Cases of Anemia Reported in Pediatric Patients in Northern Brazil

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Highlights:
(1) Anemia affects children.
(2) Measures must be implemented to avoid these damages.

ABSTRACT

Anemia affects almost a quarter of the world's population and causes numerous damages to various tissues, causing low oxygenation and signs and symptoms such as shortness of breath, lack of appetite, headache, dizziness and learning disabilities. However, there are no data on anemia in children in northern Brazil, which is necessary to establish reliable parameters for reestablishing the health of these patients. Our objective was to evaluate cases of anemia reported in children in the northern region of Brazil. This are a retrospective cross-sectional study, carried out over a period of one year. Demographic characteristics were noted, all children were carefully assigned to the study. The blood collection procedure was performed according to the established protocol. A total of 600 patients were included in the study. Most were female (52.5%), brown (51.6%), with a family income of 1 to 2 minimum wages and incomplete primary education. Anemia was more evident in ages 9 to 12 years (74.8%) and the proportion of children with hematocrit, iron, and ferritin below 35%, 50 μg/dL and 7 μg/L, respectively, was higher among children's patients with anemia. In addition, they had numerous morphological classification variables, compared to the hemametric index. The study showed that anemia affects children. In view of the magnitude of the risks presented in this article, preventive measures for this pathology must be implemented to guarantee the integrity of the health of these patients, under penalty of irreversible damage for future generations.

Keywords: anemia; children; public health.

CASOS DE ANEMIA NOTIFICADOS EM PACIENTES PEDIÁTRICOS NO NORTE DO BRASIL

RESUMO

A anemia afeta quase um quarto da população mundial e causa inúmeros danos em vários tecidos, como baixa oxigenação e sinais e sintomas, como falta de ar, falta de apetite, dor de cabeça, tontura e dificuldade de aprendizado. Não há, no entanto, dados sobre anemia em crianças na Região Norte do Brasil, o que é necessário para estabelecer parâmetros confiáveis para restabelecer a saúde desses pacientes. Nosso objetivo foi avaliar os casos de anemia notificados em crianças na Região Norte do Brasil. Trata-se de um estudo transversal retrospectivo, realizado no período de um ano. As características demográficas foram anotadas e todas as crianças foram cuidadosamente designadas para o estudo. O procedimento de coleta de sangue foi realizado de acordo com o protocolo estabelecido. Um total de 600 pacientes foram incluídos no estudo. A maioria era do sexo feminino (52,5%), parda (51,6%), com renda familiar de um a dois salários-mínimos e ensino fundamental incompleto. A anemia foi mais evidente nas idades de 9 a 12 anos (74,8%) e a proporção de crianças com hematócrito, ferro e ferritina abaixo de 35%, 50 μg/dL e 7 μg/L, respectivamente, foi maior entre as crianças com anemia. Além disso, possuíam inúmeras variáveis de classificação morfológica comparadas ao índice hematimétrico. O estudo mostrou que a anemia afeta crianças. Diante da magnitude dos riscos apresentados neste artigo, medidas preventivas para esta patologia devem ser tomadas para garantir a integridade da saúde destes pacientes, sob pena de danos irreversíveis para as gerações futuras.

Palavras-chave: anemia; crianças; saúde pública.

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INTRODUCTION

Anemia is established as a lack of hemoglobin (Hb) levels, a protein in red blood cells (or red blood cells) that helps conduct oxygen throughout the body[1]. Therefore, different tissues and organs of the body suffer from the suppression of oxygenation, causing numerous symptoms and symptoms, such as pallor of the skin and mucous membranes, tiredness, lack of appetite, headache, dizziness, shortness of breath, chest pain and in the case of children, learning and concentration problems[2]. Treatment depends on the type and intensity of the problem, and ranges from iron supplementation or B vitamins to bone marrow transplantation[3,4].

According to estimates by the World Health Organization (WHO), anemia affects almost a quarter of the world's population, which corresponds to 1.62 billion people, most of whom are children under four years of age[5,6]. In Brazil, data are imprecise, so few studies have attested to an increase in the prevalence and magnitude of the disease in the last 30 years, regardless of the region analyzed or the socioeconomic level of the cases[7].

