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EC GASTROENTEROLOGY AND DIGESTIVE SYSTEM

Research Article

Intestinal Parasites in a Vulnerable Population in the Province of Buenos Aires, Argentina

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Received: January 25, 2023; **Published:** February 17, 2023

Abstract

Socio-environmental factors are frequently related to health/illness, in parasitism and other communicable diseases. The objective of this research was to determine the presence of enteroparasites in a vulnerable population living in an area at risk of health and to analyze the possible risk factors for infection. Serial fecal samples were taken and analyzed using the Sheather and Telemann techniques. Serial anal brushes were also made to search for *Enterobius vermicularis*. Semi-structured surveys were completed to find out the risk factors. For the statistical analysis, the EPI INFO 3.5.1 was used. A total of 866 people were analyzed, of which 566 (65.3%) were positive. Of these, anal swabs were performed on 656, the results of which showed that 250 (38.1%) had *E. vermicularis*. This was the species with the highest frequency, followed by *Blastocystis* spp. (35.1%) and *Giardia* spp. (20.0%). The specific richness was 14 species, coexisting up to 6 species per host. 51.1% of the positives were monoparasitized and 48.9% polyparasitized. Intestinal parasites were more frequent in males ($p < 0.01$), in children from 5 to 9 years old ($p < 0.01$), who lived in houses with dirt floors ($p < 0.01$), drank water from a well or connected outside the home ($p < 0.01$), disposed of waste in an unsanitary manner (without municipal collection) ($p < 0.01$), whose parents had a low educational level ($p < 0.01$) and who presented some characteristic symptom of these infections ($p < 0.01$). People are at considerable risk of infection from intestinal parasites. The findings respond to a complex set of factors that condition the health of individuals, diminishing their abilities and restricting their chances of achieving an education that contributes to strengthening their hygienic habits. Hence, measures must be promoted to prevent people from becoming infected, such as health education, improved access to drinking water and sanitation in schools, since school-age children represent the main reservoir.

Keywords: *Intestinal Parasites; Vulnerable Population; Risk Factors*

Introduction

The social history of an individual conditions and/or determines the probability that he will get sick. Enteroparasitosis is associated with both environmental and social factors [1]. Socio-environmental factors are frequently related to health/disease, in parasitism and other communicable diseases [2,3]. Numerous investigations have pointed out the association between poverty and sanitary limitations,

which is reflected in high rates of parasite prevalence [1,4-8]. In man, enteroparasitosis causes, among other gastroenteric disturbances, eosinophilic colitis [9], diarrhea [10], dysentery (Apt, 2013) [3], decreased growth rate due to malabsorption syndrome [11], anemias [12], modification of the microbiota [13]. This generates, among other things, low intellectual performance and decreased work capacity in affected individuals. In urban and peri-urban populations, the presence, persistence, and dissemination of intestinal parasitism (IP) are directly related to the geographical and ecological characteristics of the area, basic sanitation conditions, and socioeconomic and cultural factors. Therefore, its control is linked to political and social aspects [14]. The water emergency areas are generally vulnerable zones, with a predominance of latrines and cesspools for the final disposal of excreta, or depositions in the open air. The problem is aggravated by the movement of cysts, oocysts, eggs and larvae to where rainwater or floods disseminate them. The quality of water, whether used for drinking, for domestic purposes, for food production or for recreational purposes, has an important impact on health [15].

Canines can spread enteroparasites that are transmissible to humans with their feces [16,17]. Some helminthiasis [18,19], various protozoa [20] and the parasitic algae *Blastocystis* spp. [21], are common in canines and humans. *Giardia lamblia*, a zoonotic enteroparasite [22], causes malabsorption syndrome and modification of drug molecules [23], it is also correlated to giardiasis with Whipple's disease and other gastroenteric disorders [24]. The use of antiparasitic drugs decreases environmental contamination by forms of parasite dissemination and is effective for its control. However, it is difficult to use all the available information to assess the true efficacy of drugs, possible geographical variations, or drug resistance among other variables must be considered [25].

