Abstract

Objective: to assess the evolution of nutritional status in children admitted to the Teaching Hospital of Universidade Federal de Alagoas.

Methods: a retrospective study was performed on 52 children (0-10yrs) whose length of hospital stay exceeded 10 days (from February to July/2001). We compared their nutritional status, expressed in terms of Z score of the weight-for-age ratio at the beginning (T1) and at the end of the hospitalization period (T2).

Results: the predominant age range (44.2%) was less than 1 year (median = 1.4yrs). The hospitalization period varied from 10 to 77 days (median=20 days). Although the prevalence rates of protein-energy malnutrition (PEM) in T1 and T2 were, respectively, 71.2% and 69.2%, only 15.4% had this diagnosis on the medical records. These children diagnosed with protein-energy malnutrition presented extreme wasting and greater length of hospital stay than the others (PEM, n = 8: -4.38 2.1, T = 30 4.5; undiagnosed PEM, n = 13: -3.13 0.9, T = 23 18; other conditions, n = 31: -0.63 1.1, T = 21 13). Among the 52 children analyzed, only 29 showed positive weight variation. However, the average magnitude of negative Z values was higher than that of positive values: -0.56 and 0.50. Children who remained in hospital for a longer period of time showed larger weight deficits, indicating that hospitalization did not contribute towards the improvement of their initial nutritional status.

Conclusion: the prevalence of weight-for-age deficit among children at hospital admission was very high. This situation remained unchanged at hospital discharge.


Introduction

Despite the numerous reiterations by United Nations member states of their commitment to guaranteeing the right of all human beings not to suffer from starvation, infant malnutrition continues to be a serious public health problem in less developed countries, due to its magnitude and consequent effects on the growth, development and survival of children.1,2

The origins of malnutrition can be either primary or secondary. When primary, malnutrition is the result of an inadequate diet with no other interfering factors.3 With secondary malnutrition, however, certain factors exist which interfere with the individual’s normal use of nutrients, even when the diet is adequate. This can occur, for example, in the presence of palatal fistula, cystic fibrosis of the pancreas or nephrosis, among many other conditions, which interfere with deglutition, digestion and excretion, respectively.3

Protein-energy malnutrition (PEM) is a term which describes a class of clinical disorders which result in variable combinations and degrees of protein and energy...
deficiencies, to the detriment of the normal growth and development of children and contributing to an important extent to higher levels of morbidity and mortality, being recognized as one of the most serious of Brazil’s public health problems, above all in the North East by virtue of the larger percentage of the population with a low socioeconomic level. These aspects make plausible the assumption that, in this region, malnutrition is one of the principal diseases that affect the children who attend the various health services.

In 1999, the Brazilian Society of Parenteral and Enteral Nutrition undertook a multicenter study with the objective of quantifying hospital malnutrition. The results found were alarming due to the elevated levels and to the absence of adequate interventional procedures which would allow improvement of the existing situation. In developed countries malnutrition affects between 15 and 20% of hospitalized patients. In contrast, in countries such as Mexico, mild malnutrition of up to 80% has been found among hospitalized children. A worsening of the condition was also observed during the period of hospitalization. It is probable that the etiology of these malnutrition profiles is distinct with relation to origin, with a prevalence of secondary malnutrition in developed countries, while in poor countries malnutrition would be mainly caused by a lack of food. As such hospital demand due to malnutrition would be directly related to its prevalence in the population. In this case it is plausible to assume that, in Alagoas, one of the poorest Brazilian states and the location of the highest malnutrition prevalence in Brazil, there would be a high frequency of hospitalized children suffering from this complaint.

Given this scenario, the importance of investigating the evolution of the nutritional status of hospitalized patients is justified, with the intention of contributing to improved planning of activities designed to minimize hospital malnutrition providing the patients with conditions for a better recovery and a shorter hospital stay.

The objective of this study was to analyze the evolution of the nutritional status of children admitted to the Teaching Hospital of Universidade Federal de Alagoas (HU).

**Method**

From February to July 2001, all the children listed in the admissions registry of the HU pediatric clinic were enrolled. The relevant medical records were obtained from the Department of Medical Files and Statistics (SAME) in order to analyze and select the children to be included in the study. All children between 0 and 10 years old who had been hospitalized for more a period of 10 or more days were included.

For the 52 children who met the inclusion criteria the following details were collected: sex, age, body weight, date of admission and discharge, origin (state capital or interior) and diagnosis.

For the assessment of the nutritional status at admission and at discharge, a weight-for-age ratio was used. The ratio was expressed in standard deviation units (Z score) relative to the NCHS (National Center for Health Statistics) anthropometric reference standard. The nutritional classification took into account the following criteria: eutrophy: $Z > -1$ SD; mild malnutrition: $-1 \leq Z < -1.9$ SD; moderate malnutrition: $-2 \leq Z < -2.9$ SD; extreme malnutrition: $Z \leq -3$ SD.