The high prevalence of this Hb deficiency in children and adolescents reflects the shallow consumption of foods that are sources of bioavailable iron and the growth of organic mineral demand, generated by the expansion of tissues and red cell mass[7]. Furthermore, such as parasitic diseases, mainly helminthic infections, defined by the fragile health and sanitary circumstances in which children and their families live[8]. In this context, it must be believed that basic sanitation and housing conditions, in addition to food consumption habits, are influenced by the family's standard of living, which, ultimately, is established by the social and economic situation of the population[6,7,8].

The criteria for regularity of Hb concentration in children and adolescents differ from those seen in adults[9]. For example, between 6 months and 5 years, the lower limit is 11.0 g/dL; between 6 and 11 years, 11.5 g/dL; between 12 and 14 years, 12.0 g/dL, a value that remains for women from then on[8,9]. For male adolescents, the lower limit is more difficult to define in view of the oscillation of testosterone levels for each age until the end of adolescence[10].

However, some reasons related to anemia are well described. However, the lack of knowledge about this problem, when the target group is school-aged children and adolescents[7,8,9,10]. Thus, the present study aims to estimate the reported cases of anemia in children and adolescents treated at a clinical analysis laboratory in the city of Belem, state of Para.

METHODS

Study population and configuration

This is a retrospective cross-sectional study carried out in Brazil, between October 2021 and October 2022, in a clinical analysis laboratory in the city of Belem – Para. The City of Belem is the most populous municipality in the state of Pará and the second in the northern region of Brazil, with an estimated population of 1,506,420 inhabitants, with a territory of 1,059,458 Km^2, with an estimated HDI of 0.746, in a latitude of − 1.45502 and longitude of − 48.5024[11].

The study was approved by the Research Ethics Committee of the Health Sciences Institute of the Federal University of Pará, under number 5,137,452.

Data collect

The sample was randomly selected among those who spontaneously sought the clinical analysis laboratory to perform the blood count during the period from October 2021 to October 2022, totaling 600 exams collected. After the consent of the parents and/or guardians, a questionnaire was filled

out and then blood was collected for the hematological examination. The questionnaire contained information on gender, color/ethnicity, age, income, and family education.

The blood collection procedure was performed according to the established protocol[12]. Patients and/or guardians were advised to avoid strenuous activities. Venipuncture was scheduled between 7 and 10 am. Then, the patients' arms were fixed to allow the location of the vein for puncture, and the tourniquet was installed approximately 10 cm above the site chosen for blood collection. Skin antisepsis was performed with cotton soaked in 70% alcohol and the needle was inserted in the chosen location with the bevel positioned upwards. Then, 4 mL of blood were collected by venipuncture in an EDTA tube with anticoagulant. They were analyzed using a semi-automated methodology, evaluating the erythrogram parameters, such as: red blood cells (mm3), hemoglobin (g/dL), hematocrit %, VCM (mean corpuscular volume), HCM (mean corpuscular hemoglobin), MCHC (mean concentration of corpuscular hemoglobin) and RDW (red cell distribution width). To visualize possible cellular alterations, the blood extension was performed in all samples submitted to optical microscopy as a method of visualization of cellular elements[12].

Serum iron levels were determined by the colorimetric method, using the Hemoglobin K023 (Bioclin®) and Serum Iron K017 (Bioclin®) kits, respectively. Serum ferritin levels were determined by the turbidimetry method using the Ferritin K081 kit (Bioclin®)[12,13].

To carry out the analysis, the results of examinations of patients aged 12 years or less, of both genders, who underwent the blood count examination were included. Laboratory results of patients over 12 years of age, results of patients who did not have anemia and results in which they did not have a blood test were excluded from the survey. Based on these criteria, 151 reports were included for the present study.

The presence of anemia was defined according to the criteria of the WHO as hemoglobin levels below 11.5 g/dL for the age group of 1 to 12 years[13]. Ferritin and iron deficiencies were defined by levels below 7 µg/L and 50 µg/dL, respectively, and a hematocrit below 35% was considered low[13,14]. Children were classified according to the presence or absence of anemia and according to the presence or absence of ferritin deficiency.