The district of Ensenada (Province of Buenos Aires) is made up of 14,660 households, of which 10.3% have unsatisfied basic needs [26]. The El Molino neighborhood is located there, inhabited by a vulnerable population of approximately 1,296 families, on the coast of the Río de La Plata, a water emergency area [27]. The current layout is the product of an uninterrupted process of occupation, the study area being a settlement area for populations from other provinces of Argentina and neighboring countries, without resources. This, added to the lack of infrastructure works and the growing deforestation increase the vulnerability of the area. In addition, the clayey soil does not allow the infiltration of rainwater, causing cyclical flooding. In the area, 60.2% of human enteroparasitosis [28] and 64.8% [29] have been registered. Studies on canine enteroparasitosis of the place report 87.5% [30] and 76.7% [29] this is a fact to take into account, since canines are usually a source of enteroparasitosis infection in humans.

Objective of the Study

The objective of this research was to determine the presence of enteroparasites in a vulnerable population living in an area at risk of health and to analyze the possible risk factors for infection.

Materials and Methods

Study area

The study was carried out within the setting of healthcare-education workshops and was specifically programmed to perform parasitological diagnoses on the population of the El Molino neighborhood (34° 55' S, 57° 56' W) within the District of Ensenada, adjacent to the city of La Plata, capital of the Province of Buenos Aires (Figure 1). El Molino neighborhood within the Marginal Forest of Punta Lara, the southernmost gallery forest in the world, has specific hydrographic characteristics that contribute to the spread of parasites [31]. The flooding there is not produced mainly by rain, but rather by the wind from the southeast that overcomes the containment of the estuary by its low banks. These geomorphologic characteristics in combination with the lack of an infrastructure of water-runoff and river channelling, along with an ever increasing population of local residents, enhances the vulnerability of the area to the easy growth of parasites in addition to a clay-rich soil that prevents the ready absorption of rainwater, thus superimposing some cyclic flooding as well.

Figure 1: *Location of the study area El Molino neighborhood (arrow), in Ensenada district, Buenos Aires, Argentina.*

Sampling

Sampling occurred within the framework of a monthly educational healthcare day taking place from 2004 through 2019 in "El Molino" neighborhood. Workshops on preventive measures and control of parasitosis were given in educational institutions and the Sanitary Unit. Throughout this period, human samples were obtained to search for intestinal parasites. Human samples were analyzed between the years 2017 and 2019. Research protocols followed the principles regarding the privacy of personal data outlined in the Helsinki Declaration and successive modifications as well as those under Argentine National Law (Nº 25.326).

Socio-environmental data

The persons in charge of the children's homes were interviewed by means of a structured questionnaire to evaluate several socio-environmental characteristics and measure housing variables through information regarding the structural qualities, amenities and family characteristics [1].

Stool samples

Fecal samples of children were collected for 5 successive days in wide-mouthed screw-capped jars containing 10% (v/v) formalin. The sedimentation technique of Telemann and the flotation technique of Sheather were used for the coproparasitological analysis [32].

To detect eggs of *E. vermicularis* the perianal zone was brushed each morning using sterile gauzes. This procedure was carried out for 5 mornings, immediately after getting up. They were stored in a container with 25 ml of a solution of formalin 10%. The containers with the gauzes (brushed anal) were vigorously shaken. Then, the liquid was centrifuged at 400g for 10 minutes and the obtained sediment was observed by optical microscope.

Statistical analyzes

For the statistical analyzes comparing the sex, age, and risk factors with reference to the presence of intestinal parasites; the nonparametric Chi-Squared or Fisher's Exact test with $p < 0.05$ and Prevalence Ratio with a 95% confidence interval were calculated using the EPI INFO 3.5.1 statistical program.

Results

The demographic and housing data that characterize the surveyed population are shown in table 1. It was made up mostly of children (86.6%), 34.3% lived in houses made of precarious materials, 33% had dirt floors in some environment of the house. The sanitary infrastructure services (disposal of excreta, drinking water, final waste disposal) showed a certain degree of sanitary vulnerability. 74.4% of the mothers and 44.4% of the fathers did not have a job, while the majority of fathers and mothers lacked secondary education and social work. A total of 866 people from the El Molino neighborhood were analyzed, of which 566 (65.3%) were positive. Of these, anal swabs were performed on 656, the results of which showed that 250 (38.1%) had *E. vermicularis*. Thus, this was the species with the highest frequency, followed by *Blastocystis* spp. (35.1%) and *Giardia* spp. (20.0%) (Table 2). The specific richness was 14 species, coexisting up to 6 species per host (Figure 2). The total prevalence of protozoa was 49.7% and that of helminths was 38.3%.

