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Prevalence of intestinal parasitosis in children and pre-adolescents in the municipality of Breves, Brazil

Prevalência de parasitoses intestinais em crianças e pré-adolescentes no município de Breves, Pará, Brasil

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ABSTRACT
Current paper diagnosed intestinal parasites in children and pre-adolescents (0 to 14 years old) and verified their health conditions. The study was carried out in the Igarapé Santa Cruz, municipality of Breves, in the state of Pará, Brazil. A questionnaire was handed out and fecal samples from 250 children were collected. Further, 91.20% of positive cases was detected for at least one parasite species, although 62.72% had polyparasitism. In the case of parasite groups, 70.8% were infected by helminths and 65.6% by protozoa. The most prevalent species were *Trichuris trichiura* (68.8%), *Endolimax nana* (48.4%), *Ascaris lumbricoides* (37.2%) and *Entamoeba histolytica/E.dispar* (33.6%). Health status revealed that 62.9% had a history of gastrointestinal disease and 18.0% of hospitalization. The most prominent clinical manifestations were abdominal pain, elimination of worms and diarrhea. In view of the state of health and high prevalence of entero-parasitosis, interventions involving control and treatment are mandatory.

Keywords: Basic sanitation. Parasitic diseases. Public health.

RESUMO
O estudo objetivou diagnosticar parasitas intestinais em crianças e pré-adolescentes (0 a 14 anos) e verificar o estado de saúde deles. Foi desenvolvido no Igarapé Santa Cruz, município de Breves-PA, e consistiu na aplicação de questionário e coleta de amostras fecais de 250 pessoas. Detectou-se prevalência de 91,20% de casos positivos para ao menos uma espécie de parasita, e destes, 62,72% apresentaram poliparasitismo. Quanto aos grupos de parasitas, a infecção foi de 70,8% para helmintos, e 65,6% para protozoários. As espécies predominantes foram *Trichuris trichiura* (68,8%), *Endolimax nana* (48,4%), *Ascaris lumbricoides* (37,2%) e *Entamoeba histolytica/E. dispar* (33,6%). Quanto ao estado de saúde, 62,9% apresentam um histórico de doença gastrointestinal, e 18,0%, de hospitalização. As manifestações clínicas de maior destaque foram dores abdominais, eliminação de vermes e diarreia. Diante do estado de saúde e da alta prevalência de enteroparasitoses, são necessárias intervenções para combate, controle e tratamento.

Palavras-chave: Doenças parasitárias. Saneamento básico. Saúde pública.

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INTRODUCTION

Intestinal parasitic diseases caused by protozoa and helminths are still important groups of human infections, albeit featuring low mortality rates[1,2]. However, intestinal parasites cause important transient morbidity events, such as diarrhea, deficiency in nutrient absorption and food intake, intestinal bleeding, and more serious complications such as intestinal obstruction, rectal prolapse, severe anemia and the formation of extra intestinal (mainly hepatic) abscesses[3]. These complications impair physical and cognitive development, attention capacity and school performance, hinder learning, provide school repetition, increase the number of children of inadequate age for the proper school grade and contribute to dropout[4].

Enteroparasite infections are generally associated with poor hygiene and sanitary conditions in which people live[5]. Consequently, rampant different socioeconomic conditions, lack of adequate basic sanitation, untreated water, difficulty in accessing medical diagnosis and efficient treatment are the cause and the bases of high prevalent parasitosis, especially in regions poorly assisted by public policies, such as rural settlements, native villages, riverside communities, rural areas, former slave communities and town outskirts and suburban areas[6,7].

More than 3.5 billion people are infected worldwide by some type of intestinal parasite. Needless to say, developing countries are most hit[8]. In Brazil, several studies have revealed high rates of people infected by intestinal parasites in different regions, with higher prevalence rates in the North and Northeast regions of the country[2,6].

The municipality of Breves, in the state of Pará, Brazil, has several favorable conditions for the occurrence of intestinal parasites. It is actually one of the municipalities of the Marajó Archipelago that has one of the lowest Human Development Indexes (HDI). Its population lives in extreme conditions of socioeconomic vulnerability, with poor basic sanitation[9]. Breves has only 6.1% of homes with adequate sewage system for an estimated population of 99,080 inhabitants and an area of 9,563 km^2 [10].