Statistical analysis

Data were organized in a database using Microsoft Excel® software for descriptive statistics and the results were categorized and presented in percentage tables. Variables that presented normal distribution were expressed as mean and standard deviation and forum compared by means of Student's T test. Variables that did not present normal distribution were expressed as median (25%-75% percentile) and were compared using the Mann-Whitney U test. Categorical variables were expressed as absolute and relative frequency n (%) and were compared using the qui-square test.

RESULTS

A total of 600 patients were admitted for blood tests. Females were the most prevalent (52.5%) and the median age was 8.98 years. As for skin color, 51.66% were referred by guardians as brown. About socioeconomic conditions, it was observed that 71.33% of families had an income between 1 and 3 minimum wages. Of the patients, 65.10% had incomplete elementary school or were illiterate (Table 1).

Table 1 – Characteristics of patients treated at the clinical analysis laboratory

Characteristics	Patients % (n=600)
Feminine	52,5% (315)
Male	47,5% (285)
Age	8,98 (1-18)
Color/Ethnicity	
White	30,83% (185)
Black	15% (90)
Brown	51,66% (310)
Yellow	2,5% (15)
Family income	
1-2 minimum wage	71,33 (428)
> 3 minimum wages	21,33 (128)
Education of Parents and/or Guardians	
Illiterate	21,30 (128)
Elementary Incomplete	43,80 (263)
Elementary Complete	6,7 (40)
High School Complete	13,5 (81)
Medium Incomplete	4,5 (27)
Graduated	3,5 (21)
Uninformed	6,7 (40)

The laboratory profile of the children classified according to the existence or not of anemia determined by Hb levels below 11.5 µg/dL are shown in Table II. The proportion of children with hematocrit, iron, and ferritin levels below 35%, 50 µg/dL and 7 µg/L, respectively, were higher among children with anemia (Table 2).

Tabela 2 – Laboratory characteristics of children classified according to the presence of anemia

	Children without anemia	Children with anemia	P-value
Number of children	449	151	
hematocrit %	38 (36-39)	34 (33-36)	0,001*
Iron (µg/dL)	57 ± 26	44 ± 22	0,018*
Ferritin (µg/L)	36 (15-90)	79 (23-102)	NS
Hematocrit less than 35% (n, %)	8 (8,7)	11 (32,2)	0,005*
Ferro less than 50 µg/dL (n, %)	32 (7,1)	17 (11,2)	NS
Ferritin less than 7 µg/L (n, %).	19 (4,2)	5 (3,3)	NS

*p<0.05 for children with anemia in comparison with children without anemia. NS = not significant.

Among the 600 individuals, 25.1% (151) were anemic. The age group of 9 to 12 years was the most frequent (74.84%), followed by 1 to 4 years (23.17%) (Table 3).

Table 3 – Distribution of patients with anemia by age group

Age (years)	Number of patients (n, %)
1-4	35 (23,17)
5-8	3 (1,99)
9-12	113 (74,84)
Total	151 (100)

About hematimetric indices, 28.47% of patients were classified as having microcytic anemia, 10.59% macrocytic and 60.92% had normal blood status, about red and white blood cells. Furthermore, 48.34% had a reduction in the reddish hue of the red blood cells (hyporchromia) and 51.65% of the patients had the normal color of red blood cells (Table 4).

Table 4 – Morphological classification of anemia according to hematimetric índices

Variable	Patient (n, %)
Microcytosis	43 (28,47)
Macrocytosis	16 (10,59)
Normocytosis	92 (60,92)
Hypochromia	73 (48,34)
Normochromia	78 (51,65)

DISCUSSION

In this study, a prevalence of 25.1% of pediatric patients diagnosed with anemia was observed and the most prevalent age group was between 9 and 12 years. Anemia among patients in this age group impairs the quality of health among these population groups, causing lower school performance, tiredness, fatigue, insomnia, irritability, and pallor[13]. Therefore, data obtained in the northeast of Brazil also suggested a percentage of 27.4% of anemia in the child population, in this same age group[14,15].