Characteristics	N = 866	
	N	%
Sex		
Women	451	52
Men	415	47,9
Age (years)		
0-4	379	43,7
5-9	271	31,2
9-14	102	11,7
>14	114	13,1
Housing materials		
Precarious (sheet metal, wood)	297	34,3
Bricks	569	65,7
Housing floor		
Dirt	286	33
Cement or others	580	67
Excreta disposal		
Open sky, latrine	406	46,8
Sewers, cesspool	460	53,1
Water		
Pump, running water outside the dwelling	226	26
Running water inside the house	640	62,1
Waste disposal		
Elimination outdoors, burn or bury	156	18,1
Municipal collection	710	81,9
Living with animals		
Yes	778	89,8
No	88	10,1

Mother work activity		
Unemployed or housewife	679	78,4
With work activity	187	21,5
Father work activity		
Unemployed	385	44,4
With work activity	481	55,5
Mother educational level		
Primary	524	60,5
Secondary	342	39,5
Father's education level		
Illiterate-Primary	647	74,7
Secondary	219	25,3
Social security		
No	713	82,3
Yes	153	17,6
Symptoms		
With symptoms	495	57,1
No symptoms	371	42,8

Table 1: *Composition of the population and risk factors analyzed.*

Species	Total		Males		Women		OR	P
	N = 866		N = 415		N = 451			
	N°	%	N°	%	N°	%		
Blastocystis sp.	292	33,7	162	18,7	130	15	1,5	< 0,01
Giardia sp.	174	20,1	98	11,3	76	8,8	1,5	0,01
Entamoeba coli	73	8,4	44	5,1	29	3,3	1,7	< 0,05
Endolimax nana	46	5,3	26	3	20	2,3	1,4	>0,05
Enteromonas hominis	14	1,6	11	1,3	3	0,3	4	< 0,05
Dientamoeba fragilis	13	1,5	9	1	4	0,5	2,4	>0,05
Iodamoeba butschlii	3	0,3	2	0,2	1	0,1	0,5	>0,05
E. vermicularis (N = 656)	250	38,1	131	20	119	18,1	1,2	>0,05
A. lumbricoides	65	7,5	40	4,6	25	2,9	1,8	< 0,05
Trichuris trichiura	13	1,5	4	0,5	9	1	0,4	>0,05
Uncinarias	8	0,9	8	0,9	0	0		
Strongyloides stercoralis	2	0,2	2	0,2	0	0		
Taenia sp.	1	0,1	0	0	1	0,1		
Hymenolepis nana	27	3,1	18	2,1	9	1	2,2 *	< 0,05
Total	566	65,3	303	35	263	30,4	1,9	< 0,01

Table 2: *Prevalence of total enteroparasitosis and by sex in the population of the El Molino neighborhood, Ensenada (N = 866).*