For the analysis of length of hospital stay the distribution was stratified into four categories according to the quartiles delineated by the 25th, 50th and 75th percentiles.

Results are presented as mean standard deviation or amplitude and median. Differences were considered statistically significant when the probability of false rejection of a null hypothesis was less than 5% ($p < 0.05$). To ascertain this, the Student’s test for dependent (paired) samples was employed.

**Results**

Fifty-two children were studied, of whom 36 (69.2%) were male and 16 (30.8) female. The predominant age group was less than one year old (infant), making up 44.2% of all cases. The patients from the interior of the state were more numerous (53.8%) than those from the capital. Twenty-eight diseases were registered as main diagnoses, and the most frequent condition was malnutrition (15.4%), followed by pneumonia (9.6%), iron-deficiency anemia (7.7%) and dehydration (5.8%). The length of hospital stay varied from 10 to 77 days. Table 1 illustrates the general characteristics of the sample.

Table 2 presents the nutritional classification of the group of children at the beginning and at the end of their hospital stay. Note that 71.2% of children were malnourished at the time of admission. There was a reduction of the order of 15.2% in the prevalence of extreme malnutrition and of 6.5% in that of mild malnutrition, while the number of cases of moderate malnutrition increased by 24.7%. At hospital discharge, the prevalence of PEM was 69.2%, just two percentage points below the initial prevalence.

Table 3 shows the individual evolution of the groups according to the initial nutritional status. Note that of the 13 children admitted with severe malnutrition, 11 remained in this state at hospital discharge. Of the eight patients who had had moderate malnutrition, only two evolved to mild malnutrition. Sixteen children had been mildly malnourished. Of these, four evolved to eutrophy while three worsened and came to present moderate malnutrition.

Of the 52 children studied, 29 showed a positive variation in weight, while this variation was negative in 23 cases. Nevertheless, the magnitude of the average of the negative $Z$ values was greater than the average of the positive values: -0.56 and 0.50, respectively.
Table 4 shows the evolution of nutritional status according to specific diseases and length of hospital stay. Note that those children who had been admitted with a diagnosis of malnutrition (more than 70% of the patients had some degree of malnutrition, but not all of them had this diagnosis on their medical records) stood out from the rest due to the extreme level of emaciation. These children presented an average Z score of -4.38±2.1, against -3.13±0.9 for children who had moderate to severe malnutrition, but who had not received this diagnosis, and -0.63±1.1 for all other conditions.

A worrying situation was confirmed with relation to those children diagnosed with iron-deficiency anemia. This group showed a statistically significant deterioration in nutritional status (p = 0.05). The pneumonia and dehydration cases presented a slight improvement, but were not statistically significant.

The children who had the highest degrees of nutritional deficit remained in hospital for longer periods of time. Nevertheless, this longer period did not result in improved prognoses with relation to the nutritional status of the patients.

Discussion
A study performed at the Hospital de Pediatría of the Centro Médico Nacional, in Mexico, revealed that, among 450 children admitted, 72.2% had some degree of malnutrition.8 This prevalence was very similar to that found in our study. Of the 52 children studied, 71.2% were malnourished at the time of hospital admission. It is important to point out that for the majority of these children, such a diagnosis was not registered on the medical record, possibly indicating that the nutritional status of patients is not receiving due consideration in relation to the treatment, which corroborates the conclusions made by Waitzberg et al.7

These authors, in a multicenter study involving 4,000 patients, detected an elevated prevalence of hospital malnutrition and concluded that clinics were inattentive to this problem and that nutritional treatments were being underused.

In this study, PEM prevalence at the end of the hospital stay was only two percentage points below the initial prevalence, a change that is insignificant in the light of statistics. An even more worrying situation is found with respect to the nutritional evolution of children hospitalized specifically because of malnutrition. The eight children admitted with this diagnosis, in addition to not getting out of the “severe malnutrition” category, did not present any significant alteration in terms of evolution in Z score units. Even the group of children diagnosed with dehydration, remained seriously malnourished, despite the “expected” weight gain resulting from the rehydration process. From a statistical point of view, among all data analyzed, the only significant change was the deterioration of the weight for age ratio observed in the children diagnosed with iron-deficiency anemia. It is possible that, by virtue of the extent of iron depletion, these children presented some degree of edema, which would have receded with treatment, and would have caused the weight loss.