When estimating the frequency of anemia by sex, color, and income, it was found that women had a higher prevalence of cases, as well as people of mixed race and family groups that receive amounts between 1 and 2 minimum wages. Such findings are corroborated by the literature[7,10,16,17,18,19]. This can be justified because women, compared to men, have less red blood cells (red blood cells), but this is normal, however, they are also more prone to anemia. Although anemia is not seen as a public health problem restricted to developing countries, it is relevant to consider that the favorable ways for the aggravation of the disease are linked to the social and economic condition of the lower income classes, either by an inadequate quantitative diet and qualitative, either due to the fragility of environmental sanitation, age, low maternal education, weight and height deficit in relation to the standard, diarrhea, low iron density in the diet, density of calories from cow's milk or other indicators that directly or indirectly may be contributing to its high prevalence[16,17]. As for education, the population of this study was characterized by a low educational level. The results corroborate the study carried out by Mariath et al.[16], where they reported that 68.66% of the patients had incomplete primary education.

The erythrogram is the part of the blood count that quantitatively and qualitatively evaluates the erythrocytes[17].This occurs by counting the total number of these cells, measuring the Hb concentration and calculating the hematocrit[18,19]. In addition, the hematimetric indices (VCM, HCM, CHCM and RDW) are part of the erythrogram[18,20].

It was verified that 33.6% of the children exhibited anemia and that 11.2% found themselves with iron deficiency. Children are a vulnerable group to iron deficiency, due to the high demand for this mineral due to the accelerated growth rate[17,19]. The WHO establishes that close to one in five children manifest iron deficiency anemia, corroborating how we are sick[15,18,20].

It was also observed that hematocrit levels were lower in children with Hb levels less than 11.5 g/dL and the proportion of patients with hematocrit levels below 35% was higher among those with reduced Hb levels, or that it is suitable as a clinical picture of anemia. According to some authors, anemia is characterized as the highest stage of iron deficiency anemia, where there is a decrease in hematocrit levels and recurrent infections[20]. Concomitantly, this process may also reflect changes in the erythrocyte cytomorphology, presenting microcytosis and hypochromia and causing disturbance in the mechanism of oxygen transport[10,18,19].

In Table III, the findings were hypochromic microcytic anemia, this type of anemia is characterized by the size of erythrocytes (MCV<80fl), low concentrations of hemoglobin (CHCM<32%) with high levels of RDW and normally, this occurs through iron deficiency in the diet, as well as causes of hereditary anemia[21]. Therefore, it is considerable to obtain knowledge about anthropology and migratory movements of the population, as well as the contributions that public health and public health policies[16,18].

In several studies, it is stated that children are more exposed to anemia, which is explained by the growth in this age group[7,12,20,21], the high prevalence of early weaning in the country, the lack of foods rich in iron in the child's diet and the higher prevalence of diseases such as diarrhea and respiratory infections in the first years of life[19,21]. Amarante et al.[17], saw that 17.8% of patients aged 11 to 20 years old had hypochromic microcytic anemia, it is known that the main nutritional problems of adolescents are micronutrient deficiencies, in particular the deficiency of iron and, depending on the context, malnutrition or obesity and comorbidities[19].

However, it was also observed that patients had a higher proportion of normochromic normocytic anemia. These anemias are difficult to interpret and relate them to the causes and origins that provoke them[19]. Therefore, these anemias are not related to a deficiency in the production process of these cells as micronutrients but are characterized either by blood loss such as anemia due to parasitic infections or by an excess of destruction of red blood cells, as is found in patients with hemoglobinopathies[16,20].

Other pathological situations related to nomocytic and normochromic anemia occur in anemia caused by: inflammatory diseases that are common in the elderly and in people with cancer; chronic diseases typical of hematological neoplasms and bone marrow diseases; hemolytic anemia[5,14.16.21].

CONCLUSION

Several studies have shown that anemia affects people of all ages, especially children. In view of the magnitude of the risks presented in this article, preventive measures for this pathology must be implemented to guarantee the integrity of the health of these patients, under penalty of irreversible damage for future generations.

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