**Invalid OR, confidence interval includes 1.*

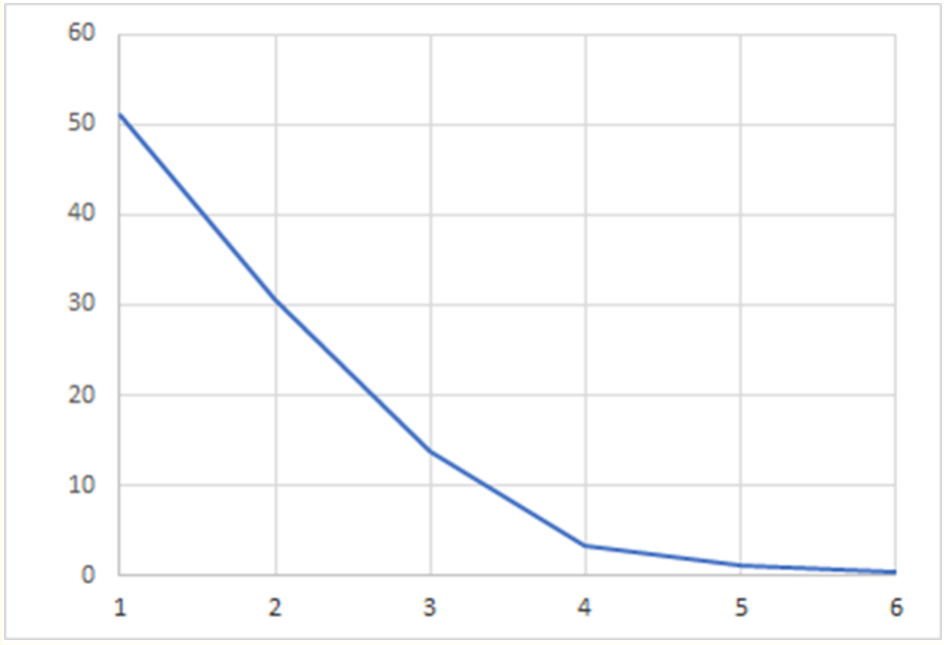

Figure 2: *Number of species per host in the population of the El Molino neighborhood, Ensenada.*

Fifty-one point one percent (51.1%) of the positive cases were monoparasitized and the remaining 48.9% were polyparasitized, with a maximum of 6 species in coinfection (Figure 2). An average of 1.7 species per host was detected, without significant differences between monoparasitized and polyparasitized ($p > 0.05$), when comparing by age ranges (0 - 4, 5 - 9, 10 - 14 and over 14 years of age).

A higher frequency of parasites was observed among men (73%) than in women (58.4%), with significant differences (X^2 corrected Yates = 19.6 $p < 0.01$, table 2). Males were between 1.1 and 2 times more likely to be infected by *Blastocystis* spp. that the women. Males also showed higher prevalences of *E. coli, Giardia* spp., *E. hominis*, and *Ascaris lumbricoides* (Table 2).

For statistical analysis, people were divided into two age ranges: children, from 0 to 14 years (748), and adults, over 14 years (114). Children were significantly more parasitized (68.8%) than the population over 14 years of age (44.7%), ($X^2 = 24.4$ $p < 0.01$; Table 3). Analyzing the childhood range (0 - 14) in three age ranges (0 to 4, 5 to 9 and 10 to 14 years), it was observed that children from 5 to 9 years were more parasitized (75.6%), with lower values in the ranges from 0 to 4 years (64.6%) and 10 to 14 years (63.7%), and statistically significant differences ($p < 0.01$; Table 3). Figure 3 shows the prevalence of each parasitic species by age range. When analyzing the distribution of species in these age groups, it was observed that children under 14 years of age showed higher frequencies in all species detected. The most prevalent species, such as *E. vermicularis*, *Blastocystis* spp., *E. coli*, *Giardia* spp. and *A. lumbricoides*, were more frequent in the range of 5 to 9 years, gradually decreasing with increasing host age. These differences were statistically significant ($p < 0.01$). *Endolimax nana*, a species of reduced frequency, maintained similar values in the 4 age ranges. *E. vermicularis* exceded 30% at all ages.

A statistical association was found between pairs of species, such as *Blastocystis* spp. and *E. vermicularis* ($X^2 = 4.3$; $p < 0.05$), *Blastocystis* spp. and *Giardia* spp. ($X^2 = 7.4$; $p < 0.01$) and *Blastocystis* spp. and *H. nana* ($X^2 = 18$; $p < 0.01$).

