/ml) was found to be lower than that in the well nourished children (0.99ug/ml) as shown in Table I. The Table also shows variations in SD SEM (which were similar to the control) and in the CV which was larger in the control.

Table II shows that the mean levels of Zn in both the marasmus and marasmic kwashiorkor children were found to be higher (1.02ug/ml and 1.09ug/ml, respectively) than the mean level in the control group (0.99ug/ml). However, it was

different for the kwashiorkor children where it was considerably lower (0.85ug/ml) as compared to the control. These differences were statistically significant;  $p < 0.05$ , except for the marasmic children and the control.

**Table I:** The mean, standard deviation (SD), standard error of mean (SEM) and Coefficient of variation (CV) for the Zinc level of the study and control Cohorts.

STUDY (N=30)					CONTROL (N=30)			
Parameters	Mean	SD	CV	SEM	MEAN	SD	CV	SEM
ZINC (Ug/M)	0.95	0.13	13.68	0.02	0.99	0.19	19.19	0.03

**Table II:** Mean (x), standard deviation (SD) and coefficient of variation (CV) for the zinc levels in the different forms of malnutrition (Ug/ml).

Parameters	Kwashiorkor (N=15)	Marasmus (N=09)	Marasic-Kwashiorkor (N=6)	control N=30
X	0.85	1.02	1.09	0.99
SD	0.07	0.12	0.07	0.19
CV	8.83	11.76	6.42	19.19
p-VALUE	$p < 0.05$	$p > 0.05$	$p < 0.05$	

## DISCUSSION

This study demonstrated a low Zn level (0.95Ug/m) in children admitted in JUTH for malnutrition when compared with the control (0.99Ug/ml). Earlier studies from Egypt<sup>15</sup> and South Africa<sup>16</sup> found low levels of zinc in malnourished children. However, in these studies, the serum Zn levels in malnourished children were found to be half those of the recovered children and/or controls, unlike in this study where there was only a slight difference of no statistical significance. It appears that generally, the serum Zn level in children of this area is at the lower range of normal. This was demonstrated in an earlier study of lactating mother/infant pairs<sup>17</sup>. Also, Lehl<sup>10</sup> had shown that the nature and type of food during weaning coupled with the significantly low level of Zn in breastmilk may affect serum Zn level in malnourished children.

However, in contrast to our finding, Chuwa *et al*<sup>18</sup> in Tanzania demonstrated a slightly increased zn level for their test group (0.82Ug/ml) as compared to the control (0.78Ug/ml), which however was not statistically significant;  $p > 0.05$ . It is interesting to note that the level of Zn in our study group is higher than those of the

Tanzanian and Moroccan malnourished children.<sup>18</sup>

The particularly low level of Zn in children with kwashiorkor seen in this study was earlier demonstrated by Lahrichi et al<sup>19</sup>.

Also in this study, slightly higher levels of Zn in marasmic (102Ug/ml) and marasmic kwashiorkor (1.09Ug/ml) children was noted when compared to the mean Zn level for the control group (0.99Ug/ml). The differences noted in marasmic kwashiorkor and kwashiorkor as compared with the control were found statistically significant  $P < 0.05$ .

Considerable evidence links decreased serum Zn level to numerous abnormalities observed in PEM. Some of these include growth retardation, severe skin lesions, chronic diarrhoea, poor wound healing amongst others. Since Zn is required for several enzyme functions, its deficiency may lead to either reduced or complete loss of the activities of these enzymes and, therefore, result in the abnormalities mentioned above. The authors, therefore, suggest that routine zinc supplementation in malnourished children particularly kwashiorkor should be re-emphasized and encouraged.

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