

Original Article:

## Factors associated with enteroparasitosis in children from educational institutions in the Guapán parish, Cañar, Ecuador in the year 2024

*Factores asociados a la entero parasitosis en niños de instituciones educativas de la parroquia Guapán, Cañar, Ecuador en el año 2024*

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### Summary

**Introduction:** Enteroparasitosis are highly prevalent intestinal infections in the pediatric population, especially in rural settings with poor sanitary conditions. It is estimated that more than 1.5 million children are affected by these pathologies worldwide. **Methodology:** An observational, analytical, cross-sectional and correlational study was carried out with the participation of 140 children, corresponding to all the students enrolled from the first to the seventh year of basic education in both institutions. Stool samples were collected for coproparasitological analysis by direct and concentration methods. In addition, a structured survey was applied to parents or representatives, and the Graffar Méndez scale was used for socioeconomic classification. **Results:** The prevalence of enteroparasitosis was 95.7%. Monoparasitosis was identified in 70.9% of the cases and polyparasitosis in 29.1%. Among the significantly associated factors were: not washing hands before eating (32.5%) or after using the toilet (42.3%), not boiling water for consumption (35.8%), living in houses with earthen (57.1%) or ceramic (46.4%) floors, and adobe walls (50.0%) ( $p < 0.05$ ). **Conclusions:** The results evidence a high burden of childhood enteroparasitosis in the area studied, related to poor hygienic practices and vulnerable socioeconomic conditions. The implementation of educational and health interventions aimed at improving personal hygiene, access to safe water and housing conditions in these rural communities is recommended.

**Keywords:** Intestinal Parasitosis, Protozoa, Diarrhea, Food

## Resumen

**Introducción:** Las enteroparasitosis son infecciones intestinales altamente prevalentes en la población infantil, especialmente en contextos rurales con condiciones sanitarias deficientes. Se estima que más de 1.5 millones de niños se ven afectados por estas patologías en todo el mundo. **Metodología:** Se realizó un estudio observacional, analítico, transversal y correlacional con participación de 140 niños, correspondientes a la totalidad de estudiantes matriculados de primero a séptimo año de educación básica en ambas instituciones. Se recolectaron muestras de heces para análisis coproparasitológico mediante métodos directos y de concentración. Además, se aplicó una encuesta estructurada a los padres o representantes, y se utilizó la escala de Graffar Méndez para la clasificación socioeconómica. **Resultados:** La prevalencia de enteroparasitosis fue del 95,7%. Se identificó monoparasitosis en el 70,9% de los casos y poliparasitosis en el 29,1%. Entre los factores significativamente asociados se encontraron: no lavarse las manos antes de comer (32,5%) ni después de ir al baño (42,3%), no hervir el agua para consumo (35,8%), vivir en viviendas con pisos de tierra (57,1%) o cerámica (46,4%), y paredes de adobe (50,0%) ( $p < 0.05$ ). **Conclusiones:** Los resultados evidencian una alta carga de enteroparasitosis infantil en la zona estudiada, relacionada con prácticas higiénicas deficientes y condiciones socioeconómicas vulnerables. Se recomienda la implementación de intervenciones educativas y sanitarias orientadas a mejorar la higiene personal, el acceso al agua segura y las condiciones habitacionales en estas comunidades rurales.

**Palabras clave:** Parasitosis intestinal, Protozoos, Diarrea, Alimentación

## Introduction

Enteroparasitosis represents an important public health problem in developing countries, particularly in vulnerable pediatric populations. This condition, caused by intestinal parasites such as protozoa and helminths, affects the growth, development and nutritional status of children. It also compromises their academic performance and quality of life (1,2). In Latin America and specifically in Ecuador, this problem persists with a high prevalence in communities with limited

socioeconomic conditions, deficiencies in basic sanitation, access to drinking water and health education (3-6).

The epidemiology of parasitic infections reveals an alarming global picture. According to the World Health Organization (WHO), approximately 3.5 billion people are infected by parasites, with 450 million suffering from parasitic diseases (2). In Latin America and the Caribbean, the prevalence of these infections varies considerably, with rates exceeding 20%. The most affected population is school children, where it is estimated that about 46 million children have a high incidence of developing parasitic infections (3).

