



## The effects of hospitalization on the nutritional status of children

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### Abstract

**Objective:** To evaluate the nutritional status of children at hospital admission and again at hospital discharge and to investigate factors associated with the onset and/or exacerbation of malnutrition.

**Method:** An observational study of 203 children under 5 years old admitted to a hospital in the city of Fortaleza between August and December 2003. Nutritional status, expressed in z-scores for weight/age, stature/age and weight/stature, was compared at the time of admission and on hospital discharge and broken down by sex, age, condition responsible for hospitalization and length of hospital stay.

**Results:** On admission prevalence rates for moderate and/or severe malnutrition (z-score < -2) were 18.7, 18.2 and 6.9%, for weight/age, stature/age and weight/stature, respectively. During their stay in hospital 51.6% of the 186 children who completed the study lost weight, with most weight being lost by those with prolonged hospital stays and pneumonia as the disease responsible for their hospitalization. Children who had malnutrition on admission were still malnourished at hospital discharge and 10 (9.17%) well-nourished children developed mild malnutrition while hospitalized.

**Conclusions:** The prevalence of malnutrition at the time of admission was elevated and remained unchanged by discharge. Prolonged hospitalization and pneumonia were linked with weight loss in hospital.

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### Introduction

Protein-energy malnutrition (PEM) in children under 5 years old remains one of the most serious public health problems in developing countries. Approximately 80% of these malnourished children live in Asia, 15% in Africa and 5% in Latin America and 43% of these children (230 million) are chronically malnourished.<sup>1</sup> This is a disease with multifactor origins resulting from the interaction between many factors, such as poverty, infectious processes and low levels of protein and energy consumption.<sup>2,3</sup>

According to statistics produced by the Pan American Health Organization (PAHO), every year more than 200

thousand children die before their fifth birthday in the Americas because of malnutrition and preventable diseases.<sup>4</sup> Around 20 to 30% of severely malnourished children will die during treatment by the health services of these countries.<sup>5</sup>

Assessment of nutritional status is of fundamental importance to investigating whether a child is growing within recommended limits or is falling outside of them due to disease or unfavorable living conditions. Measuring a child's growth is one of the most efficient ways of assessing their general state of health, making effective interventions possible that can reestablish ideal conditions for health and avoid the damage resulting from malnutrition.<sup>6</sup>

Despite the existence of countless studies in published literature on the worldwide prevalence of malnutrition in children, nutritional assessment of hospitalized children is very often neglected, contributing to the occurrence of complications and prolonged hospital stays. Pereira et al.<sup>7</sup> carried out a retrospective study of the frequency with which nutritional assessments were made of children

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under 5 admitted to the university hospital at the *Universidade Federal do Ceará* between July and December 1999. They concluded that just 59% of the children had had a nutritional assessment on admission. An understanding of the nutritional status of hospitalized children is of fundamental importance to establishing a strategy for maintaining and/or recovering nutritional status during their hospital stay.<sup>8,9</sup>

A study carried out in Alagoas state demonstrated an elevated prevalence of pre-hospitalization malnutrition and suggested that the dietary care provided to hospitalized children was not effective at improving their nutritional conditions.<sup>10</sup>

The objective of this study is to assess the nutritional status of hospitalized children under 5 years old at the time of admission and again at discharge and to relate length of hospital stay and the disease responsible for admission with the presence and/or exacerbation of malnutrition.

### Patients and methods

An observational study to assess the nutritional status at admission and again at discharge of all children of both sexes aged under 5 years old and admitted between August and December 2003 to the *Hospital Infantil Albert Sabin* (HIAS), which is the only public hospital offering pediatric tertiary care in the city of Fortaleza, Ceará state. Children were excluded if they had chronic liver or kidney diseases, surgical pathologies or cerebral palsy, or if they were admitted to intensive care or oncology units with re-hospitalization during the study period.

Nutritional status was assessed by means of z-scores for weight/age, stature/age and weight/stature, taking as reference standard the percentile curves published by the NCHS (National Center for Health Statistics). Nutritional status was classified in accordance with WHO criteria: malnutrition was severe if z-scores were less than -3 SD, moderate from -2 to -3 SD and mild from -1 to -2 SD. Ages were corrected for children with gestational ages of less than 37 weeks.

Anthropometric data at admission were collected by the researcher herself within 48 hours of hospitalization and discharge data a maximum of 24 hours prior to discharge. Children exhibiting dehydration at the time of admission were only weighed after hydration had been reestablished. Children younger than 2 years were weighed unclothed on a digital baby scale, with a 16 kg capacity and a sensitivity of 10 g, and their lengths were measured in decubitus dorsal on a flat surface with an anthropometric rule scaled in centimeters up to a maximum of 1 m, with two people performing the examination together to guarantee head position and foot contact. Children older than from 2 years were weighed with a minimum of

clothing on an adult scale accurate to 100 g. Height was measured with children standing upright against a vertical rule with a metric scale, reading up to 150 cm, marked off in centimeters and fixed to the wall.