Further, the growth of popular housing estates on the banks of the Igarapé Santa Cruz within the urban perimeter of Breves started in the 1980s at the apex of the timber industrial complex. In other words, the housing process was not followed up by systematic planning, or rather, precarious and makeshift dwellings were built in a disorderly manner, favoring conditions of environmental degradation, unhealthiness and risk of infections and parasitic reinfections. Currently, 257 families (1,377 inhabitants) live on the banks of the igarapé Santa Cruz.

Current study analyzes intestinal parasites in children and pre-adolescents and verify their health status foregrounded on reports (questionnaire) by family members. In addition, the study provides an economic and environmental diagnosis of the inhabitants of the Igarapé Santa Cruz in the municipality of Breves, island of Marajó, Pará, Brazil.

METHODOLOGY

Current investigation, featuring a survey on the prevalence of intestinal parasitosis in children and pre-adolescents (0 - 14 years), was undertaken with inhabitants on the banks of the river Santa Cruz River, near its source (50° 29' 12'' W; 01° 40' 15''S) and mouth (50° 29' 26''W; 01° 41' 4''S), in a suburban area of the municipality of Breves, mesoregion of Marajó, state of Pará.

So that an economic and environmental diagnosis could be undertaken characterizing the target population's health conditions, a half-structured questionnaire was applied to all 257 resident families. Information on family income, garbage collection, sanitary sewage, children's health status, hygiene habits, sociocultural habits and other factors was obtained. In the case of laboratory testing of health

status, 204 families, with 512 individuals aged 0 to 14 years, were examined. Two hundred and fifty were selected for the diagnosis of intestinal parasites.

The questionnaire was handed out and filled between March and April 2017 when homes were visited. A member of each family (husband or wife or other family member over eighteen years old) was invited to participate in the research. When the invitation was accepted, a Free Consent Form (FCF) was handed out, read and signed by the participant. After making clear all ethical issues, the questionnaire was applied to collect the information required by current study. After the application of the questionnaire, the families were told that fecal samples would be collected later on.

Fecal samples were collected between May and June 2017. Individuals between 8 and 14 years old were invited to participate. The participation of children between 0 and 7 years old depended on their parents' or guardians' decision. The FCF was handed to all consenting and participant people and signed by parents or guardians authorizing participation in the parasitological diagnosis. The FCF was also given to people aged between 8 and 14 years old to confirm their consent. Criteria for the inclusion of children and pre-adolescents in the parasitological diagnosis comprised: age between 0 and 14 years old and living on the (right or left) banks of the Igarapé Santa Cruz Igarapé for more than one year; authorization by parents or guardians; aged between 8 and 14 years old. Exclusion criteria comprised lack of authorization; use of anti-parasite drugs during the last four months; people under 14 years old who were unable to defecate on the day of fecal sample collection. Procedure complies with the ethical and legal aspects of Resolution 466/12 of the Brazilian Health Council [11].

Parents or guardians of children between 0 and 14 years of age were then instructed on procedure in feces collection. They received a pair of clinical gloves, a surgical mask and a collecting container with gel (formaldehyde 22%), already tagged for identification. Only one sample was required from each participant. Container with the stool sample was collected on the next day, in the afternoon, at the participant's residence. If the fecal sample was not provided, a new visit and another date for delivery of the sample was scheduled. If on the third appointment, the child or pre-adolescent could not provide the sample, another participant was selected.

Fecal samples were conditioned in a properly sealed and identified thermal polystyrene box, and sent to the Laboratory of Clinical and Parasitological Analyses of the Centro Saúde Escola do Marco of the Universidade do Estado do Pará (UEPA). Technique for the Parasitological Examination of Feces (PEF) consisted of direct and spontaneous sedimentation methods (Hoffman, Pons and Janer Method - HPJ)[12]. In each case, two slides were prepared and read by two examiners. Lugol solution was used for the analyses and the slides were observed under optical microscopy (100x and 400x). Parasite was reported when eggs or larvae of helminths and cysts or trophozoites of protozoa were detected in at least one of the procedures used.