Characteristics	Parasitized		P	OR (IC)
	N	%		
Sex			< 0,01	1,9 (1,4-2,5)
Women (n = 451)	263	58,3		
Men (n = 415)	303	73		
Age (years)			< 0,01	
0-4 (n = 379)	245	64,6		
5-9 (n = 271)	205	75,6		
10-14 (n = 102)	65	63,7		
>14 (n = 114)	51	44,7		
Housing materials			>0,05	1,1 (0,8-1,5)
Precarious (sheet metal, wood) (n = 297)	199	67		
Bricks (n = 569)	367	64,5		
Housing floor			< 0,01	2,7 (1,9-3,8)
Dirt (n = 286)	226	79		
Cement or others (n = 580)	340	57,7		
Excreta disposal			>0,05	1,1 (0,8-1,5)
Open sky, latrine (n = 467)	312	66,8		
Sewers, cesspool (n = 399)	254	63,6		
Water			< 0,01	1,6 (1,1-2,2)
Pump, running water outside the dwelling (n = 226)	165	73		
Running water inside the house (n = 640)	401	62,6		
Waste disposal			< 0,01	3,3 (2,1-5,2)
Elimination outdoors, burn or bury (n = 156)	131	83,9		
Municipal collection (n = 710)	435	61,2		
Living with animals			>0,05	1,0 (0,6-1,6)
Yes (n = 778)	509	65,4		
No (n = 88)	57	64,7		
Mother work activity			>0,05	1,0 (0,7-1,4)
Unemployed or housewife (n = 671)	441	65,7		
With work activity (n = 195)	125	64,1		
Father work activity			>0,05	1,1 (0,8-1,5)
Unemployed (n = 404)	272	67,3		
With work activity (n = 462)	294	63,6		
Mother educational level			< 0,01	1,7 (1,3-2,4)
Primary level (n = 500)	366	73,2		
Secundary level (n = 331)	200	60,4		
Father educational level			< 0,01	2,9 (2,1-4,0)
Primary level (n = 627)	454	72,4		
Secundary level (n = 239)	112	46,8		
Social security			>0,05	1,2 (0,9-1,8)
No (n = 701)	466	66,4		
Yes (n = 165)	100	60,6		
Symptoms			< 0,01	2,5 (1,9-3,3)
With symptoms (n = 490)	365	74,4		
No symptoms (n = 376)	201	53,4		

Table 3: *Association between parasites and risk factors in 866 people analyzed.*

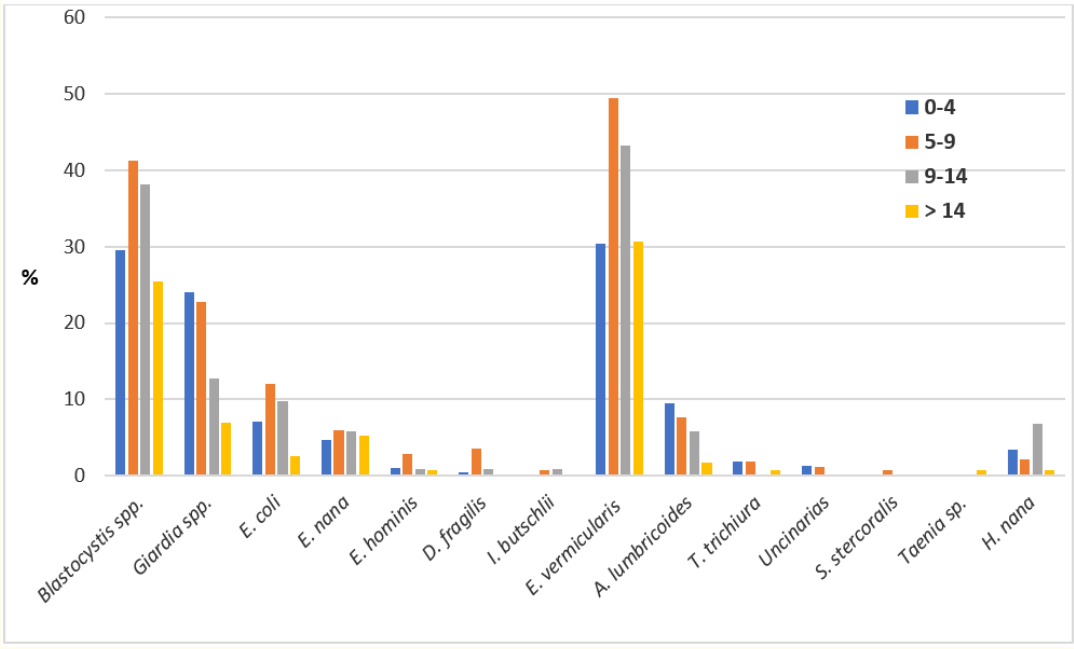

Figure 3: *Distribution of enteroparasitosis by species and age ranges (0-4, 5-9, 10-14 and >14 years) in the population of the El Molino neighborhood, Ensenada.*

Regarding socioenvironmental factors, a statistical association was found between the frequency of intestinal parasitism and the floor of the houses, the type of drinking water, garbage disposal and the level of education of the parents (Table 3). In addition, 74.4% of the symptomatic patients were parasitized ($X^2 = 40.6$ $p < 0.01$).

