Research article

ESTIMATING THE FREQUENCY OF Giardia intestinalis INFECTION IN INDIGENOUS AND AFRO COMMUNITIES OF COLOMBIA: A CROSS-OVER STUDY

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ABSTRACT

Introduction: Intestinal parasitic infections are a major problem of public health. Parasitic diseases: such as giardiasis, are Relevant for the study of health in isolated Communities in Colombia. Objective: To describe the frequency of G. intestinalis infection in 21 isolated Communities in Colombia (18 indigenous and 3 black Communities Communities). Materials and Methods: Microscopic analysis on 671 samples from 21 stool of volunteers isolated Colombian Communities. The analysis included prevalence of giardiasis, nutritional status and management of water and sewage for each of the Communities. Results: The overall prevalence of G. intestinalis infection was 11% in Indigenous Communities and 9% in black Communities. The community prevalence ranged from 0% to 63%. 100% of the evaluated Individuals were affected by at Least one kind of intestinal parasite. Discussion: prevalence of intestinal parasitism by G. intestinalis is similar to other indigenous groups in South America. The cause of intestinal parasites should be considered by each community and ACCORDING TO Known Risk Factors Such residual waters as management and access to drinking water.

Keywords: Intestinal Diseases, Parasitic, Giardia, Indigenous Population, Prevalence.

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INTRODUCTION

Intestinal parasitic infections are a major public health problem, both because of its high prevalence and its worldwide distribution (1-3). Parasitic diseases are responsible for a wide range of morbidities and are considered difficult to control and eradicate diseases, not only for its widespread but by the various factors involved in chain propagation (4). The frequency of infection and type of parasite vary between geographical regions and although they can affect anyone, the main risk factors identified for parasite infestation are: immunosuppression, malnutrition and lack of access to potable water (5). It is estimated that there are about 3,500 million people infected with intestinal parasites in the world, i.e. a global prevalence of 52%, of which 450 million are clinically ill (6).

Giardiasis is the most prevalent intestinal parasitosis worldwide and is characterized by various clinical symptoms that include abdominal pain epigastric or right upper quadrant, bloating, flatulence, nausea and weight loss. It is associated with various allergic reactions and intestinal malabsorption syndrome when there is a high parasite load (7). In the pediatric population, the disease is associated with alterations in the size and weight for age (8). Clinical manifestations are more severe in patients with some degree of malnutrition, creating a vicious cycle of infection, malabsorption and consequently a higher nutritional deficit (9).

Most prevalent parasitic diseases, such as giardiasis, are of particular relevance to the study of health in isolated communities in Colombia, given that their living conditions, these groups have risk factors that make them vulnerable to infestation (lack access to potable water, raw food, malnutrition) and in turn, are communities subjected to various interventions of political, social and medical order, seeking to improve their health, scenario in which knowing the prevalence of parasitosis is essential for assess whether the interventions have been useful and if the social conditions of the communities have improved over time.

In the present study the frequency of G. intestinalis infection in 21 isolated communities in Colombia (18 indigenous communities and 3 black communities), assessed in the framework of the Great Human Expedition between 1992 and 1993, which was described a scientific expedition It was to provide a description of the communities purpose, taking into account ethnic, cultural and health aspects leading to establish a global vision, both immediate health needs of each human group, and understand the context in which developed the enormous human diversity that these populations represent such that the analysis of health conditions high impact, such as intestinal parasitosis, is part of a study to be contextualized within the findings of the expedition, more than two decades ago. However, to date no other study that establishes a baseline from which is known more precisely, the prevalence of G. intestinalis infection in isolated communities of the country.

These results should be considered as a reference to establish a baseline of the prevalence of this parasitosis in the communities studied and in future studies to be contrasted with the living conditions of that time and the present, in order to determine whether changes each isolated group has suffered influence the prevalence of the disease.