PEF results were delivered to parents or guardians of participating children and pre-adolescents. They were instructed to seek a health center so that appropriate measures and treatment of parasites would be taken when cases of infection by intestinal parasites were detected. A brief guide on the symptomatology of the main intestinal parasites was also given. Further, through a frank chat, parents and guardians were instructed on water treatment, food intake and children's hygiene and leisure habits to avoid new infections.

All data retrieved from the questionnaire and PEF results were analyzed in spreadsheets of Microsoft Excel 2016 and statistically tabulated by two-way ANOVA at 5%, with Bioestat 5.3.

Current study was approved by the Committee for Ethics in Research (CEP) of the Universidade do Estado do Pará (UEPA) – Campus XII – Tapajós, CAAE 63809516.9.0000.5168, protocol 1,956,233 and

by the Committee for Ethics in Research of the co-participating Centro de Ciências Biológicas e da Saúde (CCBS) of the UEPA, CAAE 63809516.9.3001.5174, protocol 1,967,193.

RESULTS

ECONOMIC AND ENVIRONMENTAL DIAGNOSIS

One hundred and eighty-six (72.37%) out of the 257 families living at Igarapé Santa Cruz had a family monthly income equivalent to one Brazilian minimum wage (BR$937.00); 70 (27.24%) earned between two and three minimum wages a month, and only one family (0.39%) earned up to four minimum wages per month. Practically, the families' main income was the product of informal employment, registered work, pension and public service (state or local town hall), in just a few cases.

Only 1.17% (n = 3) of home waste produced by the families was dumped directly into the stream. Nevertheless, several types of waste (organic, plastic, metal, glass) were seen deposited in the shallower parts of the stream and near or under the floor of homes.

Further, 125 families (48.64%) deposited physiological wastes (feces and urine) in cesspits; 91 (35.41%) in non-plastered cesspools; 35 (13.62%) in the stream, and 6 (2.33%) did not have absolutely any type of disposal. The area under analysis lacks any sewage system or treatment and 61 of the non-plastered cesspools and 46 of the cesspits lie only between 2 and 5 meters far from the stream. It has to be underscored that the stream water is an indispensable resource for the leisure and domestic use of most residents.

HEALTH STATUS OF CHILDREN AND PRE-ADOLESCENTS AND THEIR HYGIENE HABITS

Three hundred and twenty-two (62.9%) out of the 512 children and pre-adolescents of the 204 families living on the banks of the Igarapé Santa Cruz, have been constantly plagued by some type of gastrointestinal disease. The 3 – 5 years old group (n=83; 25.77%) and the 0 - 2 years old group (n=38; 11.8%) respectively had the highest and lowest number of infections. In addition, 58 (18.0%) out of the 322 children affected by gastrointestinal diseases have been hospitalized for intestinal infections caused by helminths and protozoa, besides typhoid fever (n = 4) and hepatitis A (n = 3), according to family reports.

Families living on the banks of the Igarapé Santa Cruz declared that clinical manifestations of intestinal parasite diseases are common in children. Diagnosed manifestations such as abdominal pain (174 reports), elimination of worms (146 reports) and diarrhea (129 reports) were the most frequent (Table 1). Several parents even said they witnessed the elimination of roundworm (*Ascaris lumbricoides*) through children's mouths.

Table 1. Clinical manifestations of intestinal parasitosis in children and pre-adolescents living on the banks of the Igarapé Santa Cruz, Breves PA Brazil, reported by families between March and April 2017

Clinical manifestations	Number of families	%
Abdominal pain	174	85.29
Elimination of worms	146	71.56
Bloodless Diarrhea	96	47.05
Lack of appetite	94	46.07
Fever	92	45.09
Slimming	88	43.13
Flatulence	81	39.70
Indisposition	63	30.88
Feeling of fatigue	56	27.45
Vomit	51	25.00
Nausea	49	24.01
Anal itching	45	22.05
Skin spots	41	20.09
Diarrhea with blood	33	16.17
Intestine constipation	26	12.74

Source: Data retrieved from research.

Further, 58.33% (n = 119) of parents and guardians reported taking their children and pre-adolescents to the doctor only when they were sick; 36.76% (n = 75) took their children to the doctor´s between one and four times; 3.92% (n = 8) of the families took their children every month for medical consultation. The latter group was composed of newborn children. Only two families stated that they do not take their children to the doctor.

