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Nutritional Disorders: Infant Protein-Energy Malnutrition

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ABSTRACT

Malnutrition is characterized as a deficiency of food and nutrients, mainly affecting children of pre-school age (up to 5 years). Responsible for 30% of the world's child deaths, malnutrition can compromise the child's physical and mental development. The objective of this study was to present, through a literature review, information on energy-protective malnutrition; to expose the effects of malnutrition on the development and growth of the child and the immune system. Consequently, to discuss ways of diagnosis and treatment in order to reduce the high rates of child morbidity caused by malnutrition.

Keywords: Protein malnutrition, PEM, child, energy-calorie malnutrition.

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Introduction

Protein energy malnutrition (PEM) is considered a common nutritional disorder and represents one of the main collective health problems. According to the United Nations Children's Fund (UNICEF) and the World Health Organization (WHO), an estimated 190 million pre-school children are malnourished and 30 % of child deaths worldwide are related to malnutrition¹

PEM is characterized by the deficiency of energy foods and proteins; the causes are diverse and dangerous and can compromise the individual's immune system leaving him more susceptible to infectious diseases. The nutritional condition of the patient must be constantly monitored so that the control of malnutrition is effective. The most important measure in controlling PEM is nutritional control to mitigate the effects and consequences of the disease.

Objective

To discuss the main factors that lead to protein energy malnutrition, understand its risks to child health and evaluate nutritional strategies to combat and treat this pathology.

Methods

This work is a literature review, through searches in the sites SCIELO, LILACS, BVS and BIREME. Searches were conducted from August 2018 to December 2019.

The descriptors used were: protein malnutrition, PEM, child malnutrition. Recently published books and journals on nutrition were included in the analysis, and they are related to the theme of this work.

Results

Protein energy malnutrition is characterized as a multifactorial disease of high lethality, which causes physiological changes in the body in an attempt to adapt it to nutrient shortages. It leads to the loss of fundamental elements in the patient's body, promoting the reduction of energy reserves, decrease of glycogen and fat stocks, making protein mass the main source of energy, also presents scarcity of micronutrients, such as

vitamins type A and E, magnesium, zinc, copper and selenium, which contributes to the dysfunction of the immune system and reduction of protein synthesis² The main metabolic dysfunctions that are regularly observed in PEM are: hypoglycemia and hyperglycemia, hypothermia, dehydration and diarrheic disease.

The PEM is configured as one of the major public health problems, and poverty is one of the aspects that is closely related to the emergence of malnutrition, associated with low socioeconomic conditions, precarious basic sanitation conditions, unemployment and family breakdown; affecting mainly young children (up to the age of 5), as they show accelerated growth and development, which requires great demand for nutrients during this phase³

The influence of malnutrition on the child's body ranges from compromising growth, where in an attempt to save energy to maintain vital functions, nutritional deficiencies slow down the gain in height, decrease in weight due to loss of muscle mass and subcutaneous tissue⁴ Children with PEM are more likely to acquire infections because they have an impaired immune system; this condition can lead to general impairment in development, learning and motor functions⁴

Regarding the heredity of the disease, studies related to the nutritional status of individuals from the same family correspond in most cases to the analysis of mother and child nutrition, considering that the maternal nutritional status during pregnancy and the conditions of the intrauterine environment have fundamental importance in the nutritional status of the newborn. Observational studies have shown that fetal supply in the human body is influenced by mechanisms that depend on the availability of nutrients, such as a hypoproteic diet that during pregnancy can alter the expression of leptin, a fundamental hormone in the control of numerous body functions, almost all related to weight control, appetite and metabolism in general^{5,6}

With regard to nutrition, epigenetic changes

reflect on the effect of nutrients on the chromatin structure; such changes are capable of programming and reprogramming the cellular communication network, which highlights the role of the environmental factor in the regulation of the epigenome, especially in food, since chemical compounds of the diet have the potential to influence the individual's phenotype, then, if dietary intake is insufficient and the mother's nutrient stocks are low, the fetus will need to use pre-conceptual reserves to supply itself, causing the maternal-fetal binomial compromise, causing alterations in nutrient transport. For example, protein deficiency in the mother's diet during pregnancy may decrease the expression of the genes responsible for the insulin-like growth factor, the *Insulin Growth Factor* (IGF), contributing to growth retardation, often observed in malnourished children⁷

Energy-protective malnutrition includes clinical situations whose severity ranges from very severe to mild. In this spectrum are called Kwashiorkor and Doldrums, which have high mortality rates. PEM, regardless of its origin, presents acute and chronic effects, slowing growth and hindering psychic development, leading to negative effects, which may consequently result in adults with intellectual and biological limitations with reduced work capacity⁸

The clinical manifestations of Kwashiorkor are growth retardation, edema mainly located in the legs, loss of muscle and subcutaneous fat, hepatomegaly, may also present hair lesions such as hair loss, loss of shine and color, which may be generalized or local (flag sign), also present skin lesions (dermatosis, peeling and depigmentation)¹

The doldrums in an advanced setting has an unmistakable aspect, the child is evidently very thin, with loss of muscle mass and prominent abdomen; they present very low weight, subcutaneous fat scarce or absent and retardation in growth, besides generally manifesting pictures of diarrhea, tuberculosis,

infections and parasitosis. Signs of micronutrient deficiency and vitamin deficiency of the B complex are also observed¹

The diagnosis of malnutrition is made based on the child's clinical history, clinical examination and assessment of nutritional status. If the resources allow laboratory tests should be done, however, it is important to emphasize that in cases of severe malnutrition, the interpretation of biochemical tests should be careful, since malnutrition itself can lead to altered results⁸ Studies warn that a late diagnosis may be responsible for longer hospital stays and increased mortality rates.

