Z-SCORE: AN INDICATOR OF PROTEIN-CALORIE MALNUTRITION

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Z-SCORE: AN INDICATOR OF PROTEIN-CALORIE MALNUTRITION (Abstract). According to the World Health Organization, malnutrition is a chronic disorder of nutritional status, especially among infants and young children, triggered by the imbalance between the nutritional intake and the body’s needs to ensure the harmonious growth and development and the fulfillment of the body’s specific functions. **Aim:** WHO introduced the Z-score, which has been used for child growth standards; since then, malnutrition and its severity have been determined according to this score. **Material and methods:** We conducted a retrospective study of the cases of malnutrition admitted to the “Pediatric Recovery” department between May and December 2016. The sample considered for the study includes 74 infants showing signs of malnutrition at the moment of hospitalization: significant weight loss, asthenia, fatigue etc. **Results:** Of all the indicators used for the assessment of malnutrition, the Z-score is the most reliable. It expresses the anthropometric value in the number of standard deviations that are inferior or superior to the mean reference value. The graphical processing of the data showed that the Z-score for the height on admission generally ranged from -3.5 to -0.5, being below the reference limit. **Conclusions:** The Z-score is harder to calculate, but it is age-independent and it accurately diagnoses malnutrition. **Keywords:** Z-Score, Protein-Calorie Malnutrition, Dystrophic Infant.

Half of the nutritional deficiency states occur in the first 6 months of life, overlapping the maximum period of development of the central nervous system, given that the neural multiplication takes place up to 18 months of life. Thus, nutritional deficiency causes severe and often irreversible mental disabilities (1). According to the World Health Organization, malnutrition is a chronic disorder of nutritional status, especially in infants and young children, triggered by the imbalance between the nutritional intake (both caloric and protein intake) and the body’s needs to ensure the harmonious growth and development and the fulfillment of the body’s specific functions. It is characterized by low birth weight, low weight-for-age and, in chronic forms, by a low weight-for-height (2). In 2006, WHO introduced the Z-score, which has
been used for child growth standards; since then, malnutrition and its severity have been determined according to this score (3). The term protein-calorie malnutrition is used to cover a large number of clinical conditions in adults and children, including: growth failure, marasmus, cachexia, nutritional nanism, kwashiorkor and nutritional edema or hunger edema. Regardless of the clinical differences between these situations, most of the physiological, biochemical and compositional features of the body are common to all forms of severe malnutrition (4).

**MATERIAL AND METHODS**

We conducted a retrospective study of the cases of malnutrition admitted to the “Pediatric Recovery” department between May and December 2016. The sample considered for the study includes 74 infants showing signs of malnutrition at the moment of hospitalization: significant weight loss, asthenia, fatigue, decreased resistance to cold and infections, dry skin, changes in pigmentation, edema, hypotension and bradycardia, diarrhea and hepatomegaly.

The data were taken from the observation sheets of the “Pediatric Recovery” department of the “Sf. Maria” Clinical Emergency Hospital in Iasi, respecting the code of ethics and deontology for scientific research. The study was designed so as to achieve the following objectives: to assess the nutritional status in newborns and infants and to determine the risk factors for malnutrition in newborns and infants in the Iasi area. The observation sheets were used to collect data such as the child’s sex, his or her age at the moment of hospitalization, his or her mother’s age, the data related to the mother’s educational and socioeconomic background, the age of gestation and the child’s place of birth as well as the data on his or her condition at birth (Apgar score, weight, height), the way the child was fed before the admission to hospital, the period of hospitalization, the anthropometric indicators on admission and on discharge from hospital and the Z-score calculated for each anthropometric indicator.

**RESULTS**

Out of the total of 74 infants in the study group (admitted due to malnutrition symptoms), female was found to have a higher incidence (65%) compared to male. The analysis of the statistical data shows that more than half of the mothers were aged less than 25 years old (70%), with a predominance of those under the age of 20, which is correlated with their lack of education. Mothers’ marital status was also associated with underweight children for their age. More than half of the mothers in the study are unmarried (66%), and this has a negative influence on the growth and development of children. Most mothers of the children admitted to hospital and considered for this study had more than 4 pregnancies and a low number of abortions, which means they belong to families with many children. This is caused by the mother’s lack of education, the low level of living standards and the area where they live – most of them are from rural areas.