The individuals exposed to the dirt floor variable presented between 1.9 and 3.8 (OR = 2.7) more probabilities of being sick than those not exposed. Therefore, the dirt floor is considered to be a risk factor. On the other hand, those who consumed pump or network water connected outside the home presented between 1.1 and 2.2 (OR = 1.6) more probabilities of be sick than those who consumed network water installed inside the home. Therefore, the consumption of pump or network water outside the home is considered a risk factor.

People exposed to the variable inadequate garbage collection had between 2.1 and 5.2 more probabilities of be sick than those not exposed (using the limits of the logarithmic approximation). Therefore, inadequate garbage collection is considered a risk factor.

The labor activity of the parents was not found to be associated with the prevalence of intestinal parasitism. However, individuals whose father did not reach a higher level of education than primary school were between 2.1 and 4 times more likely to be sick than those whose parents had higher levels of education. Therefore, it is considered that the level of education of the parents is a risk factor. On the other hand, the people whose mother did not reach a level of education higher than primary, presented between 1.3 and 2.4 times more probabilities of be sick than those whose mother presented higher levels of education. Therefore, it is considered that the mother's level of education is a risk factor.

Discussion and Conclusion

The movements of the population from the interior of the country and from neighboring countries to the big cities has been a constant in the last decades. This has caused overpopulation in suburban areas, extending those marginal sectors of cities, peri-urban areas, which grow at a rate much higher than planning times. This is how the residential occupation of areas that are not prepared for such use, environmentally degraded areas and high environmental vulnerability occurs. There, people without resources live on public land, subject to flooding, without sanitary infrastructure services, depending on state subsidies to live and eating in neighborhood or school canteens.

This situation, product of socio-spatial segregation and territorial fragmentation, added to insufficient hygiene habits in families, constitutes an environment suitable for the development of parasitic cycles, through fecal contamination of the same, added to zoonotic transmission by companion animals [33,34].

This study was carried out from an eco-epidemiological perspective, taking into account the ONE HEALTH criterion, through the analysis of the human and animal population, in parallel with socio-environmental aspects and hygiene practices that enable the insertion and persistence of parasites. intestines in the area. 14 parasitic species were detected in the surveyed population, many of them of possible zoonotic transmission and/or due to environmental contamination, which implies a high risk of infection.

In this study, 65.3% of the people positive for some parasitic genus were found, out of a total of 866 analyzed. Research carried out in nearby vulnerable populations revealed higher, 85.7% [1]; similar, 70% [5], 67.8% [35]; and lower, 39.1% [4]. In contrast, Carvajal Restrepo., *et al*. analyzed 284 adult volunteers in Colombia, without including the child population, with a frequency of enteroparasitosis of 14.5% [36].

Fourteen parasitic species were found represented. Polyparasitosis was frequent, with an average of 1.7 species per host and a maximum of 6 species in coinfection, without significant differences between monoparasitized and polyparasitized by age range. Erismann., *et al*. observed the same average number of species per person, a maximum of 5 coinfected species, and a higher frequency of multiple infections in 12-year-old children among West African schoolchildren [37]. *Enterobius vermicularis* was the most frequent species, followed by *Blastocystis* spp. and *Giardia* spp. These results were consistent with those found by other researchers in suburban populations in nearby areas [4,5,35].

Males were significantly more parasitized than females, both in terms of total parasitism and of the different species in particular, unlike other publications in nearby areas [5] and in other parts of the world [8] and in agreement with others, who observed a higher prevalence of infection among men [6,36-38].

This result could be associated with some behavior that allows a greater degree of exposure to the infective forms of parasites, among which the game in the peridomiciliary environment in contact with the earth would be a possible variable. According to the World Health Organization, the differences between the sexes could not be attributed to differential susceptibility, but rather to occupational and behavioral factors [39]. Suntaravitun and Dokmaikaw related the high prevalence infection of males to the highest rates of occupational exposure through work activities in the field, added to the absence of footwear [38].