The approach to appropriate treatment in PEM, in addition to involving rapid and accurate diagnosis, also encompasses the use of appropriate medicines and nutritional therapy in order to reduce the risk of life.⁹ The clinical measures that should be taken are divided into 3 phases:

Phase 1 or stabilization phase: it goes from the 1st to the 7th day of treatment, in this phase the problems with the risk of life are identified and treated, correcting the specific deficiencies, metabolic abnormalities such as circulatory disturbances. As far as food is concerned, it should be started as soon as the child is admitted to the hospital, with small meals, low osmolarity, offered every 3 or 4 hours, preferably orally. If the child is in the breastfeeding phase, the breast milk should be accompanied by an adequate milk formula to cover the desired caloric needs⁹ The nutritional goal in this phase is to reach 100Kcal/Kg/day and 1-1.5 g of protein/Kg/day, because, due to its pathophysiological condition, the patient does not tolerate the administration of large volumes, therefore the nutritional therapy should be adequate to the energy needs of macro and micronutrients⁸

Phase 2 or rehabilitation phase: the return of the appetite is the sign of entry of the child in the rehabilitation phase, which lasts from the 2nd to the 6th week, the patient in this phase, is in

clinical stability and nutritional rehabilitation can be initiated. In this phase, a fast weight gain of >10 g/day is necessary, increasing the patient's caloric intake. It is therefore recommended a gradual transition in nutritional therapy in order to avoid the risk of heart failure, which can occur when there is a consumption of large amounts of food in this initial phase. The formula initially used is replaced by 48hr by the milk formula for rapid growth (100 kcal and 2.9 g of protein/100mL). After the transition period, meals should be offered, according to the child's acceptance, to achieve the nutritional goal of 150-220 kcal/kg/day and 4-6 g of protein/kg/day. The child should not only be adequately fed, but also receive motor and emotional stimuli. This phase is initially performed in the hospital until the child is able to be discharged from hospital. Family members should be instructed to continue the care at home⁸

Phase 3 or outpatient follow-up: it begins immediately after discharge from hospital, and the follow-up is performed in a health unit to prevent relapses, especially if the child was discharged before completing the rehabilitation phase, ensuring the continuity of the child's emotional, physical and mental development. The mother or guardian of the child should receive guidance on how to prepare meals according to the child's energy needs, and the frequency of meals offered, which at this stage should be at least 5 meals a day. Foods should be prepared so as to contain 100 kcal and 2-3 g of protein per 100 g of food, approximately. Supplementation of vitamins, electrolytes/minerals and iron should also be adopted. In this phase, the child should be weighed weekly, if it does not gain or presents weight loss, in two weeks it should return to the hospital for review⁸

The success of the treatment does not require sophisticated facilities or equipment, but it requires trained professionals. Malnutrition in its severe state can bring sequelae to life, especially to the child's cognitive development. Stimulation work is extremely important to

minimize the sequelae that can definitively compromise the performance of children, who suffered severe malnutrition in the first years of life¹⁰

The introduction of nutrition in routine care for children has played a key role in preventing malnutrition. Nutritional management actions can be promoted by health professionals, through direct guidance to mothers about breastfeeding, complementary feeding in children over 6 months (which includes foods rich in zinc, iron, vitamins A and B6)⁹

The prevention of protein energy malnutrition in children cannot be seen in isolation from measures aimed at meeting the basic needs of poor families¹¹ Historically, it has been proven that the solution to poverty is an ambitious goal in the short term; on the other hand, it has been seen that interventions that have been well implemented in the health sector contribute to reducing child malnutrition¹²

Reducing the prevalence of childhood PEM requires systematic action not only in the area of health, but also in food security. Access to health care, good quality water, ensuring adequate micronutrient intake are key elements, together with an adequate system for monitoring and supporting malnourished children. When done effectively, it is possible to significantly reduce malnutrition rates.

Conclusion

Child protein energy malnutrition still remains one of the world's major collective health problems. It can cause harm to the body in the short and long term, and in more severe cases until death in children. Changes in physiology and the immune system can be observed, as well as decreased absorption of nutrients, leaving the malnourished individual more susceptible to contracting infectious diseases.

Within the spectrum of malnutrition, Kwashiorkor and Doldrums are also present, which, when inadequately treated, have a high mortality rate in preschool-age children. Both present similar

clinical manifestations, and the Kwashiorkor is quite characterized by the sign of the flag, a very frequent capillary lesion.

The treatment of PEM has a multidisciplinary approach, including nutritional therapy and recovery of the motor and cognitive system, which increases the importance of a thorough assessment since the first symptoms of malnutrition, so that the treatment is effective and provide a healthy life for the child.

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