The infants included the study group showed symptoms of malnutrition at the moment of admission, although 69% of them were born on term; more than a quarter of them had a birth weight of less than 2500 grams. The birth weight of a child represents an indicator of his / her mother’s health and nutritional status and, at the same time, of the population’s socioeconomic level. The birth height of the infants included in the study was generally normal, ranging from
47 to 55 cm. This indicator is known to be the most reliable for the infant’s age, as it is not influenced by malnutrition in the long term. Most of these infants were hospitalized for one month. The statistical data show that about three quarters of them had an admission weight of less than 5 kg and during the hospitalization they had a weight gain of 500-1,000 grams. The infants’ measurement showed that less than half of them had a smaller height than normal and that they gained 1 or 2 cm in height during the month of hospitalization.

Of all the indicators used for the assessment of malnutrition, the Z-score is the most reliable. It expresses the anthropometric value in the number of standard deviations that are inferior or superior to the mean reference value. The graphical processing of the data showed that the Z-score for the height on admission generally ranged from -3.5 to -0.5, being below the reference limit. The normal Z-score must be 0 with ± 1 SD. 4.05% of infants had a Z-score of less than -4.5, 10.81% had a Z-score between -4.5 and -3.5, 16.22% had a Z-score between -3.5 and -2.5, 28.38% had a Z-score between -2.5 and -1.5, 25.68% had Z-score between -1.5 and -0.5, 12.16% had a Z-score between -0.5 and 0.5 and 2.7% had a Z-score above 0.5. The Z-score for the height on discharge was also calculated – its values slightly increased, ranging from -2.5 to -0.5. This showed that the statural deficit decreased; however, the normal values were not reached. The Z-score for the height on discharge indicated that 1.35% of infants had a Z-score below -4.5, 10.81% had a Z-score between -4.5 and 3.5, 10.81% had a Z-score between -3.5 and -2.5, 33.78% had a Z-score between -2.5 and -1.5, 27.03% had a Z-score between -1.5 and -0.5, 14.86% had a Z-score between -0.5 and 0.5 and 1.35% of infants had a Z-score above 0.5.

The indicator weight-for-age was used to calculate the Z-score; along with the processed data, it showed that the nutritional deficiency of the infants included in the study was increased compared to the weight they had on admission. This fact is also confirmed by the literature (7). The analyzed data showed that the Z-score for weight on admission was generally between -5 and -2, which means that the nutritional deficit of these infants was very high. Upon discharge, the Z-score for weight was one standard deviation higher than the normal value – this showed that the care and nutrition during the hospitalization period had the expected effect on the infants in the study group.

Regarding the Z-score for weight on admission, 10.81% of infants had a Z-score of less than -5, 18.92% had a Z-score of -5 to -4, 28.38% had a Z-score of -4 and -3, 29.73% had a Z-score between -3 and -2 and 12.16% of infants had a Z-score which above -2. Upon discharge, 4.05% of infants had a Z-score of less than -5, 16.22% of infants had a Z-score of -5 to -4, 25.68% had a Z-score for weight between -4 and -3, 29.73% had a Z-score between -3 and -2, 18.92% had a Z-score between -2 and -1 and 5.41% of infants had a Z-score for weight above -1 (fig. 1). The Z-score for weight-for-height compares the weight of the child under analysis with the weight of a child of the same height in the control population. As for the Z-score for weight-for-height on admission, it appears that 1.35% of infants had a Z-score of less than -5, 14.86% of them had a Z-score ranging from -5 to -4, 24.32% had a Z-score between -4 and -3, 21.62% had a Z-score between -2 and -1, 31.08% had a Z-score...
between -1 and 0, 5.41% had a Z-score between 0 and 1 and 1.35% of infants had a Z-score above 1.

On discharge, 1.35% of the infants had a Z-score for weight-for-height which was below -5, 6.76% had a Z-score between -5 and -3, 18.92% had a Z-score between -3 and -2, 24.32% had a Z-score between -2 and -1, 35.14% had a Z-score between -1 and 0, 10.81% had a Z-score between 0 and 1 and 2.70% of infants had a Z-score above 1 (fig. 2).

![Fig. 1. Z-score for weight on admission](image1)

![Fig. 2. Z-score for weight on discharge](image2)

**DISCUSSION**

The literature shows that the gender distribution of malnutrition in infants is relatively equal, with a slight predominance of the male gender (7).