The frequencies of most of the species observed were higher in the range from 5 to 9 years of age, decreasing progressively in the older ones. This result is consistent with the improvement in immune status and health habits generally observed in those over 9 years of age. Infections by *E. vermicularis* tend to maintain high prevalence in vulnerable and non-vulnerable populations, given its transmission mechanism independent of fecal contamination of the environment, as happened in this population [40].

In another area of Argentina, Rivero., *et al*. [7], found the same age group associated with the prevalence of enteroparasitosis. In contrast, Suntaravitun and Dokmaikaw [38] observed a higher prevalence of intestinal parasitosis among those over 40 years of age in Thailand. But in this case, it was about farmers, who worked barefoot on the land and the most frequent species were *S. stercoralis* and Hookworms, parasites that penetrate through the skin.

As described in the results, various sanitary and social conditions were associated as infection risk factors, in accordance with other studies carried out in vulnerable populations in the area [1,4,5,35]. On the other hand, Suliman., *et al*. studied 253 school children in Sudan and found an association between intestinal parasite infections and the type of drinking water. These authors did not observe an association with the disposal of unsanitary excreta, coinciding with this study, but, in contrast to the present work, found a correlation with the educational level of the parents [8].

Coincident with our experience, Carvajal Restrepo., *et al*. found the presence of enteroparasitosis associated with the type of drinking water [36]. The same was described by Wong., *et al*. who observed lack of sanitary water, proximity to the river, overcrowding, young age and open defecation as risk factors for enteroparasitosis [41]. In this study, people who used well water and/or had connections to the piped water network outside their home had a higher risk of infection by intestinal parasites than those with a connection inside the house. In general, the external connections consisted of a plastic hose in contact with the ground, animals and waste. In addition, it is known that cesspools can be a direct source of water contamination, since groundwater flows through soil contaminated with human feces [42].

On the other hand, the community analyzed is located on the banks of the Río de la Plata, in a flood zone due to the "sudestadas" (southeast wind), for which reason, the houses are usually under water, which facilitates the transmission of different kinds of infections.

Erismann., *et al*. studied the distribution of enteroparasitosis in schoolchildren from 2 towns in Burkina Faso, in West Africa, and found no association between the type of drinking water and the presence of these infections, unlike what was observed in the present study [37].

The most prevalent parasite in this study was *E. vermicularis*, a species that due to its mode of transmission is frequent in all types of human populations, without showing any association with the socioenvironmental conditions of its hosts. In contrast to this result, native communities in Peru showed low prevalence of this parasite, because they did not use specific techniques for its diagnosis [43].

The two most prevalent protozoa (*Blastocystis* spp. and *Giardia* spp.) are linked to fecal contamination of the environment, water, and food, insufficient infrastructure services, inadequate hygienic practices, and zoonotic transmission [1,44]. Both species were also detected in the canine population of the area in previous studies [29,30] and in other countries [44]. Although no statistical association was demonstrated between the presence of these species and coexistence with animals, unlike other authors [37]. Several studies have shown that *Giardia* spp. it is prevalent in both humans and dogs worldwide, and anthroponotic, zoonotic, and animal-specific cycles of transmission have been postulated [45,46].

No correlation was found between animal ownership and intestinal parasitism in people. But, it is likely that many of those found come from an animal source, given the presence of a large number of owned canines that roam and disperse parasitic forms. Previous studies in the area demonstrated high prevalence of canine enteroparasitosis, 87.5% [30] and 76.7% [29]. The high frequency of *Blastocystis* spp. It should be the reason for further analysis, since several authors demonstrated the genetic similarity between the subgroups of this parasitic species detected in humans, pigs, horses and dogs [47,48]. Other authors found an association between animal ownership and the prevalence of intestinal parasitosis [38,41]. The lack of information of the population about preventive measures and the risk of contracting zoonotic infections, makes people live with animals that roam freely and defecate in an open environment, contaminating the soil with feces, which increases the risk of infection.

