

## Case Report

# Relevance of Zinc in Infant Nutrition - Case Report

Marco Antonio Valadares Oliveira<sup>1</sup>, Maria Luiza Doria Almeida<sup>1</sup>,  
Angela Maria da Silva<sup>1</sup>, Ana Jovina Barreto Bispo<sup>2\*</sup>, Gleide Maria  
Gatto Bragança<sup>2</sup>, Isabela Soares Costa<sup>2</sup>, and Lucas Silva Brito<sup>3</sup>

<sup>1</sup>Medicine Department, Federal University of Sergipe - UFS, Brazil

<sup>2</sup>University Hospital, Federal University of Sergipe - UFS, Brazil

<sup>3</sup>Brazilian Odontology Association (ABO-SE). Av. Gonçalo Prado Rollemberg, Brazil

**\*Corresponding author**

Ana Jovina Barreto Bispo, Medicine Department,  
Universidade Federal de Sergipe - UFS, Rua Claudio  
Batista, s/n, Aracaju-SE, Brazil, Tel: 55-79-2105-1700; 55-  
79-99984-0454; Email: anajovina70@gmail.com

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**Abstract**

Over the last few decades, zinc deficiency has become a nutritional problem present in developed and developing countries. It has encompassed many abnormalities in the metabolism caused by inadequate dietetic ingestion, a decrease in the absorption or an increase in the urine excretion, presence of agents in the diet that compromise its absorption, bowel surgery, malabsorption syndromes, renal diseases, chronic liver diseases, alcohol abuse, total parenteral nutrition without zinc addition and, still, genetic problems. In this case report we present the case of a preschool child hospitalized for investigation and explanation of a dermatologic bullous situation. As comorbidities, malnutrition and chronic diarrhea were also identified. After the introduction of therapeutic zinc, during the period of hospitalization, the patient improved substantially.

**ABBREVIATIONS**

**ORS:** Oral Rehydration Solution; **WHO:** World Health Organization

**INTRODUCTION**

The physiological functions of zinc, as well as its involvement in biochemical mechanisms have been extensively studied. Its importance is recognized in metabolic functions and in the functioning of its cell membranes [1], including a synthesis of nucleic acids, the energetic metabolism of carbohydrates and lipids and the immune response [2].

Its deficiency has been revealed as an important nutritional shortage around the world. Zinc deficiency is estimated to be responsible for 4% of global morbidity and mortality of children under five years of age [3]. On the other hand, its implementation results in the reduction of mortality from diarrhea and pneumonia [4].

Over the last few decades, zinc deficiency has become a nutritional problem present in developed and developing countries. It has encompassed many abnormalities in the metabolism, caused by inadequate dietetic ingestion, a decrease in the absorption or an increase in the urine excretion, presence of agents in the diet that compromise its absorption, bowel surgery, malabsorption syndromes, renal diseases, chronic liver diseases, alcohol abuse, total parenteral nutrition without zinc

addition and, still, genetic problems [5]. Besides other clinical manifestations of this mineral deficiency, delay in the growth, hypogonadism, alteration of immune response, difficulty in healing, increased risk of miscarriage, diarrhea, anorexia, weight loss, alopecia, and premature birth are highlighted [6].

Zinc necessity can be bigger in children due to their rapid growth, especially in those who are born underweight. Its reduced levels in the diet, a consequence of low animal protein intake, puts the children from underdeveloped countries at a high risk of having such deficiency [7,8]. A diet that is poor in proteins and calories and rich in cereals, which inhibits zinc absorption, strengthens the deleterious effects of its deficiency [9-13].

Some authors describe the importance of the so called immunological recovery in malnourished children, due to the supplementation of micronutrients involved in the immunological function, especially zinc. Supplementation shortens hospitalization time, recurrence of infectious processes, and consequently, shortens nutritional state recovery time [14]. Another important aspect, shown in laboratory animals, which could be related to zinc deficiency associated to malnutrition, is the reduction of immunoglobulin production by reflecting on the reduction of vascular response of gastrointestinal tract [15].

Diarrhea is one of the main causes of mortality in children under five years of age in underdeveloped and in developing countries [16]. Although therapy with ORS has lowered mortality

rates, it does not interfere in the duration or gravity of the situation [17]. Adding to ORS, in the treatment of diarrhea, a supplementation of zinc has shown contribution to this purpose and clear improvement is noticed, especially in malnourished children, by clinical proof of deficiency of this micronutrient in this population [17,18]. Besides assisting in the acute setting, there are also benefits in reducing diarrhea episodes estimated in two or three months [13]. For acute or persistent diarrhea scenarios in children from underdeveloped countries, the WHO recommends zinc supplementation of 10mg per day in children who are less than 6 months old and 20 mg per day in older children for 10 - 14 days [18].

