

Anemia in patients with intestinal parasitic infection

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ABSTRACT

Anemia and intestinal parasitic strengthen a topic of growing interest in Brazilian public health. Anemia is the most common diseases found in developing countries, estimating that affects half of children and adolescents in these locations. Among the factors that contribute to this cause are intestinal parasites and / or low iron intake. Thus, the objective of this study was to conduct a study, with the screening of infected individuals who had changes in hemoglobin and hematocrit, and associate this data to iron deficiency anemia by identifying the parasites that occurred in these individuals. In this study analyzed medical records of 302 subjects were positive for intestinal parasites of these, 44.7% male and 55.3% female. The most prevalent parasite was *Entamoeba coli* (27.48%), followed by *Giardia lamblia* infections (26.49%), *Endolimax nana* (11.92%) and *Iodamoeba butschlii* (7.94%). Among the individuals infected with *Giardia lamblia*, 25% had anemia. Adult prevalence of anemia in helminth parasites individuals, where 65% of those infected with *Trichuris trichiura*, followed by 47.4% of those infected with *Strongyloides stercoralis* anemic. Therefore, this study suggests that this association should be subject to investigation in order to obtain a better understanding of factors involved in co-morbidity of iron deficiency anemia and intestinal parasites.

Key words: Anemia, intestinal parasites, helminths, protozoa.

RESUMEN

Anemia es una enfermedad muy corriente en los países en desarrollo. Entre los factores que contribuyen a que así, sea, están la presencia de parásitos intestinales y/o la baja ingesta de hierro. El objetivo del presente estudio fue estudiar la presencia de alteraciones hematológicas en personas infectadas por parásitos intestinales. Se estudiaron 302 individuos (44,7% hombres y 55,3% mujeres). El parásito más prevalente fue *Entamoeba coli* (27,5%), seguido por *Giardia lamblia* (26,5%), *Endolimax nana* (16,9%) e *Iodamoeba butschlii* (7,9%). De los individuos infectados con *G. lamblia*, 25% presentaron anemia. La prevalencia de anemia en adultos se presentó en el 65% de aquellos infectados con *Trichuris trichiura*, seguida por el

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47,4% de los infectados con *Strongyloides stercoralis*. Por lo tanto, este estudio sugiere que esta asociación debe ser objeto de investigación con objeto de tener una mejor comprensión de los factores que pueden intervenir en la co-morbilidad de la anemia, deficiencia de hierro y la presencia de parásitos intestinales.

Key words: Anemia, Parásitos intestinales, helmintos, Brasil.

INTRODUCTION

Parasitic diseases are among the largest public health problems in underdeveloped and developing countries, mainly by socioeconomic status and poor sanitation conditions observed in several regions of these countries, which makes a parasitic intestinal disease with higher prevalence in these population (Tsuyuoka *et al*, 1999; Souza *et al*, 2002).

According to Rocha (2004), poor sanitation conditions and measures for health education in conjunction with low socioeconomic status are factors in addition to increasing the prevalence of parasitic diseases and increase the prevalence of anemia in this population. In Brazil, intestinal parasites are common, especially among children and the main consequences are: chronic diarrhea, poor absorption of nutrients, anemia, low attention span and learning disabilities.

Anemia is a blood disease caused by the decrease of abnormal hemoglobin, which is considered the leading cause of iron deficiency in the body, which in turn is considered the most prevalent nutritional deficiency in the whole world (OMSL, 1972; Monteiro & Szarfarc, 1998). In Brazil, there are no available data that may indicate the exact size of this problem (Silva *et al*, 2001). Screening for iron deficiency anemia associated with parasites has been the determination of hemoglobin (Bain, 1997).

Although some studies could not present a correlation between parasites and anemia (Jorge, 1983; Sigulem, 1985; Pedrazzani *et al*, 1988; Tsuyuoka *et al*, 1999), other authors have reported the presence of intestinal parasites with appearance of anemia deficiency (UNICEF/WHO, 1998; Ferreira *et al*, 2002), and also with worsening nutritional status, especially in children (Tsuyuoka *et al*, 1999). Other authors showed a relationship between anemia and intestinal parasites, where we observed a 26% reduction in cases of anemia in children treated with anti-helminths (Guyatt *et al*, 2001). It is

estimated that approximately half of the world's children under the age of four years, in developing countries, are affected by anemia (FNUI, 1998), therefore anemia is a disease with high prevalence in studied populations (Bain BJ, 1997; Tsuyuoka *et al*, 1999). And despite the lack of data available in Brazil, that can demonstrate the exact prevalence of this pathogen, studies showed an increase in the number of cases of the 80's to the 90's children in São Paulo (Monteiro *et al*, 1997; Monteiro, 1998).