One hundred and sixty-seven (81.86%) parents or guardians among the 204 families visited replied that one time or another they took their children´s feces for clinical analyses. One hundred and one (60.48%) reported obtaining a positive diagnosis for helminths and/or intestinal protozoa. One hundred and eighty-two (89.22%) stated that they treated intestinal parasitosis with Albendazole. Several mentioned treatment with herbal medicines such as the juice of the herb *Chenopodium ambrosioides* L., popularly known as *mastruz*. However, many mentioned that children or adolescents take anti-parasite medication only in times of parasite campaigns carried out mainly in government-run schools.

Further, 89.71% of the families under analysis stated that children and pre-adolescents have a habit of washing food before ingesting; 58.82% declared that their children under 14 years of age wash their hands with soap and water or only water before feeding; 67.64% stated that they wash their hands with soap and water or only with water after using the bathroom with soap and water or only with water; 68.14% declared that children and pre-adolescents (0 - 14 years old) have the habit of walking barefoot during everyday activities around their homes (Table 2).

Table 2. Hygiene habits of children and pre-adolescents living on the banks of the Igarapé Santa Cruz, Breves PA Brazil, according to reports by parents and guardians, between March and April 2017

Family responses on children and pre-adolescents hygiene habits	Number of families (n)	%
Wash food prior to eating		
Yes	183	89.71
No	6	2.94
Sometimes	15	7.35
Wash one´s hands prior to eating		
Yes, with water only	66	32.35
Yes, with water and soap	54	26.47
Very often, only with water	33	16.18
Very often, with water and soap	27	13.24
Does not wash	24	11.76
Washing hands after going to the toilet		
Yes, with water only	65	31.86
Yes, with water and soap	73	35.78
Very often, only with water	32	15.69
Very often, with water and soap	21	10.29
Takes a shower	2	0.98
Does not wash	11	5.40
Walking barefoot		
Yes	139	68.14
No	54	26.47
Sometimes	11	5.39

Source: Data retrieved from research.

In the case of social and cultural habits, 74.02% (n=151) of the families have domestic animals, such as dogs and cats; 44.37% (n=67) reported living with these animals within the home; 38.41% (n=58) said that the animals were kept outside the home; 17.22% (n=26) stated that dogs and cats were free to come in or go out of the home. It should be underscored that 119 (78.81%) of the families with domestic animals reported never deworming the animals and that 90 (59.60%) reported that the children had direct contact with the animals.

DIAGNOSIS OF PARASITOSIS

PEF in 250 children and pre-adolescents (0 - 14 years old) living on the banks of the Igarapé Santa Cruz Igarapé revealed that 91.20% of clinical tests (n = 228) were positive for at least one helminth or protozoan species; 14.05% (n = 32) were positive for mono-parasitism; 23.24% (n = 53) for bi-parasitism; 62.72% (n = 143) for polyparasitism (Table 3). The latter varied between 3 and 8 parasite species. Most comprised three species. A lesser number comprised an association of eight species.

Table 3. Type of parasitism by children and pre-adolescents´ age group living on the banks of the Igarapé Santa Cruz, Breves PA Brazil, between May and June 2017

Type of parasitism	Age group					
	0 - 2 n=50 (%)	3 – 5 n=50 (%)	6 - 8 n=50 (%)	9 - 11 n=50 (%)	12 - 14 n=50 (%)	Total frequency n=250 (%)
Monoparasitism	17 (7.46)	1 (0.43)	3 (1.32)	5 (2.20)	6 (2.64)	32 (14.05)
Biparasitism	6 (2.63)	12 (5.26)	11 (4.82)	8 (3.51)	16 (7.02)	53 (23.24)
Polyparasitism	11 (4.82)	37 (16.23)	36 (15.79)	33 (14.48)	26 (11.40)	143 (62.72)
Total	34 (14.91)	50 (21.92)	50 (21.92)	46 (20.19)	48 (21.06)	228 (100)

Source: Data retrieved from research.

