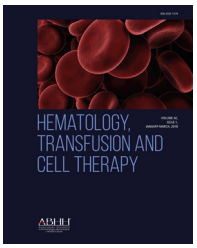
HEMATOL TRANSFUS CELL THER. 2018;xxx(xx):xxx–xxx

HEMATOLOGY, TRANSFUSION AND CELL THERAPY

www.rbhh.org



Original article

Prevalence of anemia in schools of the metropolitan region of Curitiba, Brazil

Juliana Spezia[a,*], *Laísa Ferreira da Silva Carvalho*[a], *Marcelo Ferrari de Almeida Camargo-Filho*[b], *Aline Emmer Furman*[a], *Shirley Ramos da Rosa Utiyama*[a], *Railson Henneberg*[a]

[a] *Universidade Federal do Paraná (UFPR), Curitiba, PR, Brazil*
[b] *Faculdades Pequeno Príncipe, Curitiba, PR, Brazil*

ARTICLE INFO

Article history:
Received 20 July 2017
Accepted 23 November 2017
Available online xxx

Keywords:
Anemia
Complete blood count
Iron-deficiency anemia
Hypochromic microcytic anemia
Prevalence studies

ABSTRACT

Background: Anemia during childhood is one of the biggest public health problems worldwide, including Brazil. Insufficient or abnormal production of hemoglobin, loss of iron and excessive destruction of red blood cells are the most common causes of anemia. Among the reasons of anemia, iron deficiency accounts for 50% of anemia cases in developing countries. Affected individuals present a wide range of clinical problems, including delayed neuropsychomotor progression, impaired cellular immunity and reduction of intellectual capacity. This study aimed to evaluate the prevalence of anemia in children attending public schools in the metropolitan region of Curitiba, Paraná, Brazil.

Method: A retrospective study was conducted of 409 children aged 8–12 years old included in an extension project of the Universidade Federal do Paraná. The results of complete blood count and hemoglobin electrophoresis of all children were evaluated. Anemia was considered when the hemoglobin levels were <11.5 g/dL.

Results: The prevalence of anemia was found to be 2.2% of the population studied, with hypochromic microcytic anemia being the most common type. Seven children had sickle cell trait and one had β-thalassemia.

Conclusion: The prevalence of anemia in this study was considered normal according the World Health Organization classification, which is different from the data found in other Brazilian regions.

* *Corresponding author at*: Universidade Federal do Paraná, Departamento de Análises Clínicas, Av. Lothário Meissner, 632, Curitiba, PR, CEP 80210-170, Brazil. Tel.: +55 041 3360-4084.
E-mails: juliana.spezia@ufpr.br, julispz@hotmail.com (J. Spezia).

https://doi.org/10.1016/j.htct.2017.11.007

Please cite this article in press as: Spezia J, et al. Prevalence of anemia in schools of the metropolitan region of Curitiba, Brazil. Hematol Transfus Cell Ther. 2018. https://doi.org/10.1016/j.htct.2017.11.007

Introduction

Anemia is a common clinical condition characterized by decreased hematocrit or hemoglobin (Hb) levels, which are insufficient for the body's demand.[1]

Mechanisms related to the development of anemia are nutritional deficiencies and genetic or hemorrhagic conditions, leading to an inadequate production or exacerbated destruction of Hb.[2,3]

The main consequences of anemia are related to delayed psychomotor development, impaired cellular immunity, and low cognitive performance due to poor tissue oxygenation.[4,5]

The laboratory diagnosis of anemia can be achieved by a complete blood count (CBC), Hb electrophoresis, biochemical markers and genetic tests. The CBC is an important diagnostic tool for the morphological evaluation and Hb content of red blood cells. It directly measures erythropoiesis and, at low levels of Hb, it indicates insufficient essential nutrients in the bone marrow.[2,3]

Early diagnosis and, more importantly, identifying the etiology of anemia are fundamental not only for adequate treatment but also to design public policies aimed at the promotion and protection of health.[6–9]

This study aims to evaluate the prevalence of anemia in children attending public schools in the metropolitan region of Curitiba and to contribute to the epidemiological data of this population.