In this retrospective study, a screening was done of subjects who had changes in hemoglobin and hematocrit and these data were associated with parasitic infections that the individuals had concomitant. Considering, then, the prevalence of anemia and also needs the presence of intestinal parasites, and considering the damage that can cause these diseases in affected individuals, this study aimed to determine the hematological alterations found in patients suffering from various intestinal parasites also differing age and sex of affected individuals.

METHODS

This study analyzed blood counts of three hundred and two patients with positive parasitologic results, regardless of sex and age group, patients with multiple parasitic infections were excluded. All patients were met at the Clinical Laboratory of Santa Casa de Misericórdia in Araraquara, São Paulo, Brazil, from April to September 2007. For the analysis took into account the different types of parasites, separating individuals by age and sex. This study was approved by the ethics committee on research of the University Center of Araraquara (UNIARA) on March 12, 2007 under Protocol N°. 608 on February 22, 2007.

Blood samples were obtained by venipuncture and collected into a tube containing anticoagulant (K²EDTA). Soon after collection, blood smears were prepared, stained with May-Grunwald-Giens.

All determinations (hematocrit, hemoglobin, total count of red blood cells, total leukocyte count) were performed using the electronic cell counter Coulter T-890. The reference values of hemoglobin and hematocrit were considered according to Lee *et. al.*¹⁷, being: < 3 years, Hb = 10.4 - 14 (g / dL) and HT = 32 - 43, four to ten years Hb = 11.5 to 14.5 g / dL and HT = 33 - 43%, eleven to sixteen years Hb = 12.5 to 16.1 and HT = 36 - 47% and > 17 years, Hb = 13.5 to 18.0 g / dL and HT = 42 - 52%.

RESULTS

With data from 302 positive cases for intestinal parasites, it was possible to analyze the prevalence of these parasites in the city of Araraquara - SP, as shown in Figure 1. The three parasites found in greater quantity in the study population were *Entamoeba coli* (27.48%), *Giardia lamblia* (26.49%), *Endolimax nana*(11.92%). In addition, we performed an analysis of the distribution of parasites in relation with the patient gender, where 44.7% of them were male and 55.3% female. Of the 80 individuals with positivity to *G. lamblia*, was found that 21 had anemia according to criteria of Wintrobe (Lee *et al.*) equivalent in percentage to 26.3%. On average of MCV and MCH for ages less than three years, was observed microcytosis and hypochromic as shown in Table 1 and Figure 2. Of the 20 patients, all aged above 17 years, with positivity for *Trichuris trichiura*, 13 had hemoglobin values below the reference value for this age group showing the presence of anemia in 65% of infected

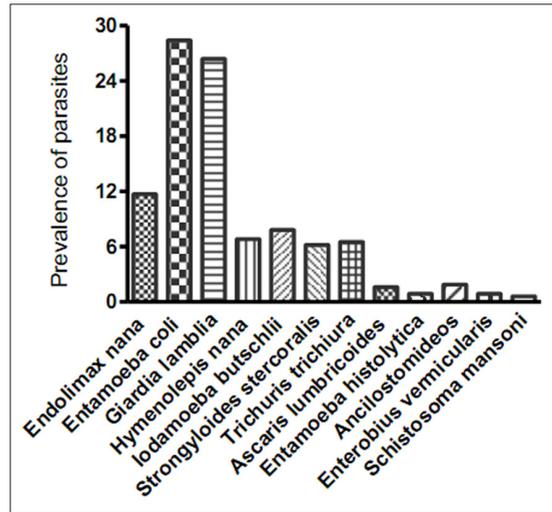


Figure 1. Prevalence in percentages (%) of infections caused by parasites in individuals in the city of Araraquara, in the period of April to September 2007.

individuals (Table 1). Of the 19 patients, all aged above 17 years, with positive *Strongyloides stercoralis*, 9 had hemoglobin values below to the reference value for this age group showing the presence of anemia in 47.4% of infected individuals (Table 1).

DISCUSSION

In this retrospective study was possible to identify the relationship between anemia and parasitic infections, especially in infections caused by *G.*

Table 1. Average of hemoglobin levels, number of erythrocytes, VCM, HCM, according to the age of individuals infected with *Giardia lamblia* (n = 80), *Trichuris trichiura* (n = 20) and *Strongyloides stercoralis* (n = 19)

Parasite	Number of cases	Age (years)	Hemoglobin (g/dL)	Erythrocytes (x106/mm ³)	VCM (FTL)	HCM (PCG)
<i>Giardia lamblia</i>	18	< 3	10 ± 1,5	5 ± 0,4	71 ± 7,6	22 ± 3,1
<i>Giardia lamblia</i>	54	4 - 10	12 ± 0,9	5 ± 0,3	82 ± 4,4	27 ± 1,9
<i>Giardia lamblia</i>	3	11 - 16	12 ± 0,3	5 ± 0,1	84 ± 1,3	27 ± 0,4
<i>Giardia lamblia</i>	5	> 17	14 ± 1,5	5 ± 0,3	90 ± 3,8	30 ± 2,0
<i>Trichuris trichiura</i>	20	> 17	13 ± 1,6	4 ± 0,5	87 ± 5,3	29 ± 2,6
<i>Strongyloides stercoralis</i>	19	> 17	13 ± 1,6	5 ± 0,5	86 ± 7,5	28 ± 3,7