MATERIALS AND METHODS

Population: The Great Expedition Humana took place between 12 October 1992 and 13 July 1993, nearly 400 teachers and students from the Pontificia Universidad Javeriana and other academic centers participated in the expedition that crossed uninterruptedly, one much of the Colombian territory, carrying out research projects and service among indigenous communities, black and isolated from Colombia (10). Out in each community health brigades they had with people, who voluntarily came to receive a medical evaluation. The group of people valued were proposed sample analysis, which was accepted only by some individuals. So that the criterion for sample selection was based on the voluntariness of the subjects.

Samples: 671 stool samples for analysis of intestinal parasites were obtained as part of a medical assessment with complete medical history and a group of subjects in each community visited physical exam. In each of the communities also they rose, demographics, housing conditions and nutritional data (weight, height, body mass index).

Microscopic analysis: Regarding the study of intestinal parasitism, each volunteer was supplied the day before the examination a collection vessel appropriately marked. The samples were treated and analyzed in the field, immediately after collection. Each sample was prepared with iodized lugol solution and saline, search for parasites by light microscopy (magnification: 40X). The samples were classified as positive or negative for the presence of Giardia intestinalis observed in any of its forms, trophozoites or cysts.

The relative frequencies of infection and prevalence for each human group were calculated in communities according to the use of boiled water (boiled water consumption vs. no boiled water consumption) and according to wastewater management (not available vs. sewage disposal) were classified. A comparison between the groups, those using water boiled with those not treated water was performed, according to the presence of giardiasis; likewise, communities without water management and water management were compared, according to the presence of giardiasis. The comparison was performed using c2 considering significant $p < 0.05$. Because none of the volunteers showed no symptoms and acute manifestations of the disease were found, no comparisons between healthy and sick were made.

Georeferencing: the approximate location of each of the communities described stood at a map of Colombia using latitude and longitude through the Power Map

tool Microsoft Excel 2013. On the geographical coordinates of the respective prevalence of infection it stood by G. intestinalis. The location of each community is an approximation, the geographical coordinates of the nearest municipality or other geographic landmark related to the community of interest were used.
Ethical aspects: the collection of data for this analysis was carried out in the great project of the Human Expedition. So that it had the authorization of the academic authorities involved and informed consent of the respective communities.

RESULTS

The Great Human Expedition made 19 trips, visiting indigenous and Afro isolated communities, in which data from 8,815 individuals distributed as follows were collected:

5,989 Indians, 558 mestizos, 1,675 afros and 593 settlers. On each trip, stool samples and blood of a group of volunteers from each community visited were taken. data from 4,580 subjects 18 indigenous and black communities 1,050 subjects who had complete information for the study of prevalence of intestinal parasite infection were analyzed. A complete description of the conditions of life, culture and geographical environment of each community is in the land of the Great Expedition collection Humana (11).

4,580 subjects valued in indigenous communities, stool samples were obtained in 671 cases (15%), 77 of which (11%) were positive for G. intestinalis. In the three Afro-Colombian communities 1,050 subjects were assessed and data analysis fecal material in 203 subjects (22%), of which 21 subjects (9%) had the presence of G. intestinalis were obtained. The overall prevalence of isolated communities all valued was 11%.