Since infections were produced by different types of parasitism, a significant difference has been detected especially in the case of people predominantly infected by polyparasitism when compared to those infected by monoparasitism and biparasitism. However, there was no statistically significant difference between age groups. The most recurring polyparasitism case was that between *Ascaris lumbricoides*, *Trichuris trichiura* and *Endolimax nana*, even though a case with eight parasite species was detected (Table 4).

Table 4. Association of intestinal and entero-commensal parasites in polyparasite infections in children and pre-adolescents living on the banks of the Igarapé Santa Cruz, Breves PA Brazil, between May and June 2017

Association	n (Freq. %)
A. lumbricoides + *T. trichiura* + *E. Nana*	9 (6.3)
A. lumbricoides + *T. trichiura* + *Giardia lamblia*	7 (4.9)
T. trichiura + *Blastocystis hominis* + *E. nana*	6 (4.2)
A. lumbricoides + *T. trichiura* + *G. lamblia* + *E. Nana*	4 (2.8)
A. lumbricoides + *T. trichiura* + *B. hominis*	4 (2.8)
T. trichiura + *Entamoeba histolytica/E. dispar* + *E. coli* + *E. nana*	4 (2.8)
A. lumbricoides + *T. trichiura* + *E. histolytica/E. dispar* + *B. hominis* + *E. coli* + *E. nana*	4 (2.8)
A. lumbricoides + *T. trichiura* + *E. histolytica/E. dispar* + *G. lamblia* + *B. hominis* + *E. coli* + *E. nana* + *Iodamoeba butschlii*	1 (0.7)
Other combinations	104 (72.7)
Total	143 (100)

Source: Data retrieved from research.

The groups of intestinal and entero-commensal parasites were distributed as follows: 77.63% for helminths (n = 177); 71.92% for parasitic protozoa (n = 164) and 63.59% for commensal protozoa (n = 145). Age groups with the highest prevalence were 3 – 5 years old group for helminths (n = 45); 3 - 5 years old group and 6 - 8 years old group for parasitic protozoa, both with 40 cases, and 6 - 8 years old group for commensal parasites (n = 37) (Figure 1). Population sample studied consisted of 115 boys and 135 girls, and the prevalence of intestinal parasitosis reached 92.17% and 90.37% for boys and girls, respectively.

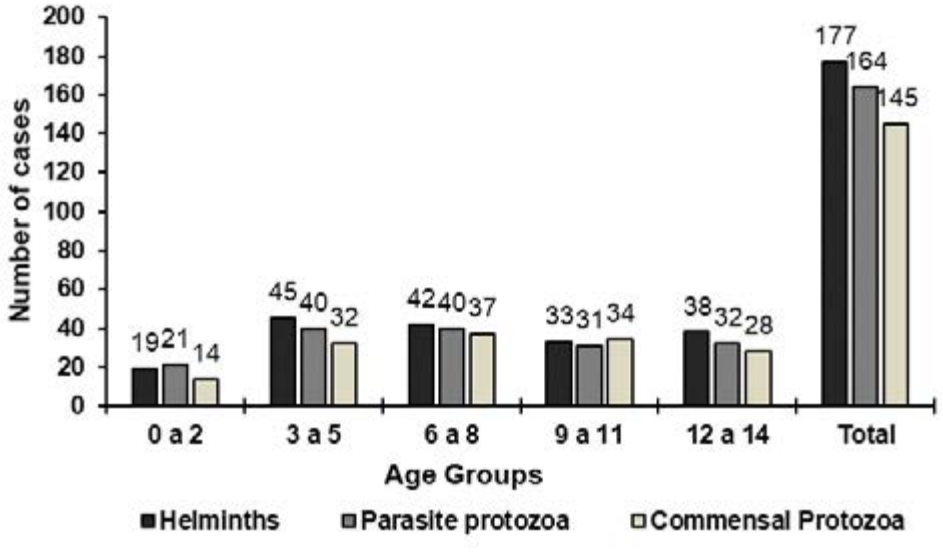

Figure 1. Distribution of intestine parasite groups by age groups of children and pre-adolescents (0 - 14 years old) living on the banks of the igarapé Santa Cruz, Breves PA Brazil, between May and June 2017.

Source: Data retrieved from research.