Methods

This is a retrospective analytical study. A total of 409 children aged 8–12 years old (55.2% female and 44.7% male) who attend public schools in the metropolitan region of Curitiba participated in an extension project of the Pharmacy Course of the Universidade Federal do Paraná (UFPR). The study was approved by the Research Ethics Committee of UFPR (CAAE: 57571316.7.0000.0102). The following data were collected from all 409 children: age, gender, and the results of a CBC and Hb electrophoresis. Samples obtained by venipuncture were collected from March to December 2015 and processed using the ABX Micros 45 hematology analyzer. Anemia is characterized by an Hb level of <11.5 g/dL according to the World Health Organization (WHO) criteria.[1] Hb electrophoresis was performed at alkaline pH with qualitative results being based on the position of the electrophoretic bands. Solubility tests for Hb S and Hb A_2 measurements by the elution method were used as complementary tests. Statistical analysis used the Statsoft software version 10.0 with data being expressed as means and standard deviation (SD) using a 95% confidence interval.

Results

Table 1 describes the hematological parameters of the 409 children.

The prevalence of anemia in the studied children was 2.20% (9/409), but none had severe anemia. There was no significant difference between genders.

Regarding the red blood cell count, 1.2% of the children (5/409) had values lower than the reference values ($4.0–5.2 \times 10^{12}$/L). On the other hand, 10.2% of the children (44/409) had counts above the upper limit.

Thirty-seven children (9.04%) had microcytosis (mean corpuscular volume <77.0 fL). There were no cases of macrocytosis. Hypochromia was observed in 23 children (5.62%), characterized by mean corpuscular hemoglobin values <25.0 pg. Hypochromia and microcytosis were found in 5.4% (22/409) of the children with one having an Hb value of <11.5 g/dL (10.8 g/dL).

Screening by qualitative Hb electrophoresis at alkaline pH identified seven cases (1.7%) with sickle cell trait (Hb AS) all of which were confirmed using the solubility test and one case had β thalassemia trait, confirmed by a 4.8% Hb fraction using the elution method. Table 2 presents the hematological parameters of the eight children with altered electrophoretic patterns.

Discussion

Anemia is one of the biggest public health problems in Brazil and the world. The prevalence of anemia in developing countries affects up to 50% of children, especially those in poorer neighborhoods and school-aged children.[1] Iron deficiency is the most common cause of anemia in children; this may reflect an imbalance between the amounts of iron consumed and absorbed or loss of iron reserve, resulting to inadequate synthesis of Hb.[1,3,4,10] This condition is very important because iron is required for the complete myelination of the sensory neurons, which are correlated to behavior and learning.[11,12] Physiological damage from iron deficiency includes poor cognitive development, reduced psychomotor skills, and decreased immunity, which may lead to increased susceptibility to infections.[4,12]

Due to the influence of anemia on public health, the WHO proposed a classification based on the estimated prevalence of anemia. Severe prevalence refers to anemia in >40% of the population. Between 20% and 39.9% of anemia, the prevalence is considered moderate, while from 5.0 to 19.9% and <5.0% are classified as mild and normal prevalences, respectively.[1] The prevalence of anemia found in this study (2.20%) corresponds to normal values according to the WHO classification. These data differ from higher prevalences observed in population surveys conducted in several regions of Brazil. A study of 754 children aged 0–12 years in Santa Maria reported a 29.17% prevalence of anemia.[13] Santos et al.[14] conducted a study with students (6–10 years) of public schools in Maceió and found a 9.9% prevalence of anemia. Another study conducted by Miglioranza et al.[15] in the same region as this present work found a 41.3% prevalence of anemia in children and adolescents ($n = 526$) aged 7–14 years using Hb <12.0 g/dL as the main criterion. In Brazil, there is no national survey on the prevalence of anemia, only regional studies, which report variable prevalences of anemia depending on the region and socioeconomic conditions of the analyzed population.

The rate of malnutrition has improved considerably in recent decades; however, the prevalence of anemia is still high in populations on diets containing little iron, in patients with

Please cite this article in press as: Spezia J, et al. Prevalence of anemia in schools of the metropolitan region of Curitiba, Brazil. Hematol Transfus Cell Ther. 2018. https://doi.org/10.1016/j.htct.2017.11.007