The number of subjects rated by community and the proportion of subjects with stool test described in Tables 1 and 2. The prevalence of G. intestinalis infection by community with its geographical location, is shown in Figure 1. The prevalence ranged in communities like this: in five communities the parasite was not identified, identified the minimum prevalence in indigenous community was 2% (Waunana Pacific coast) and the maximum was 63% in the Sikuani community of the Eastern Plains. Among the Afro-Colombian communities, the community of Bellavista in the Atrato River, had a prevalence of 9% while the Palenque de San Basilio had a prevalence of 44%.
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Comunidad	Valorados	Muestras[1]	Prev[2]	Edad[3]	Rango[4]
Arhuaco de Simonarua y Nabusimake	464	84(18%)	13(15%)	22	1 - 72
Chimila de San Ángel	115	17(15%)	1(6%)	15	1 - 44
Coreguaje (Río Orteguaza)	185	21(11%)	7(33%)	18	1 - 60
Cuna de Caimán Nuevo	196	41(21%)	7(17%)	24	1 - 87
Curripaco de Samuro	42	8(19%)	3(38%)	22	1 - 47
Embera de Salinas	154	55(36%)	0(0%)	24	1 - 72
Emberá-Epena (Río Guangui)	233	38(16%)	0(0%)	25	1 - 72
Guambiano de Guambía	747	54(7%)	0(0%)	36	2 - 70
Guane	210	41(20%)	17(41%)	29	0 - 84
Guayabero del Barrancón	70	13(19%)	4(31%)	11	0 - 30
Huitoto de Coropoya	48	47(98%)	4(9%)	25	2 - 98
Ingano de Puerto Nariño	28	28(100%)	11(39%)	28	1 - 55
Paéz de Pisimbalá	864	58(7%)	0(0%)	22	1 - 82
Pastos de Guachucal	209	57(27%)	3(5%)	25	2 - 90
Sikuani de Walabó	240	8(3%)	5(63%)	17	0 - 35
Waunana (Río San Juan)	201	49(24%)	1(2%)	21	2 - 65
Wayuu de Sucaramana	280	17(6%)	0(0%)	25	1 - 70
Yukpa-Yuco (Serranía del Perijá)	294	35(12%)	1(3%)	18	1 - 64
Total/Promedio[5]	4580	671(14%)	4.27	26.1	-

Table 1. Giardia intestinalis infection by indigenous community.

1 Number of subjects evaluated with stool analyzed.
2 Positive for Giardia intestinalis (prevalence).
3 Average age of the group analyzed in years.
4 Age range of the group in the stool was analyzed.
5 Total individuals and samples / Average age and prevalence.

Comunidad	Valorados	Muestras[6]	Prev[7]	Edad[8]	Rango[9]
Negra de Bellavista	225	35(15%)	3(9%)	30	1 - 83
Negra de Nuquí	369	170(46%)	7(4%)	26	1 - 82
Negra de Palenque de San Basilio	456	25(5%)	11(44%)	22	1 - 76

Table 2. Infection by Giardia intestinalis by afrocolombian community.

6 Number of subjects evaluated with stool analyzed.
7 Positive for Giardia intestinalis (prevalence).
8 Average age of the group analyzed in years.
Rank 9 age group in the stool was analyzed.

Figure 1. Map of prevalences of intestinal infection by intestinal Giardia community. In the analyzed samples described infection by parasites and other subjects were classified into subjects with more than one parasite (parasitism) which may or may not include the G. intestinalis and parasitism or infection with one parasite. In all groups identified at least one parasite in the analyzed samples, ie 100% of subjects analyzed it was infected with at least one intestinal parasite. Other parasites identified were: Blastocystis hominis, Strongyloides stercoralis, Chilomastix mesnili, Balantidium coli, Entamoeba spp, Ascaris lumbricoides and Trichuris trichuria.

Comunidad	Basuras y Excretas		Agua Hervida		DNT [10]	Prev [11]	
	Si	No	Si	No			
Arhuaco de Simonaura - Nabusimake	X			X	1,2%	15%	
Chimila de San Ángel		X	X		11%	6%	
Coreguaje (Río Orteguaza)		X	X		2%	33%	
Cuna de Caimán Nuevo		X		X	2%	17%	
Curripaco de Samuro		X		X	25%	38%	
Emberá de Salinas		X	X		6,8%	0%	
Emberá-Epena (Río Guangui)		X	X		26%	0%	
Guambiano de Guambía	X			X	7%	0%	
Guane	X		X		17,6%	41%	
Guayabero del Barrancón		X		X	15%	31%	
Huitoto de Coropoya		X	X		4%	9%	
Ingano de Puerto Nariño		X		X	18%	39%	
Paez de Pisimbalá		X		X	8,6%	0%	
Pastos de Guachucal	X			X	5%	5%	
Sikuani de Walabó		X		X	-	63%	
Waunana (Río San Juan)		X		X	2%	2%	
Wayuu de Sucaramana	X		X		23%	0%	
Yukpa-Yuco (Serranía del Perijá)		X		X	2%	3%	

Table 3. Risk factors for G. intestinalis infection in indigenous communities
10 Proportion of people in the community with malnutrition.
11 Prevalence of Giardia intestinalis infection.
12 Prevalence of intestinal parasitism (more than one type of parasite identified by subject).
13 Prevalence of intestinal parasitism (one type of parasite identified by subject).