Table 5 shows parasite species detected in current study. Highest prevalence rate belonged to helminthic infections by *Trichuris trichiura* (68.8%) and *Ascaris lumbricoides* (40.8%). As a rule, a significant difference occurs when comparing infections by helminth species ($p \leq 0.05$) and those by other species when *T. trichiura* is predominant. No significant difference ($p > 0.05$) difference occurs when species distribution among age groups is given, or rather, the number of cases of helminthic infections is statistically homogeneous among all age groups.

Endolimax nana (53.1%) and *Entamoeba histolytica/E. dispar* (36.8%) were predominant among the protozoa. Although *E. histolytica/E. dispar* is the most frequent species among parasitic protozoa (Table 5), statistically there was no difference when compared with other species. In other words, prevalence was similar among the species ($p > 0.05$). Similarly, there is also no significant difference ($p > 0.05$) when comparison of species distribution by age groups is made, or rather, prevalence is statistically similar in all age groups. Significant statistical differences ($p \leq 0.05$) occurred in the case of species of commensal protozoa, when compared to prevalence per species, especially in the case of the very frequent *E. nana* (53.1%). The distribution of commensal species by age groups also revealed a significant difference ($p \leq 0.05$), with a greater frequency in the 9 – 11 years old age group (58 cases) (Table 05). When all types of protozoa (parasites and commensal parasites) are taken into account, there is a higher prevalence rate than in helminths, with 79.20% positivity.

One should underscore that all species of parasites were detected in the 12 – 14 years old age group. The 3 – 5 years old age group showed higher occurrence of helminths and parasitic protozoa and the 9 – 11 years old age group revealed the highest occurrence of commensal protozoa (Table 5).

Table 5. Distribution of intestine parasite species by age group in children and pre-adolescents (0 - 14 years old) living on the banks of the Igarapé Santa Cruz, Breves PA Brazil, between May and June 2017

Species	Age group					
	0 – 2	3 - 5	6 - 8	9 - 11	12 - 14	Total freq.
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Helminths						
Trichuris trichiura	10 (4.4)	43 (18.9)	38 (16.7)	29 (12.7)	37 (16.2)	157 (68.8)
Ascaris lumbricoides	14 (6.1)	27 (11.8)	20 (8.8)	15 (6.6)	17 (7.5)	93 (40.8)
Ancylostoma sp	0 (0.0)	1 (0.4)	1 (0.4)	1 (0.4)	3 (1.3)	6 (2.6)
Enterobius vermicularis	0 (0.0)	2 (0.9)	0 (0.0)	0 (0.0)	1 (0.4)	3 (1.3)
Strongyloides stercoralis	1 (0.4)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.4)	2 (0.9)
Parasite protozoa						
Entamoeba histolytica/E.dispar	2 (0.9)	16 (7.0)	24 (10.5)	21 (9.2)	21 (9.2)	84 (36.8)
Giardia lamblia	14 (6.1)	28 (11.8)	15 (6.6)	10 (4.4)	11 (4.8)	78 (33.8)
Blastocystis hominis	11 (4.8)	21 (9.2)	20 (8.8)	12 (5.3)	11 (4.8)	75 (32.9)
Commensal protozoa						
Endolimax nana	12 (5.3)	30 (13.2)	32 (14.0)	26 (11.4)	21 (9.2)	121 (53.1)
Entamoeba coli	3 (1.3)	10 (4.4)	15 (6.6)	21 (9.2)	15 (6.6)	64 (28.0)
Iodamoeba butschlii	0 (0.0)	6 (2.6)	7 (3.1)	11 (4.8)	8 (3.5)	32 (14.0)

Source: Data retrieved from research.

DISCUSSION

The prevalence rate of intestine parasites is high in different Brazilian regions, especially in the Amazon[13]. Current study with children and pre-adolescents (0 - 14 years old) living on the banks of the igarapé Santa Cruz revealed a high prevalence of intestinal parasites, including three to eight species of parasites in most diagnosis. The above constitutes a situation in which they may cause transient symptomatic events, such as intestinal absorption of nutrients, diarrhea and anemias, and may also cause chronic limitations to the child´s physical, intellectual, productive and social development[1]. These health problems are mainly due to poor housing, socioeconomic, environmental and basic sanitation conditions in which the population lives[3].