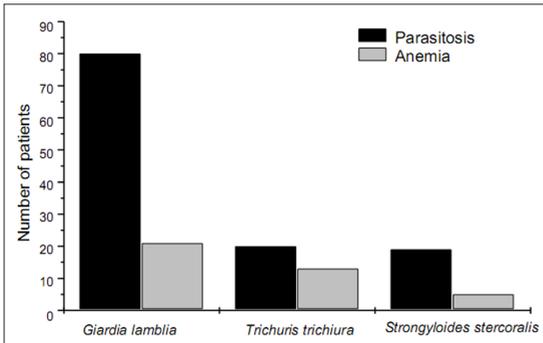


Figure 2. Relationship between positive cases of *Giardia lamblia*, *Trichuris trichiura* and *Strongyloides stercoralis* with anemia.

lamblia, *T. trichiura* and *S. stercoralis* (Figure 2). Among the most prevalent protozoa found, the only pathogenic was *G. lamblia* and coincidentally in these individuals was observed 25% of anemia (Figures 2 and 3a, b). In the infection caused by *G. lamblia* it depends on the pathogenesis of the parasite and host, especially as factors relevant to the host immune response and the proteases that could activate the lectin parasite (Cantos *et al*, 2004). The interaction of the intestinal tract with the protozoa is also an important factor, where among the adverse effects, probably stimulated by the infection are villous atrophy in various degrees in the small intestine, associated with inflammatory infiltrate and crypt hypertrophy; lesion in the structures of the enterocyte; invasion mucosa; bile acids alterations, decreased the activity of disaccharidases Crua *et al*, 2003). As a consequence of these mechanisms, the child has poor absorption of sugars, fats, vitamins A, D, E, K, B12, folic acid, iron and zinc (Rey, 2001). This poor absorption of iron described by

some authors may explain the cases of anemia found in 25% of individuals infected by *G. lamblia* (Figure 2 and Table 1).

Infections with intestinal parasites represent a public health problem worldwide, difficult to solve. Have high prevalence in our country, especially among poor people and children due to poor conditions of sanitation, housing and education. The parasites may favor the onset or worsening of poor nutrition. The form of presentation depends on factors related to the host, environment and agent (Melo *et al*, 2004). Anemia is the most common diseases found in developing countries, it is estimated that this disease affects half of children and adolescents in these locals (Cantos *et al*, 2004).

Anemia due to iron deficiency, also known as iron deficiency elevates cardiac stress, to maintain normal levels of oxygenation, and reduces the physical capacity for work, resulting in symptoms such as dysmenorrhea, anorexia, headache, dizziness, drowsiness, weakness muscle, tingling, and, most sequels, spontaneous abortion (Bashiri *et al*, 2003). Iron deficiency anemia caused by blood loss at the site of attachment of the adult worm is a common symptom of many helminths, and the most common hookworms infection (Tsuyuka *et al*, 1999). Although it has not been possible to correlate the worms in this study, Robertson *et al*, (1992) reported that children with hookworm and *T. trichiura* showed lower Hb levels than children without or with only one of these parasites. Moreover, chil-

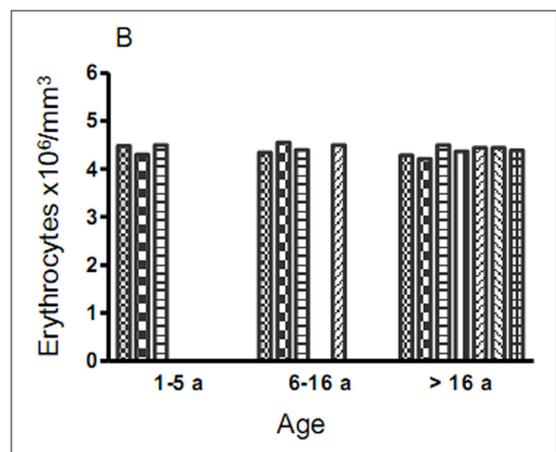
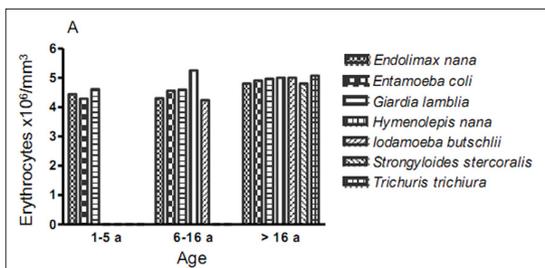


Figure 3. Absolute concentration of red cells in peripheral blood of male patients (A) and female patients (B) with intestinal parasites. The X axis represents the considered ages (1-5 years, 6-16 years and above 16 years) and the various parasites.

dren aged six months to three years old are often infected with hookworm, *T. trichiura* and *A. lumbricoides* (Robertson *et al*, 1992; Stephenson *et al*, 2000), and with hookworm and *A. lumbricoides* with increasing age (Harrison *et al*, 2002).