With respect to weight, the difference between weight at admission and weight on discharge was taken to determine the total weight gain or loss during the hospital stay.

Children admitted with diarrhea and malnutrition were admitted to the Nutritional Recovery Unit and enrolled on the Hospital Treatment Program for the Severely Malnourished and fed with the high-energy diets recommended by the WHO.<sup>4</sup>

The study protocol was developed in accordance with directives and standards regulating clinical trials and was approved by the Committee for Ethics in Research at the *Universidade Estadual do Ceará*. Parents or legal guardians signed a free and informed consent form agreeing to the study objectives and procedures involved.

Statistical analysis of the results was performed on Epi-Info 6.04 and SPSS. Qualitative variables were analyzed with the chi-square method. For all analyses the level of significance was set at  $p < 0.05$ .

### Results

Two hundred and three children were studied, predominantly males. The average age was  $21.6 \pm 15.4$  months, with a majority of children ( $n = 126$ , 62.2%) aged less than 24 months. The most frequent disease responsible for admission was pneumonia (33%) followed by diarrhea (6.4%). The remaining 60.6% were distributed across diseases such as leishmaniasis, bronchiolitis, bronchial asthma, rheumatic fever, rheumatoid arthritis, gastroesophageal reflux disease, convulsions, chronic constipation and others. A Table 1 contains general characteristics of the sample.

The prevalence rates of moderate and/or severe malnutrition ( $< -2$  z score) were 18.7, 18.2 and 6.9%, for weight/age, stature/age and weight/stature, respectively.

As the study progressed, 17 patients were lost, seven through death, all aged less than 24 months, and the remainder because their weight and stature were not measured at hospital discharge. Ninety-six (51.6%) of the 186 children that completed the study exhibited weight loss (mean loss of  $0.41 \pm 0.26$  kg) and 84 (45.2%) of them gained weight (mean gain of  $0.43 \pm 0.16$  kg). The weights of the remaining 6 children remained unaltered during hospitalization.

The disease most frequently responsible for the admissions of children who progressed with weight loss was pneumonia and they tended to spend more than 9 days hospitalized (Table 2).

**Table 1** - General characteristics of children admitted to Hospital Infantil Albert Sabin - Fortaleza (CE), Brazil, from August to December 2003

Variable	Category	n	%
Gender	Male	124	61.08
	Female	79	38.92
Age (months)	03 to 11	69	33.99
	12 to 23	57	28.08
	24 to 59	77	37.93
Diagnosis	Pneumonia	67	33.00
	Diarrhea	13	6.40
	Others	123	60.60
Malnutrition	W/A	85	41.87
	S/A	89	43.84
	W/S	57	28.07
Time of hospital stay	2 to 9 days	77	41.39
	10 to 67 days	109	58.61

W/A = weight/age; S/A = stature/age; W/S = weight/stature.

**Table 2** - Incidence of weight loss during hospital stay of children who remained in the study, according to some variables

Variable	Incidence			p*
	Total	n	%	
Gender	Male	114	55	48.25
	Female	72	41	56.94
Age (months)	3 to 11	64	33	51.56
	12 to 23	51	24	47.06
	23 to 59	71	39	54.93
Pathology	Pneumonia	59	45	76.27
	Diarrhea	13	6	46.15
	Others	114	45	39.47
Time of hospital stay (days)	02 to 09	77	28	36.36
	10 to 67	109	68	62.39

\* Chi-square test.

Nutritional therapy with special high-energy diets was given to 19 (10.21%) children, nine of whom had diarrhea.

At the end of hospitalization the nutritional status of children admitted with moderate or severe malnutrition was unaltered. Nutritional deterioration was observed in 10 of the 109 (9.17%) children who had been well-nourished at admission (Table 3).

## Discussion

Childhood malnutrition is a disease of relevance and importance to public health; it is directly linked to poverty and if its greatest ally is hunger, its greatest victims are children.<sup>11</sup>

These children exhibit elevated morbidity and increased prevalence of hospital admissions. When admitted they are not generally subjected to anthropometric assessment and do not, therefore, receive nutritional support.<sup>8,10,12,13</sup>

Currently there is concern with the with the frequency of hospital malnutrition, however, there are problems with defining this and there are no studies on which to base the choice of a cutoff point for the percentage weight loss at which the term ought to be applied.<sup>8,9,14</sup>

This work was undertaken with focus on the fact that children can fall into malnutrition or worsen a preexisting state of malnutrition while in hospital and that it is therefore of fundamental importance to perform nutritional assessments during the hospital stay.