Table 4. Risk factors for infection G. intestinalis in Afro-Colombian communities.
14 Proportion of people in the community with malnutrition.
15 Prevalence of Giardia intestinalis infection.
16 Prevalence of intestinal parasitism (more than one type of parasite identified by subject).
17 Prevalence of intestinal parasitism (one type of parasite identified by subject).

Tables 3 and 4 described in each community, the risk factors for infection with G. intestinalis. It shows that 72% of indigenous communities do not have specific management processes waste and manure to protect their water resources, even with some infrastructure for waste management and 66% of the communities do

not regularly consume boiled water. It is clear that no parasitological analysis was done to water sources.

By dividing communities or groups with waste management and regularly using water or boiled (Figures 2 and 3), a trend of higher prevalence of infection with G. intestinalis in groups with poor waste management is appreciated and limited use of boiled water. However, when comparing the overall number of infected subjects classified by use of boiled water, no statistically significant difference between groups (and a prevalence ratio of 0.84). Neither significant difference was found between the communities managing wastewater compared to those that do not (and a prevalence ratio of 0.95).

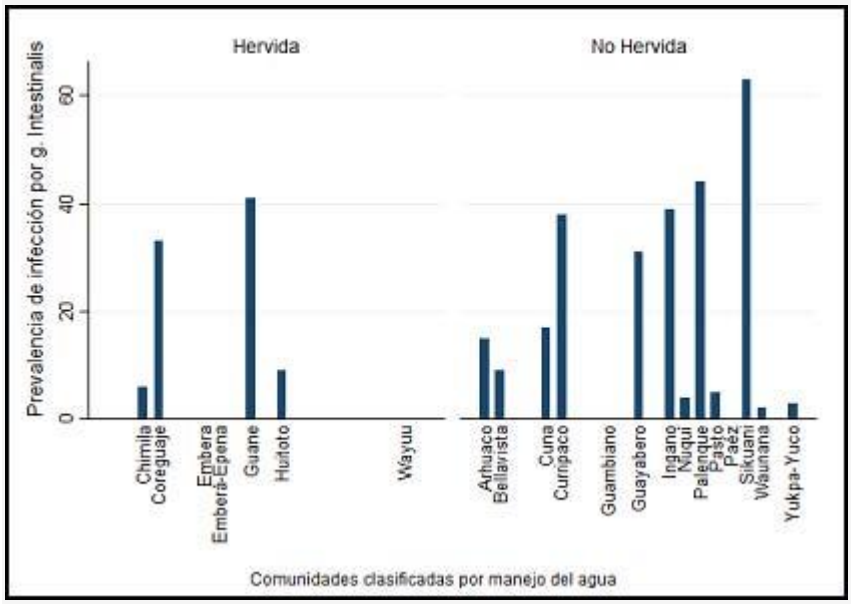

Figure 2. Distribution of G. intestinalis infection as water management. The overall comparison between two groups infected subjects found no significant difference p <0, 46 and prevalence ratio of 0.84

The sources of drinking water were classified into four categories:
1. Aqueduct in Pasto, Nuki Huitoto and black communities.
2. Water Cradle rain in Bellavista and Black communities.
3. Pozo in Chimila and Palenque de San Basilio communities.
4. River or creek in other communities.
How they dispose of their excreta, he was classified as:
1. Sewage in Guane, Pasto, Black of Black Bellavista Nuki and communities.
2. River or broken communities Arhuaco, Waunana, Ingano and Coreguaje.
3. Countryside near homes in other communities.