Among the parasite groups evaluated in this study, helminths exceeded the 70% prevalence mark in the population under analysis, underscoring the wide occurrence of cases among age groups. Or rather, all children and pre-adolescents had a high degree of infection, especially by *T. trichiura* and *A. lumbricoides*., with a great negative impact on host nutrition through various mechanisms, including chronic blood loss and nutrient malabsorption[14].

Since we are dealing with Ancylostoma (hookworms) and *S. stercoralis*, transmitted by the penetration of larvae through the skin or mucous membranes[15], the risk of infection in the children

living on the banks of the igarapé Santa Cruz Stream may be highlighted since most have the habit of walking barefoot in and around the area. Although current study detected a low prevalence of these parasites (in fact, the methodology of parasitological analysis, namely, spontaneous sedimentation and direct method, is not the specific technique for detecting these species of helminths), the damage caused by hookworms and *S. stercoralis* is serious. Anemia, intestinal hemorrhages, abdominal pain with vomiting, diarrhea and even respiratory problems may be the result[13,15].

In the case of parasite protozoa with their high prevalence rates, *E. histolytica* is rather conspicuous. Due to its high degree of pathogenicity, it is one of the most deadly intestinal parasites for children worldwide[16]. Nevertheless, one cannot say that the children were infected by *E. histolytica* since *Entamoeba dispar* is morphologically identical and nonpathogenic. Differentiation of these species require ELISA (immuno-enzymatic assay) or molecular biology[17], both of which were not used in current study. One should underscore that, regardless of *Entamoeba (*pathogenic or nonpathogenic), the study detected a high prevalence of parasitic protozoa, with great concern for the children´s health. However, it must be borne in mind that, as in all helminths, *E. histolytica/E. dispar, G. lamblia* and *B. hominis* occur at all ages and the level of contagion is similar. Further, the above protozoa may cause diarrhea, leading the child to dehydration and weight loss, which may develop into even more serious health problems They may also be fatal[15].

Abdominal pain, diarrhea and spontaneous elimination of helminths were the most frequent reported symptoms by parents and guardian. Consequently, the results on the prevalence of helminths and parasitic protozoa probably corroborate the children´s health status diagnosed.

Commensal protozoa do not jeopardize people's health, although infection by these species has important implications on the epidemiology of parasitic diseases since it reveals conditions of basic sanitation, the presence or not of a sewage network, the quality of water consumed and the hygiene habits to which children or adults are exposed[18]. In current analysis, the commensal species *E. nana* had a higher prevalence among all the other protozoa. According to Santos et al. [19], the diagnosis of commensal protozoa indicates lack of personal and family hygiene and precariousness in the population´s sanitary conditions. Consequently, family reports and the high prevalence of entero-commensal parasites in parasitological diagnosis reveal that a large section of the population living on the banks of the igarapé Santa Cruz fails in good hygiene habits. Answers of the questionnaire by parents and guardians reveal a high percentage of children who wash their hands only with water or almost always only with water before eating and also after the use of the bathroom. Actually, water alone is not a disinfectant. In addition, studies by Marques et al. [20] confirm that most residents use the water of the igarapé for different activities (recreation, domestic use, direct consumption and others). Since no adequate treatment is available, the washing of food is not done correctly[20].

Good hygiene habits is one of the main prophylactic measures against parasitosis, since the intake of uncleaned foods and precarious hygienic conditions of hands make people highly prone to contamination and dissemination of the infecting forms of helminths and protozoa[21]. Moreover, intestinal parasitosis is more frequent in children due to their bad hygiene habits and their constant interpersonal contact with contamination sources[22].

The high prevalence of helminths and protozoa in the 3 – 8 years age group reveals that the children´s parents and guardians do not have due care in their feeding and hygiene. Further, the poor environmental conditions in which most families live should be taken into account.

Most children and pre-adolescents had some gastrointestinal disease, probably due to the poor environmental conditions around the igarapé

Santa Cruz area. This is a determining factor for such diseases as Ascaridiasis, Tricuriasis, Ancylostomysis, Amebiasia, Hepatitis A, Cholera, Typhoid Fever and others[13]. Although most children had some sort of intestinal disease, the number of hospitalized children was low (18.0%) when compared to the Brazilian average (40%)[23], probably related to the families' habit of not taking children to a health unit for treatment. Needless to say, the socio-economic, environmental and sanitary conditions of the area under analysis are favorable for the development of intestinal infections[24].

