*Research Article*

# Assessment Of Some Micronutrient Levels In Children With Severe Acute Malnutrition With And Without Cerebral Palsy

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## Abstract

**Introduction:** Severe acute malnutrition is defined by a very low weight for height (below -3 z scores of the median WHO growth standards), by visible severe wasting or by the presence of nutritional edema. Globally, it is estimated that there are nearly 20 million children who are severely acutely malnourished. **Aim of the work:** To assess serum level of zinc, copper and selenium in severely acute malnourished children with and without cerebral palsy before and after nutritional rehabilitation compared with apparently healthy children. **Materials and Methods:** Our study included 40 children diagnosed as severe acute malnutrition who presented to the Pediatric Malnutrition Out-patient's Clinic, Minia University Children's Hospital in addition to 16 apparently healthy children matching age & sex with the malnourished group were included as a control group. They were grouped as following: **Results :** showed that no significant statistically difference among 3 groups regarding age, sex, residence, maternal delivery, maturity and socioeconomic level. **Discussion:** Severe acute malnutrition (SAM) is a massive global public health problem (Collins, 2007), that remains a major cause of child mortality worldwide. While pneumonia and diarrhea are often the final steps in the pathway, severe wasting is estimated to account for around 400000 child deaths each year (WHO, 2013). **Recommendations:** Lower micronutrient levels may affect cognition, behavior, social interaction and developmental outcomes and hence quality of life. **So we recommend:** Routine micronutrient supplementation especially Zinc and Selenium in malnourished children during nutritional rehabilitation in order to improve their cognition. Especial emphasis should be done on Selenium supplementation in children with CP during nutritional rehabilitation. We should take caution to serum copper level as its increase cause zinc deficiency.

**Keywords: HC:** Head Circumference **- L 1B:** Interleukin 1 Beta**- LMIC:** Low and Middle Income Countries

## Introduction

Severe acute malnutrition is defined by a very low weight for height (below -3 z scores of the median WHO growth standards), by visible severe wasting or by the presence of nutritional edema. Globally, it is estimated that there are nearly 20 million children who are severely acutely malnourished[(1).]

Malnutrition increases the risk of infection and infectious disease and weakens every part of the immune system[(2).]

The World Health Organization estimates that malnutrition accounts for 54 percent of child mortality worldwide[(3).]

Cerebral palsy is the most common movement disorder in children. It occurs in about 2.1 per 1,000 live births[(4).]

Cerebral palsy (CP) is defined as "a group of permanent disorders of the development of movement and posture, causing activity limitation, that are attributed to non-progressive disturbances that occurred in the developing fetal or infant brain[(5).]

Micronutrient deficiency is a critical concern for mothers and children throughout the world. It is estimated that 25% of the world's population suffers from IDA, 33% have insufficient zinc intake and 30% have inadequate iodine intake[(6)]. Each of these micronutrients is involved in brain development and deficiencies are likely to impair cognitive, motor, and socioemotional abilities[(7)].

Micronutrients such as zinc, copper and selenium have been implicated in the function of nervous system and their deficiencies are a critical concern among cerebral palsy Children[(8)].

## Aim of the work

To assess serum level of zinc, copper and selenium in severely acute malnourished children with and without cerebral palsy before and after nutritional rehabilitation compared with apparently healthy children.

## Materials and Methods

Our study included 40 children diagnosed as severe acute malnutrition who presented to the Pediatric Malnutrition Out-patient's Clinic, Minia University Children's Hospital in addition to 16 apparently healthy children matching age & sex with the malnourished group were included as a control group. They were grouped as following:

**Group 1 (Malnutrition without CP):**
They were 20 malnourished child without cerebral palsy or any neurological manifestation, 8 (40%) male, 12 (60%) female. Their age ranged from 6 - 43 months.

**Group 2 (Malnutrition with CP):**
They were 20 malnourished child with cerebral palsy, 10 (50%) male ,10 (50%) female. Their age ranged from 6 - 36 months.

**Group 3 (Control):**
Included 16 apparently healthy child matching age & sex with patient groups. They were 7 (43%) males and 9 (57%) females.

**Inclusion criteria:**
Severe acute malnourished children.
Malnourished cerebral palsy children.
Age ranged from 6 – 43 months.

**Exclusion criteria:**
Children having neurological disorders like inflammatory brain disease, degenerative brain disease, intracranial space occupying lesion, encephalopathy due to well defined causes.
Children with chronic medical disorder (chronic liver disease, Kidney disease, congenital heart disease).

## Results

Comparison between Zn, Cu & Se levels before and after nutritional rehabilitation in malnourished children without CP

| | Before nutritional rehabilitation | After nutritional rehabilitation | P value |
|---|---|---|---|
| **Zinc (µg/dl)** | | | |
| Range | 55-83 | 85-185 | 0.0001* |
| Mean ± SD | 65.3±7.3 | 132.6±30.8 | |
| Normal % | 30% | 85% | |
| Deficient % | 70% | 15% | |
| **Copper (µg/dl)** | | | |
| Range | 85-220 | 116-260 | 0.0001* |
| Mean ± SD | 157.6±40.8 | 193.4±45 | |
| Normal % | 100% | 100% | |
| **Selenium (ng/ml)** | | | |
| Range | 28-80 | 35-109 | 0.0001* |
| Mean ± SD | 51.6±12.7 | 69.4±16.9 | |
| Normal % | 35% | 80% | |
| Deficient % | 65% | 20% | |

**P value calculated by paired sample t-test**
***p value <0.05 considered significant**

## Discussion

Severe acute malnutrition (SAM) is a massive global public health problem (Collins, 2007), that remains a major cause of child mortality worldwide. While pneumonia and diarrhea are often the final steps in the pathway, severe wasting is estimated to account for around 400000 child deaths each year [(9)].

Patients with SAM often have multiple nutritional deficiencies, anemia and frequent intercurrent illnesses [10].

Zinc is an essential mineral perceived by the public today as being of "exceptional biologic and public health importance [11].

In children, deficiency causes growth retardation, delayed sexual maturation, infection susceptibility, and diarrhea. Consumption of excess zinc can cause ataxia, lethargy and copper deficiency[12].

Copper is essential for the normal growth and development of human fetuses, infants, and children [13].

Copper deficiency can cause a wide variety of neurological problems including, myelopathy, peripheral neuropathy, and optic neuropathy[14].

Human studies demonstrate the importance for selenium and selenoprotein synthesis for normal brain function. Selenium deficiency correlates with lower cognitive function and impaired motor function [15]

This study was conducted on 40 children from 6 to 43 months old who were admitted with a proven severe acute malnutrition according to WHO criteria for SAM. Infants and children who have a mid-upper arm circumference <115 mm or a weight-for-height/length <–3 Z-score of the WHO growth standards, or have bilateral pitting edema were included in the study [16].

**Recommendations**

Lower micronutrient levels may affect cognition, behavior, social interaction and developmental outcomes and hence quality of life.

**So we recommend:**

Routine micronutrient supplementation especially Zinc and Selenium in malnourished children during nutritional rehabilitation in order to improve their cognition.

Especial emphasis should be done on Selenium supplementation in children with CP during nutritional rehabilitation.

We should take caution to serum copper level as its increase cause zinc deficiency.

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