At the point of admission prevalence rates of 41.87 and 43.84% of malnutrition were observed for W/A and S/A. In developed countries malnutrition affects 15 to 20% of hospitalized patients. In contrast, in countries like Brazil and Mexico, rates of up to 70 to 80% of malnutrition among hospitalized children, and furthermore the condition has been observed to worsen during the hospital stay.<sup>10,15</sup>

The probable determinant factors of the elevated of the elevated prevalence of preexisting malnutrition that most stand out are: prematurity and low birth weight, lack of breastfeeding or early weaning and diarrhea. All of these factors, in isolation or conjunction, reflect the unfavorable socioeconomic living conditions of the children who seek care from public health services.<sup>5,16</sup> Preexisting malnutrition can prolong hospital stays, increase the incidence of nosocomial infections and raise both the risk and rate of mortality.<sup>17</sup>

Weight loss during hospital stay was observed in 51 % of children, which is similar to results published by Guadelus et al.<sup>8</sup> Other authors have found higher percentages of weight loss, in 65 to 80% of hospitalized children.<sup>10,12</sup>

The greatest frequency of weight loss was observed among children with pneumonia, 76.27% of 59 children, despite the majority of them presenting adequate nutritional status on admission, probably because of long periods of fasting prior to tests, failure to recognize the increased energy requirements because of infection, and, primarily, because of the lack of routines at health services for indicating nutritional therapy as an obligatory medical prescription, irrespective of the prior nutritional status of the patient.

Children with diarrhea exhibited a lower percentage of weight loss despite having an increased prevalence of

**Table 3** - Nutritional status assessed by means of z-scores, according to weight/age of children during hospital stay at HIAS

Classification	Initial prevalence				Progress					
			Severe PEM		Mod. PEM		Mild PEM		Eutrophia	
	n	%	n	%	n	%	n	%	n	%
Severe PEM	15	100	15	100	-	-	-	-	-	-
Mod. PEM	20	100	-	-	20	100	-	-	-	-
Mild PEM	42	100	-	-	-	-	42	100	-	-
Eutrophia	109	100	-	-	-	-	10	9.17	99	90.83
Total	186	100	15	8.0	20	10.8	52	28	99	53.2

HIAS = Hospital Infantil Albert Sabin; PEM = Protein-energy malnutrition.

malnutrition on admission and despite the condition being one that causes alterations to the integrity and permeability of the intestinal mucosa, leading to malabsorption. This subset exhibited 46.15% weight loss out of 13 children, in contrast with what was observed by Madzgira.<sup>18</sup> This is probably due to the nutritional support given these children with special high-energy diets during their hospital stays. Studies in low income communities demonstrate that nutritional support for malnourished children reduces mortality, in addition to resulting in weight gain during the hospital stay, irrespective of the disease responsible for admission.<sup>19,20</sup>

Length of hospital stay was another factor associated with weight loss during hospitalization. Children at nutritional risk, either because they had preexisting malnutrition or because they were subject to an imbalance between energy supply and demand, had a greater chance of prolonged hospitalization with an increased incidence of infection, resulting in the onset or exacerbation of malnutrition.<sup>17</sup>

In this study, children admitted with malnutrition were discharged with their nutritional status unchanged. Nutritional deterioration was observed in 10 (9.17%) children who had been well-nourished at admission. Ferreira e França<sup>10</sup> observed that 20% of the children who had been well-nourished at admission became malnourished. This difference was probably due to the fact that in these authors' study all of the children assessed had spent at least 10 days in hospital.

A similar study carried out in Turkey demonstrated that children with mild malnutrition are more susceptible to the adverse effects of hospitalization, probably because they do not receive nutritional support as a supplementary treatment.<sup>21</sup>

It is of extreme importance to emphasize the fact that children who were malnourished on admission were still malnourished at the end of their hospital stays. This was true even for those patients who had been enrolled on the Hospital Treatment Program for the Severely Malnourished defined by the WHO. This treatment is effective at correcting acute adverse events and thus reducing mortality, but it is not intended to modify the nutritional status of children while they are in hospital.

Dietary care is of fundamental importance in the context of clinical treatment, irrespective of the disease responsible for admission, particularly in regions with high rates of child malnutrition. Gallagher - Allred et al.<sup>22</sup> state that adequate nutritional support contributes to reducing the prevalence and magnitude of malnutrition and improving clinical prognosis.

The results obtained here allow us to conclude that the prevalence of weight for age deficit was elevated among these children at the time of admission. Weight loss during hospitalization had a significant relationship with prolonged hospital stays and with the disease responsible for hospitalization.

The fact that the nutritional status of children who had been admitted in a well-nourished state deteriorated while they were in hospital must lead us to reflect on the need for a culture that values the nutritional condition of hospitalized patients, in particular children, because of their increased nutritional vulnerability.

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