In the wake of conditions of the daily life of the children under analysis, it may be perceived that abdominal pain, lack of appetite, weight loss, diarrhea and even elimination of helminths either by the anus or by the mouth are common. Results prove to be worrisome, since the symptomatology compromises children´s development and growth and may be fatal. The elimination of *Ascaris* through the mouth may cause tracheal obstruction[25]. In this sense, interventions by the public authorities to eliminate such health problems become important, especially due to their affecting children.

It has been noted that most parents and guardians said that they only take the children to the doctor when they are sick. According to the Brazilian Society of Pediatrics (SBP)[26], children should be periodically examined by physicians. Visits may range from once a month to once a year, depending on the age group and regardless of whether or not they are sick. In fact, some diseases are asymptomatic.

There are two factors that contribute towards not having the habit of visiting the doctor: first, according to Moimaz et al.[27], there is the delay in consultations, examinations and care by the Brazilian Unified Health System (SUS), and the second is the financial condition of family members, a fact that prevents them from having a health insurance plan to making appointments in private clinics. In fact, most families have incomes less than or equal to one minimum wage. In one way or another, it is necessary that families have access to health resources and the authorities should be more attentive and committed to the well-being of children.

The health status of children and pre-adolescents living on the banks of the igarapé Santa Cruz reveals that intestinal parasitic infections are constant, since, according to the answers in the questionnaire, most children performed PEF at some date in their lives, with positive results for helminths and protozoa. Parents and guardians consequently claim that they treat children with anti-parasite medications. However, current results for PEF prove that 91.20% of the children have a positive diagnosis for different species of parasites. Similar results have been found in riverside communities in the municipality of Igarapé Miri, state of Pará, Brazil, with a prevalence of 94.5%[5] and in indigenous communities in the northwest of the Amazon, with a 96% prevalence[6].

Current analysis infers that the treatment of intestinal parasites without medical guidance performed by families is not effective, similar to treatment carried out in school campaigns. Although albendazole is routinely used by a large number of families and also in the school campaigns, the drug is indicated for the treatment of helminths only. It is inefficient for the treatment of intestinal protozoa such as *E. histolytica*[28], highly prevalent in the age groups investigated in current study. Infections caused by helminths and protozoa have rapid, efficient and low cost treatment[28,29] when properly performed. However, when no changes in habits that prevent transmissions occur, reinfections are frequent, with high prevalence rates.

Current analysis also refers to the habit of keeping domestic animals. They may contribute towards the prevalence of intestinal parasites. In fact, more than 78% of the interviewed families never dewormed or vaccinated their domestic animals. According to Zanetti et al. [30], *G. lamblia* and *Ancylostoma* ssp are the most frequent parasites found in these animals, bringing concern on the population´s health. Consequently, the importance of periodic control of intestinal parasites in dogs and cats should be underscored, based on the correct diagnosis and appropriate use of anti-parasite drugs

and on the use of preventive measures, since most animals live directly and indirectly with children. A study by Colli et al. [31] shows that sharing the home space with infected animals multiplies the chance of infection in humans.

Domestic animals in the home without any type of control against gastrointestinal diseases found in the study influence the prevalence of intestinal parasitosis, especially *G. lamblia*, a protozoon commonly found in infected domestic animals[32]. Therefore, it is necessary that any type of domestic animal be vaccinated and dewormed periodically to avoid risks to human health and prevent situations that would compromise human well-being[33].

CONCLUSION

Owing to the state of health and to the high prevalence of intestinal parasite infections diagnosed in children and pre-adolescents, coupled to environmental conditions which feature the community on the banks of the igarapé Santa Cruz in the municipality of Breves PA Brazil, immediate interventions are required to control and treat parasite-caused diseases. The public health scenario, activities involving health education, changes in the families´ hygiene habits, improvement in homes in basic sanitation conditions, and a more efficient public health system are mandatory. Current study actually reinforces the relationship between a population´s precarious living conditions and its vulnerability to intestinal parasitic diseases. Moreover, data obtained in this study are essential for the planning of socio-educational, health and decision-making measures by the public authorities.

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