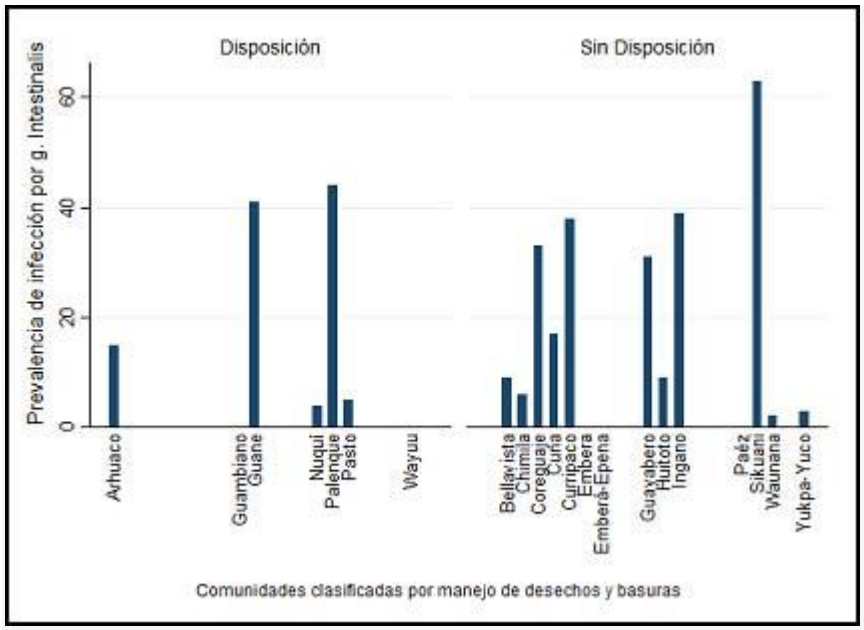

Figure 3. Distribution of G. intestinalis infection as wastewater disposal. The overall comparison between infected subjects found no significant difference between the two p <0.8 groups and prevalence ratio of 0.95.

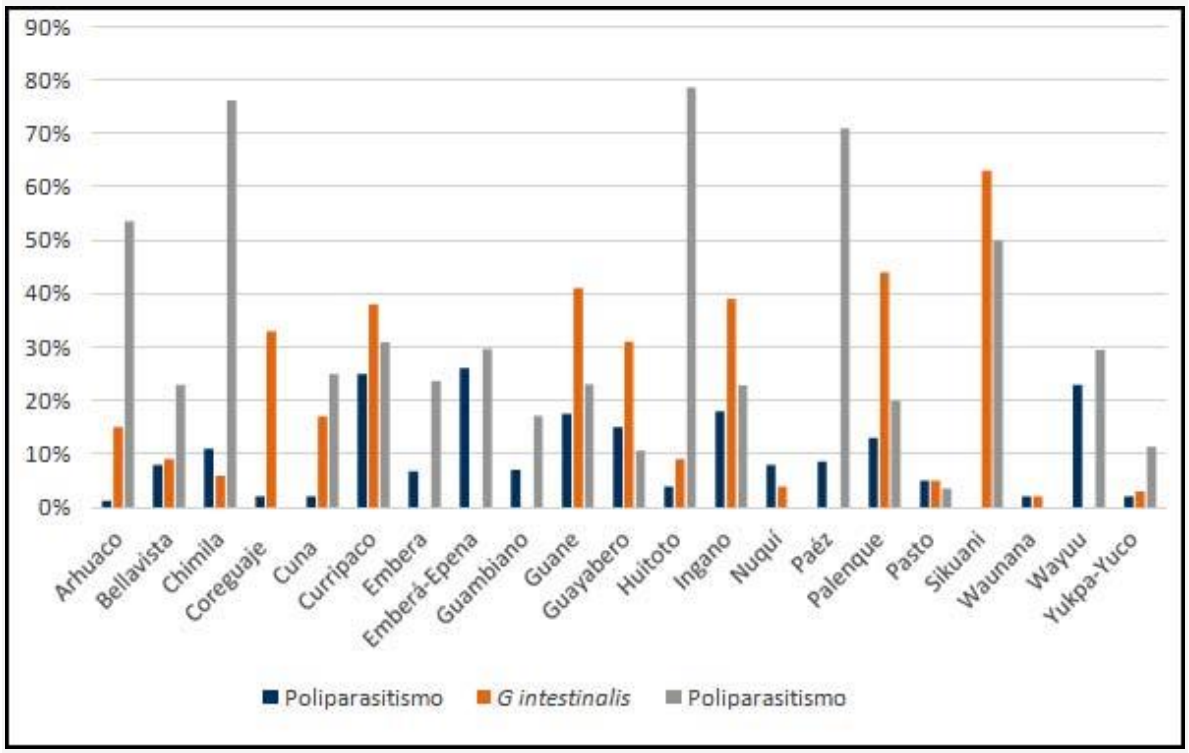

Figure 4. Distribution of G. intestinalis infection as a percentage of malnutrition in the community compared to percentage of parasitism appreciated.