The association with the dirt floor in the houses, the disposal of the waste and the level of education of the parents were also registered in previous works in La Plata district, an area close to Ensenada district, where the present work was developed [2,49]. The absence of floors made of materials such as tiles or ceramics makes proper cleaning difficult and, being made of earth, allows the presence of parasitic forms of protozoa and geohelminths, which evolve and remain on that substrate [44]. Cardozo and Samudio in 2017 [50], found a correlation between groups of parasitized and non-parasitized people and the form of disposal of household waste.

The mother's education is a factor frequently mentioned due to its importance in the incidence of enteroparasitosis. According to Ávila., *et al*. [5], families whose mothers had higher education achieved higher income and a lower prevalence of enteroparasitosis. Frequently the low level of education is correlated with multiple problems of a social order, environmental sanitation and a higher prevalence of enteroparasitosis [44]. Rivero., *et al*. [7] agreed that families with higher mothers' literacy had lower probabilities of infection. The level of education of the parents is directly related to the awareness and knowledge of the forms of transmission and preventive measures of parasitic infections.

Ascaris lumbricoides is considered an indicator of fecal contamination of the soil and of the coprophagic habits of canines [52]. Some of the human defecation practices detected in this study, together with the role of dogs in the transmission of geohelminths, justify the *A. lumbricoides* infections found, although these factors were not found to be statistically associated.

Only 2 people parasitized by *S. stercoralis* (0.2%) were found, probably because specific techniques were not used for its diagnosis, although its larvae, in parasitism with a high load, are frequently found in diagnoses made using the techniques used. in this study [53]. Eight cases of Hookworms (0.9%) were detected. It would be convenient to maintain vigilance on these parasitosis, since many of the inhabitants of the place come from the northeast of Argentina, an endemic area for both parasitosis.

Trichuris trichiura was the only species more frequent among women than among men, although without significant differences and with a low prevalence (1.5%). Given the low biotic potential of this parasite, its prevalence is often underestimated, although flotation and sedimentation techniques were used in this study to improve diagnostic efficiency [32].

The cestode *Hymenolepis nana* showed a reduced frequency in this study (3.1%). Its presence represents inadequate sanitary conditions, since it is transferred from one host to another by fecal contamination, beyond autoinfection and transmission through intermediate hosts (weevils). This species was the most prevalent helminth (although with low frequency, 6.5%), in studies carried out in Burkina Faso, Africa, a region of inadequate environmental sanitation and hygiene [37] and the only helminth found (6%), in schoolchildren in Paraguay [50].

Taenia sp. It was the least frequently detected helminth, although *Taenia saginata* is present in 21 countries in the Americas [54] and *Taena solium* is a cosmopolitan parasite [55]. Several factors may influence this result. In the first place, local people have low purchasing power, which is why, according to the information collected, they rarely eat beef or pork. In addition, due to its proximity to the river, they frequently eat fish, eels and frogs.

It could also be due to a defective sampling, since most of the people parasitized by *Taenia* species usually suffer from psychological stress, they are inhibited when observing proglottids in their feces and feeling their spontaneous elimination through the anal sphincter, due to which tends to hide this condition [56].

The results of the present study showed that almost half of the infected children had polyparasitism and that each study participant harbored an average of 1.7 species of intestinal parasites. We conclude that infections by multiple species of intestinal parasites are common in this population, which is partly explained by the socioecological context that allows the presence and transmission of intestinal parasitic infections (climate, proximity to freshwater sources, behavior, hygiene).

Intestinal parasites were more frequent in males, in children from 5 to 9 years old, who lived in homes with dirt floors, drank water from a well or connected outside the home, and disposed of waste in an unsanitary manner (without municipal collection), whose parents had a low educational level and who presented some characteristic symptom of these infections.

Sanitary education, sanitary practices and drinking water are essential to explain the higher prevalence of infection [57]. People are at considerable risk of infection from intestinal parasites. On the other hand, the findings respond to a complex set of factors that condition the health of individuals, diminishing their abilities and restricting their chances of achieving an education that contributes to strengthening their hygienic habits. Hence, measures must be promoted to prevent people from becoming infected, such as health education, improved access to drinking water and sanitation in schools, since school-age children represent the main reservoir. These factors are crucial to prevent disease transmission via the fecal-oral route.

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