The weight for age ratio, expressed in different Z score levels, was adopted in this study as an indicator of nutritional status. This ratio is created based on the comparison between observed weight and the reference weight for the respective age and sex. It identifies conditions in which the child presents a body weight below (or above) that which is expected. Its major merit is in consolidating cases of deficits of weight and/or stature, and because of this it is very useful in prevalence studies. Nevertheless, as it does not employ height measurement it is incapable of distinguishing the nature of the process, bearing in mind that there are two distinct forms of weight deficiency: weight for height deficiency, related to acute processes, and height for age deficiency, which is indicative of chronic nutritional deficits. Nevertheless it was the most sensitive index for monitoring the growth of children younger than 6 months, where
compromised height had not yet had a “chance” to become obvious.\(^1\) As our patients’ age groups varied from 0 to 10 years, this fact constitutes a limitation to this study. In contrast, as data were obtained from information contained in medical records, the absence of any height measurement perhaps reveals the low importance which should be given to the nutritional assessment of children, in order to better establish a treatment conduct and also for effective evaluation of these procedures.

In dealing with a study which involves the nutritional status of hospitalized patients, it becomes inevitable that dietary attention be discussed in this context, since it is completely accepted that well directed dietary therapy can provide intervention of fundamental importance to the favorable prognosis of patients, especially if malnutrition is part of the nosological status. According to Braunschweig et al.,\(^1\) the deterioration of the nutritional status of hospitalized patients, irrespective of their initial condition, is associated with elevated hospital costs and increased probability of complications. Conversely, Gallagher-Allred et al.\(^1\) assure us that adequate nutritional support contributes to a reduction in prevalence and magnitude of malnutrition, improves clinical prognoses and helps to reduce treatment costs.

### Table 2 - Distribution of children according to the nutritional classification by degrees of weight-for-age Z score, at the beginning and at the end of hospital stay - pediatric clinic of Hospital Universitário, Maceió, AL

<table>
<thead>
<tr>
<th>Nutritional classification(^*)</th>
<th>Initial (a)</th>
<th>Final (b)</th>
<th>Δ (b - a . 100)</th>
<th>P (t test)</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>Severe PEM ((z \leq -3) DP)</td>
<td>13</td>
<td>25.0</td>
<td>11</td>
<td>21.2</td>
</tr>
<tr>
<td>Moderate PEM ((z \leq -2 \text{ a } -2.9) DP)</td>
<td>8</td>
<td>15.4</td>
<td>10</td>
<td>19.2</td>
</tr>
<tr>
<td>Mild PEM ((z \leq -1 \text{ a } -1.9) DP)</td>
<td>16</td>
<td>30.8</td>
<td>15</td>
<td>28.8</td>
</tr>
<tr>
<td>Eutrophy ((z &gt; -1) a 1.9 DP)</td>
<td>14</td>
<td>26.9</td>
<td>16</td>
<td>30.8</td>
</tr>
<tr>
<td>Overweight ((z \geq 2)DP)</td>
<td>1</td>
<td>1.9</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>52</td>
<td>100.0</td>
<td>52</td>
<td>100.0</td>
</tr>
</tbody>
</table>

\(\) = mean Z score standard deviation from the weight-for-age ratio.

### Table 3 - Evolution of the nutritional status according to initial nutrition - pediatric clinic of Hospital Universitário, Maceió, AL

<table>
<thead>
<tr>
<th>Nutritional classification(^*)</th>
<th>Initial prevalence</th>
<th>Acute PEM</th>
<th>Moderate PEM</th>
<th>Mild PEM</th>
<th>Eutrophy</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Acute PEM ((z \leq -3) DP)</td>
<td>13</td>
<td>100.0</td>
<td>11</td>
<td>84.6</td>
<td>1</td>
</tr>
<tr>
<td>Moderate PEM ((z \leq -2 \text{ a } -2.9) DP)</td>
<td>8</td>
<td>100.0</td>
<td>–</td>
<td>–</td>
<td>6</td>
</tr>
<tr>
<td>Mild PEM ((z \leq -1 \text{ a } -1.9) DP)</td>
<td>16</td>
<td>100.0</td>
<td>–</td>
<td>–</td>
<td>3</td>
</tr>
<tr>
<td>Eutrophy ((z &gt; -1) a 1.9 DP)</td>
<td>15</td>
<td>100.0</td>
<td>–</td>
<td>–</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>52</td>
<td>100.0</td>
<td>11</td>
<td>21.2</td>
<td>10</td>
</tr>
</tbody>
</table>
Table 4 - Evolution of the nutritional status* of children according to length of hospital stay† and main diagnosis - Hospital Universitário da UFAL, Maceió, AL