A classical nosological entity associated with zinc deficiency is the Acrodermatitis enteropathica. It is a rare genetic condition, of autosomal recessive transmission, caused by a deficiency in the absorption of zinc in the bowel. Other frequent coordinates are delayed growth, photophobia, dysphonia, neuropsychiatric disorders and predisposition to infections [19]. Very similar clinical scenarios can occur in non-hereditary zinc deficiency conditions [20]. The classic triad of acrodermatitis enteropathica consists of acral dermatitis, alopecia and diarrhea [21].

### CASE PRESENTATION

Female patient, 2 years and 3 months old, transferred to the Paediatric Clinic of Sergipe University Hospital, Brazil, in February 2016, for investigation and explanation of a dermatologic bullous situation; it started at 9 months of age and progressed without settlement or improvement to previously prescribed treatment. Full-term baby, 3050 g, vaginal delivery without complications; exclusively breastfed for two months, then predominantly till the end of the first year of life; introduction of cow milk powder (not appropriate to her age) at 6 months. Vaccine calendar updated. Current diet characterized as rich in carbohydrates and poor in other protein and milk sources. Genitor reported sporadic fever (not measured) and sleep disrupted by pruritus. No report on apparent factors generating the dermatological matter. Mother stated to have no issues with vomit and/or diarrhea upon hospital admission.



Figure 1 Before treatment with zinc, with major skin lesions.

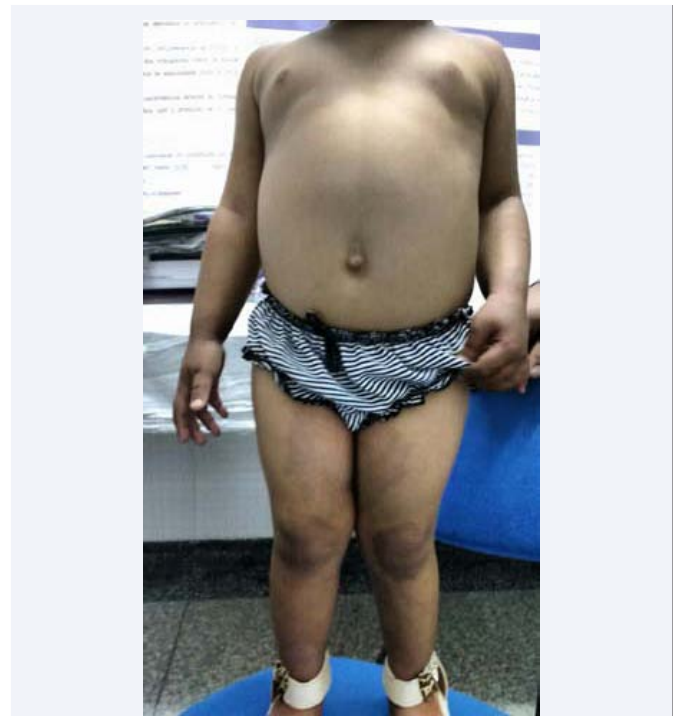


Figure 2 After treatment with zinc, with improvement of skin lesions.

As pathological background, three admissions were highlighted for investigation and treatment of cutaneous lesions, without full resolution in any of them. Poor living conditions, including lack of basic sanitation and regular drinking water.

In the physical examination, the patient presents a regular overall condition. Weight upon admission of 9,8 kg (proximate to - 2 z-score in the 2006 curve of WHO) and 79 cm in height (between -2 and - 3 z-score in the 2006 curve of WHO); a good weight/height relation. General and segmental physical examination, no noteworthy data, exception being the cutaneous and phanero changes described below, with no swelling.

Dermatological situation characterized by the appearance of multiple blisters, of various sizes, firstly on the inferior limb, disseminating to the superior ones, underarm, cervical region, face (reaching periorcular, perinasal e perioral regions) and genital area, sparing the trunk. The blisters were initially flaccid, clean, evolving to a pustular substance and breaking rapidly (within 1 or 2 days after their appearance), making erythematous and scaly injuries on site, with well-delimited edges, much pruritic and with crust melicericas formation. Paronychia and ungeal dystrophy were also observed. Alopecia associated, with complaint of weak and breaking hair. Presence of clinic aspect suggestive of fungal infection associated to genital injuries.