Despite the low percentage of these helminths in the patients studied, we can see correlation with anemia helminthic parasites. (Figure 4). In Strongyloidiasis, symptoms such as anemia, weight loss and asthenia are commonly reported in literature, but it is difficult to decide whether it is resulted from parasitism or caused by their deterioration, because these forms often affects patients living in precarious socioeconomic conditions in which malnutrition exists regardless of the infection by *S. stercoralis* (Kightlinger *et al*, 1995). Moreover, according to Cantos *et al*, (2004), in his study was observed an association between *S. stercoralis* and anemia in 6.4% of individuals. Strongyloidiasis can occur asymptotically, multisymptomatic or severe. In chronic uncomplicated, are common gastrointestinal symptoms consisting of anorexia, nausea, constipation or diarrhea outbreaks, or dysenteric syndrome with steatorrhea, with anemia and hypochromic eosinophilia (Kothary *et al*, 1999; Lagacé-Wiens: Maia *et al*, 2006. & Harding, 2007;) These results corroborate our findings, where 47.4% of individuals infected with *S. stercoralis* evaluated in this study were anemic. The *T. trichiura* infection in the worms are located mainly in the cecum, the majority, the infection is asymptomatic or accompanied by mild forms. However, in some individuals, such as malnourished children, who lives in communities with crowded and lack of sanitation, can install to trichiuriasis massive, affecting the large intestine from the cecum to the rectum. Among these symptoms are bloating, chronic dysentery, anemia and protein-energy malnutrition. Among the individuals infected with *T. trichiura* in this study, 65% had anemia, which explains this finding is the relationship to the mode of parasitism in the intestine. (Figures 2, 4). Since the adult worm installs itself it “dives” to the front of the body mucosa from where it draws nutrients, and this action spoliation favors along the bleeding that favor infection anemia iron deficiency (Rey, 2001). Some authors estimate that during the infection by *T. trichiura* approximately 0.005 mL of blood is lost per adult worms found in intestino (Layrisse *et al*, 1967), and usually the infection by *T. trichiura*

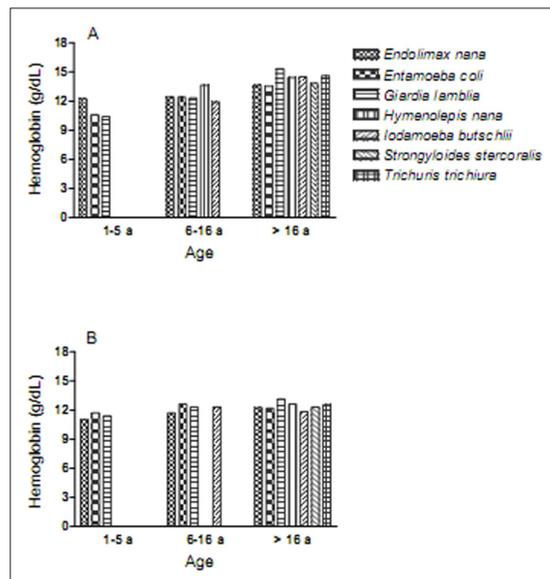


Figure 4. Hemoglobin concentration in peripheral blood of patients with intestinal parasites, obtained by sum and the average of all males (A) and female (B) involved in the research. The reference values were determined according to the age (Male: 1 year = 10.5 to 13.5, 2 to 5 years = 11.0 to 14.5, 6 to 16 years = 12.0 to 14.0 ; Over 16 years = 13.5 to 17.5 / Female: 1 year = 10.5 to 13.5, 2 to 5 years = 12.0 to 15.0, 6 to 16 years = 12.0 to 14 , 5; above 16 years = 12, oa 15.5). The bars represent the parasites prevalence in this population.

are characterized by tens or hundreds of parasites, which justifies the presence of anemia in individuals studied.

Moreover, the performed analysis of the distribution of parasites in relation to gender, where 44.7% of subjects were male and 55.3% of subjects were female, had higher prevalence of *G. lamblia* in males and *E. coli* in females (data not shown). These data have to be better investigated, since, in literature no relation between the protozoan infection and host sex is described.

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