In our study, the age distribution shows that more than half of infants were aged less than 3 months old at the moment of their admission to hospital, which corresponds to literature data (5). According to the literature, the ideal age to be a mother is between 25 and 34 years; babies born from mothers under 18 or over 40 years have a higher risk of having health problems (8). The literature shows that the mothers who have a job have higher income and use this income to take care of their children. Therefore, mothers’ partici-
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cipation in generating family income is crucial to improving children’s nutritional status (9).

In the current research, mothers gave birth in a maternity unit, most of them in a natural way. The findings of our study are similar with the se from the literature (6).

The scientific literature also shows that, in developing countries, 11% of children have a birth weight below the reference value of 2,500 grams, while in developed countries this percentage is only 2% (10, 11). A study conducted by UNICEF in Romania showed that most cases of low birth weight babies were in Moldavia. Half of the pregnancies were not monitored by medical staff because the access to specialized medical services of the people in the countryside is limited. These data are also confirmed by the literature, which shows that in other parts of the world, more than half of rural mothers do not go to a physician for consultations during pregnancy (3, 4, 6). The literature shows that the prevalence of low weight-for-height is generally below 5%, even in poor countries. In Romania, the percentage is 2.3%, which is the limit between a mild deficit and a moderate deficit; in Moldavia, the prevalence is lower than in the other regions, but this is also due to the smaller size of the children in this region. It has also been found that the environment of origin influences the prevalence of low weight-for-height, which higher in the rural environment (5, 6). Previous studies carried out by UNICEF showed that the low height-for-age in Romania has improved; even if the value of 5% is above the reference value for age groups, it does not exceed the maximum value showing a slight deficit (3, 5, 12).

CONCLUSIONS

In our study, we found that the Z-score is hard to be calculated, but it is age-independent and it accurately diagnoses malnutrition. Malnutrition remains the most common cause of mortality and morbidity among children worldwide. A low socio-economic level means a lack of access to utilities, infrastructure and proper health services, as well as inadequate housing and, most of all, a low-nutrient and vitamin diet. Therefore, the frequency of malnutrition is increased among children from disadvantaged families. Our research shows that with appropriate care and diet children with malnutrition could be recovered.

REFERENCES


**DOSAGE OF REACTIVE C PROTEIN AND TUBERCULOSIS PROPHYLAXIS IN HIV-INFECTED PATIENTS**

Prophylaxis of tuberculosis (TB) using isoniazid, in HIV-infected patients (HIVIP) is a challenge because it requires exclusion of the presence of active TB and may increase the risk of isoniazid mono-resistance. The diagnosis of TB is, however, lengthy and costly, which delay the initiation of isoniazid prophylaxis (IP). According to the World Health Organization, the eligibility of HIVIP for IP can be established based on the presence of any one of four predictive symptoms of active TB (current cough, fever, night sweats, weight loss in the past 30 days). This method of clinical triage allows the initiation of IP in less than one third of eligible HIVIP. In this context, it is necessary to use other triage method with greater sensitivity and specificity. Numerous studies have shown that an increase in C-reactive protein (CRP) greater than 10 mg/L is predictive of active TB, regardless of the patient’s immune status. A recent study conducted by C. Yoon and collaborators showed that the CRP test can improve active TB screening and eligibility for IP in HIVIP. The study group included 201 patients, of whom 196 HIVIP and 5 HIV-TB co-infection. The results showed that of the 196 HIVIP, 129 patients were eligible for IP using the CRP as screening test, while only 42 patients were eligible for IP on the basis of clinical triage. The results also established that the CRP test had a sensitivity of 80% and a specificity of 87% for the detection of active TB while the clinical triage sensitivity was 100% but with a specificity of 21%. These results have demonstrated the utility of CRP as a quick and inexpensive triage test for establishing eligibility for IP in HIVIP (Yoon C, Davis JL, Huang L, Muzoora C, Byakwaga H, Scibetta C, Bangsberg DR, Nahid P, Semitala FC, Hunt PW, Martin JN, Cattamanchi A. Point-of-care C-reactive protein testing to facilitate implementation of isoniazid preventive therapy for people living with HIV. J Acquir Immune Defic Syndr 2017; 65(5): 551-556).

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