Figure 4 shows the comparison between percentage of malnutrition, prevalence of G. intestinalis infection and parasitism, without a tendency to associate the infection with the particular nutritional status of a community appreciate intestinal parasites are a serious public health problem worldwide, especially in developing countries, which remain high endemic diseases due to low environmental sanitation conditions and lack of appropriate control measures and prevention (12).

DISCUSSION

The impact of the disease is more severe in children because of their relationship to the perpetuation of the devastating effects of malnutrition on child development, a situation aggravated in isolated communities where health care is poor (13.14). The overall prevalence of G. intestinalis infection in isolated communities studied das, was 11% in indigenous communities and 9% in black communities, which contrasts with prevalence in other vulnerable groups described in the literature, for example in school Bogota is 7% (15) while in extreme situations such as refugee camps after the earthquake in Armenia reached 66% (16) (table 5). However, it is necessary to analyze the prevalence in each of the isolated communities, considering that 100% of subjects analyzed had at least one intestinal parasite, so that, independent of the infectious agent, parasitic infection is highly prevalent in all communities, something that had already been documented in pioneering field studies where intestinal infection in indigenous communities of Choco (17) was evaluated.

The prevalence of G. intestinalis in Colombian indigenous groups described here is similar to that of other ancestral groups of South America, such as Argentina Mbyá-Guarani, with a prevalence of 20% (18), the community Japrería in Venezuela with a prevalence of 13% (19) or Wichí community in the province of Salta, Argentina, with a prevalence of 28%. The prevalence of infection in black communities varies from 9% in Bellavista (river Atrato) to 44% in Nuqui (Pacific coast), a situation that probably is associated with poor sanitation and medical care (11).

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The factors described classically parasitic infection are present in all the communities visited, such as the high rates of malnutrition, inadequate management of excreta and poor access to drinking water which leads to the presence of various parasites that contribute to morbidity of origin gastrointestinal (11).

Estudio	Muestras	+ *G. intestinalis*	%
Giardiasis en niños que viven en campamentos después del terremoto de Armenia. (2002) (16)	217	131	60%
Desnutrición y su relación con parasitismo intestinal en niños de una población de la Amazonía colombiana (2002) (29)	237	129	54%
Enteroparasitosis en poblaciones indígenas y mestizas de la Sierra de Nayarit, México (2003) (30)	306	68	22%
Prevalencia de giardiasis y parásitos intestinales en preescolares de hogares atendidos en un programa estatal en Armenia, Colombia (2005) (31)	228	42	13%
Parasitosis intestinales en poblaciones Mbyá-Guaraní de la Provincia de Misiones, Argentina. (2006) (18)	297	57	20%
Giardia intestinalis y estatus nutricional en niños que participan en un programa nutricional, Antioquia Colombia. (2006) (32)	2035	561	27%
Agentes causantes de diarrea en niños menores de 5 años en Tunja, Colombia. (2006) (33)	129	15	12%
Investigación de parásitos intestinales en una comunidad aborigen de la Provincia de Salta, Argentina (2007) (34)	112	31	28%
Enteroparasitosis en indígenas de la comunidad Japrería, estado Zulia, Venezuela (2007) (19)	191	25	13%
Prevalencia de parásitos intestinales en niños que asisten al Templo Comedor Sagrado Corazón Teresa Benedicta de la Cruz, del barrio Vallejuelos, Medellín (2007) (35)	58	15	26%
Prevalencia de parasitismo intestinal en niños y mujeres de comunidades indígenas del Río Beni, Bolivia. (2007) (36)	305	57	19%
Tuberculosis y parasitismo intestinal entre indígenas de la región amazónica del Brasil. (2009) (37)	333	34	10%
Prevalencia de parasitosis intestinales y factores asociados en un Corregimiento de la Costa Atlántica Colombiana (2008). (38)	382	61	16%
Prevalencia y factores de riesgo asociados a parasitismo Intestinal en Preescolares de Zona Urbana en Calarcá, Colombia (2009) (39)	220	29	13%
Parasitismo intestinal y malnutrición en niños residentes en una zona vulnerable de la ciudad de Santa Marta, Colombia (2010). (40)	392	50	13%
Infecciones por protozoarios intestinales en relación al estatus nutricional y morbilidad gastrointestinal en niños escolares colombianos. Bogotá (2010) (15)	443	30	7%