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>n</th>
<th>%</th>
<th>Initial W/A</th>
<th>Final W/A</th>
<th>Δ</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malnutrition (PEM)</td>
<td>8</td>
<td>15.4</td>
<td>-4.38±2.1</td>
<td>-4.22±2.1</td>
<td>-0.16</td>
<td>0.56</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>5</td>
<td>9.6</td>
<td>-0.76±1.5</td>
<td>-0.54±1.2</td>
<td>-0.22</td>
<td>0.24</td>
</tr>
<tr>
<td>Anemia</td>
<td>4</td>
<td>7.7</td>
<td>-1.42±1.3</td>
<td>-2.31±0.8</td>
<td>0.89</td>
<td>0.05</td>
</tr>
<tr>
<td>Dehydration</td>
<td>3</td>
<td>5.8</td>
<td>-3.04±1.5</td>
<td>-2.68±1.4</td>
<td>-0.36</td>
<td>0.28</td>
</tr>
<tr>
<td>Length of hospital stay (days)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10-13</td>
<td>14</td>
<td>26</td>
<td>-1.24±1.4</td>
<td>-1.19±1.4</td>
<td>-0.05</td>
<td>0.61</td>
</tr>
<tr>
<td>13-20</td>
<td>13</td>
<td>25.0</td>
<td>-1.21±1.3</td>
<td>-1.38±1.4</td>
<td>0.17</td>
<td>0.37</td>
</tr>
<tr>
<td>20-28</td>
<td>12</td>
<td>23.1</td>
<td>-2.41±2.4</td>
<td>-2.37±2.3</td>
<td>-0.04</td>
<td>0.85</td>
</tr>
<tr>
<td>28-77</td>
<td>13</td>
<td>25.0</td>
<td>-2.70±2.3</td>
<td>-2.56±2.0</td>
<td>-0.14</td>
<td>0.55</td>
</tr>
<tr>
<td>Total</td>
<td>52</td>
<td>100.0</td>
<td>-1.88±2.0</td>
<td>-1.85±1.8</td>
<td>-0.03</td>
<td>0.78</td>
</tr>
</tbody>
</table>

* Mean Z score standard deviation from weight for age (W/A) at admission and at hospital discharge.
† The categories were established according to the distribution quartiles. The median was the equivalent value at 20 days. The 25th and 75th percentiles were equivalent to the values of 13 and 28 days, respectively.

In our patients there was a predominance of children less that one year old with relation to the other age groups. Amongst possible factors which could explain the elevated prevalence of PEM at such early stages in life, the following stand out: (a) children born with low birthweight and who did not manage to achieve adequate development of weight and stature because of being subjected to an inhospitable environment, (b) absence of breastfeeding or premature weaning; (c) introduction of inappropriate weaning foods; (d) a low level of immunity (e); diarrhea, intestinal parasites and frequent infections. All of these factors are very common in Alagoas amongst populations with a low socioeconomic level. The implantation of measures to reduce these factors would contribute to a reduction in the prevalence of PEM at a populational level, and, in consequence, to a reduction in demand for hospital beds.

In São Paulo, where living conditions are relatively better than those found in Alagoas, a study conducted in the pediatric service of Hospital das Clínicas, from March 1996 to March 1997, found prevalence of 55.9% PEM amongst patients younger than two years and of 35.5% amongst those between 2 and 5 years old. This representative study of the infant population of Alagoas revealed that 18.4% of the children from Alagoas had a moderate to extreme height for age deficit. Notwithstanding, this prevalence was 22.7% in the interior and just 5.4% in Maceió (the state capital). Studies performed in Maceió, covering peripheral populations, have found prevalence similar to that found in the rural zones.

It is extremely important to point out that a hospital is not the appropriate location for the treatment of malnutrition. The treatment of malnutrition in a hospital environment involves inconveniences such as elevated cost, the chance of nosocomial infection, the psychological stress and the performance of treatment away from the child’s real environment, thus not contributing to any decrease in nutritional risk after hospital discharge. Nevertheless, when risks and benefits are taken into account, the extreme cases require hospital admission, as very often, this represents the difference between life and death for the child.

The results obtained suggest that the dietary attention being offered to patients hospitalized at the pediatric clinic of the HU is effective in terms of improving the nutritional status of these children, irrespective of the diagnosis or of...
the hospital stay. Despite the small number of patients studied, the sample is representative of all patients who were admitted and remained for more than 10 days in that service from February to July 2001. Even in the face of the necessity of performing further studies with the aim of making the problem even clearer, it is highly recommendable that the multidisciplinary team responsible for the global care of these patients discuss these findings and, if necessary, re-orient intervention protocols, giving greater importance to the nutritional status of the children and to their respective dietary care.

The data obtained allow us to conclude that the prevalence of weight for age deficiency among the children at admission was greatly elevated, a condition which was not altered at hospital discharge, irrespective of the diagnosis or length of hospital stay.

References

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