She was admitted in service with the usage of intravenous antibiotic therapy (oxacillin and fluconazole), intravenous hydrocortisone and dexchlorpheniramine; with differential initial diagnoses of staphylococcus, pemphigus bullous and herpetiformis dermatitis associated to celiac disease. According to dermatological assessment, the diagnostic hypothesis of acrodermatitis enteropathic was raised and zinc dosage was requested to confirm the diagnosis; but with no delay in the

zinc prescription, dosage of 3mg/kg/day, with a maintenance of antibiotic therapy in use. Ophthalmological evaluation solicited for the investigation of blepharitis and Keratoconus, detected no alterations in the specialist exams.

Admissional laboratory tests showed discreet leukocytosis (17900), with lymphocytes predominance, besides higher ESR (35 mm<sup>3</sup>; with normality reference for the paediatric rate in 10 mm<sup>3</sup>); but with no further alteration. Surveillance culture (blood culture and anal swab) sampled in the hospital admission showed no bacterial growth. A serum zinc dosage was requested, as well as complex B vitamins, besides other routine biochemical exams upon admission. Because of the unavailability of coverage of the exams by the public health system, it was not possible to dose zinc and vitamins of the B complex. Electrolyte dosage, liver tests, including albumin (4,6 g/dL), total bilirubin (0,3 mg/dL) and transaminases (AST = 42 U/L and ALT = 15 U/L); and evidence of renal function (urea = 13 mg/dL and creatinine = 0,5 mg/dL), all of them with no abnormality, with only discrete elevation of lactic dehydrogenase (574 U/L, with references values between 230 e 460).

During hospitalization, there were no episodes of fever but there was diarrhea. In a new systematic questioning of the child's mother, it was detected that the patient had had frequent diarrhea episodes, enough to be classified as having chronic diarrhea of an intermittent nature.

The patient improved during the period of hospitalization. Lesions initially bullous, with aspects of secondary bacteria and fungus, evolved with progressive improvement after the use of antibiotics and antifungal, as well as zinc supplementation. Aspects of lesions of crusted scar tissue at discharge, 10 days after of her admission to the hospital. There was also an improvement in the diarrhea and a good acceptance of the diet with nutritional corrections made. Discharged with a continuation of the oral administration of zinc supplementation and monitoring in pediatrics, dermatology and ophthalmology clinics.

At the first clinic visit with the dermatologist, 2 months after hospital discharge, there was a full recovery of cutaneous lesions. No episodes of diarrhea were reported and there was good acceptance of the diet. A reevaluation was scheduled 3 months after the first visit, and zinc therapy was maintained, as well as monitoring by a paediatrician. By the monitoring of the paediatrician services (including the specialties of Gastroenterology and Dermatology) withdrawal of zinc supplementation was expected in order to observe recurrence of the symptoms previously presented.

## DISCUSSION

Acute malnutrition is admittedly the biggest cause of secondary immunodeficiency in pediatric age. However, because it is a spectral disease, it can have various aspects easily mixed up as cause or consequences. Thereby, malnutrition, diarrhea and dermatitis overlap themselves so closely that they require constant possibilities of different diagnoses.

The patient from the presented case suffered from mild malnutrition, but there were two significant findings: dermatitis, hospitalization motive; chronic diarrhea. This last

nosological diagnosis was initially hidden by a limitation in gathering propaedeutic subjective data; a very common fact in populations with social and educational limitation. Finding the chronicle diarrheic disease was a ratifying piece of information in the diagnostical suspicion of acrodermatitis enteropathica, notwithstanding the presented cutaneous lesions (with predilection for extremities and periorificial regions) being very suggestive of this pathological entity.

The paediatrician and every professional attending children must always be aware of the various possible presentations of macro and microelements of nutritional deficiency. The possibility of secondary zinc deficiency due to a low offer in the intake as a possible grievance against public health is a lot more frequent than we think; considering that oligosymptomatic forms of its deficiency can be underestimated. Acrodermatitis enteropathica, usually considered a rare disease and regularly remembered in the differential diagnoses of chronicle diarrhea, must also be remembered in the differential diagnoses of dermatitis and phanero alterations with suggestive characteristics.

Although there has not been laboratory confirmation of zinc deficiency and/or other microelements because of the limitations of the service resources, the clinical condition described and the therapeutic response to the use of zinc restate the strength of diagnostic hypothesis. However, it cannot be stated if the etiology of this disease would be because of disabsorptive syndrome or because of lack of zinc in the diet.

Zinc element, which has changed, over the past two decades from a restrict indication in chronicle diarrheic diseases to acute as well, plays a growing role as immunomodulator in many other pathologies, as suggested in the growing number of clinical studies in the area.

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