Table 5. Prevalence of G. intestinalis infection in various populations, including indigenous South American populations

However, the cultural conditions that characterize each group have characteristics that modulate infection rates according to their own customs management of water and cooking food. These features are widely discussed in the books of the Human Expedition (11, 20). It should be noted that indigenous communities have beliefs and concepts about the disease that differ from the definitions of Western optional medicine, so that their dialogue and interaction with the environment are not necessarily aligned with the qualification that allopathic physicians make disease (21) and is required beyond measure prevalences, venture into the concepts of disease and health according to the contexts of each culture, this in order to have a

more appropriate measure of the disease, to plan health interventions to avoid cultural disruption and the imposition of management methods that were designed for other human groups (22).

Still, the burden of infectious disease by intestinal parasites is still severe, especially in middle- and low-income and rural areas where lack of access to drinking water is the main risk factor for infection (23). In addition, intestinal parasitosis is an important component within the group of neglected tropical diseases, although in most cases are not lethal, do cause disability, become chronic and impact heavily on nutritional indicators and impair child growth and development (24), so that although isolated communities should be subject to interventions that respect their cosmogony and culture, should not be relegated management of a disease that remains highly prevalent and associated with lack of access to basic services and the limited economic development of remote regions (25).

This study has the strength that isolated Colombian communities to be fully evaluated subjects obtaining relevant information to establish a baseline on the local prevalence of intestinal parasitosis that is more prevalent worldwide. This baseline will serve as reference for future studies that inquire about changes in prevalence when health conditions of communities vary, either for health interventions or changes in manure management services and access to drinking water. Furthermore, the study contributes to solving the need to establish a map of parasitic infections in the region to serve as a basis for planning and development of intervention strategies (26).

However, we must take into account the limitations of the study should make evaluate the results in the context in which the research was conducted. The sample was not homogeneous in all groups studied and reported the prevalence of infection reflects a broad spectrum of age (prevalence in the community rather than specific age groups). On the other hand, natural environments of each community and the possible zoonotic transmission by the genetic variability of the parasite can explain the diversity of infectious prevalence in affected populations (27,28), aspects that were not taken into account in this analysis , nor any changes in parasitosis, according to the dry season and rainy seasons.

Nutritional data only indicate the percentage of the community with malnutrition, which only allows to observe the prevalence of giardiasis facing communities with high percentages of nutritional deficiency (Tables 3 and 4). However, being unpublished data, information derived therefrom practically establishes a single reference framework for the study of parasitic infection in isolated communities of Colombia (Figure 3). Comparisons, classify groups according to two general variables, such as the wastewater management and use of boiled water, ie comparing the groups according to parasitosis and exposure risk factor most important which it is the lack of access to drinking water or contamination of water sources for human consumption. This comparison does not consider confounders and as already mentioned, the groups are not homogeneous (different

geographical areas, groups of different age), however, is an important fact to determine whether the prevalence found in that time range under current conditions each community, it will be possible to know in future studies that evaluate both parasitosis again, as water sources and access to drinking water.

CONCLUSIONS

Global prevalence of giardiasis in indigenous and black communities isolated from Colombia, relevant to know the baseline health status of populations susceptible information in relation to infection by intestinal parasites in Colombia are presented.

CONFLICTS OF INTEREST

The authors have no conflicts of interest to declare on this study.

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