In particular, factors such as overcrowding, poor personal hygiene, the educational level of caregivers and lack of access to basic services have a significant impact on the transmission of enteroparasites. Likewise, the limited knowledge of parents and caregivers about the transmission and prevention of these infections contributes to their persistence in rural and suburban areas(3,4).

The mechanism of infection involves several stages, starting with exposure to pathogens that find favorable climatic conditions for their transmission. Factors such as personal hygiene and proper food preparation are crucial to prevent these infections. Clinical manifestations can vary, including diarrhea, abdominal pain, nausea, weight loss, and anemia, among other symptoms. Stool tests are used for diagnosis, with direct examination being a common and inexpensive tool (4-7).

The Guapán parish, located in the province of Cañar, presents sociodemographic characteristics that favor the spread of enteroparasitosis in school-age children. Based on this problem, the present study aims to analyze the factors associated with enteroparasitosis in children of educational institutions in the parish during the year 2024, in order to generate evidence to support effective interventions in public health and health education.

## Methodological design

### Type of study

An observational, analytical, cross-sectional and relational study was carried out.

### Area and period of study

The study was carried out in the educational institutions Oriente Ecuatoriano and República del Ecuador, located in the communities of Buil-Chacapamba and Zhindilig, belonging to the Guapán parish, Azogues canton, Cañar province, Ecuador. The field work was carried out between September 2 and 30, 2024.

### Universe and sample

A census-type convenience sample was used, considering all students enrolled in both institutions during the study period. The Oriente Ecuatoriano school had 61 students and the República del Ecuador school 79, for a total of 140 participants. Children between 5 and 10 years of age, whose parents or representatives signed the informed consent form, were included. Those who did not submit a stool sample or had recent antiparasitic treatment were excluded.

### Data collection and variables studied

Data were collected through a structured survey, previously validated by expert judgment. This was applied in person to the parents or legal guardians of the students, in an addressed format and in Spanish. The survey included sociodemographic variables (age, sex, educational level of the caregiver, number of people in the household), sanitary conditions (access to drinking water, excreta disposal, presence of domestic animals) and history related to enteroparasitosis (symptoms, previous treatment, hygiene habits).

The socioeconomic level of each family was also evaluated using the Graffar Méndez Castellanos Scale, which considers variables such as occupation of the head of household, parents' educational level, housing characteristics and type of income. This scale was applied by trained researchers, who assigned the corresponding scores and classified the households into socioeconomic strata.

Enteroparasitosis was defined as the presence of one or more intestinal parasites in a stool sample, detected

by direct coproparasitological examination in saline and lugol, complemented with the sedimentation concentration method (formalin-ether).

### Sample collection and analysis procedure

Each participant was given a properly labeled sterile container with written and verbal instructions on sample collection. The samples were collected at the institution the day after delivery and transported in thermal boxes to the private clinical laboratory, where they were processed within a maximum of 2 hours. Each student provided a single stool sample. The coproparasitological analysis was carried out by qualified personnel for the search of protozoa and helminths. It should be noted that Graham's test for *E. Vermicularis* was not performed, guaranteeing the integrity of the samples and the confidential handling of the results.

### Data analysis

The data were entered into an electronic database and processed with SPSS v.25 statistical software. Absolute and relative frequencies were calculated for categorical variables, and measures of central tendency for quantitative variables. Chi-square and prevalence ratio (PR) tests were applied to analyze the association between the presence of enteroparasites and sociodemographic, health and socioeconomic variables, considering a value of  $p < 0.05$  as statistically significant.

### Ethical Considerations

This study was conducted in accordance with the ethical principles established in the Declaration of Helsinki and national regulations for research involving human subjects. Prior to its execution, the protocol was evaluated and approved by the Human Research Ethics Committee (CEISH) of the Catholic University of Cuenca with approval code 078-2024. Written informed consent was obtained from the parents or legal representatives of the participating children, who were informed about the objectives, procedures, benefits and risks of the study, as well as their right to withdraw at any time without consequences. The children were given an age-appropriate explanation and their willingness to participate was respected.

The confidentiality and anonymity of the data collected was guaranteed, using unique codes for each participant and restricting access to the database to the research team only. The biological samples

collected were used exclusively for diagnostic purposes within the framework of the study and were safely disposed of in accordance with biosafety regulations.

## Results

A group of 140 students who participated in a project on the presence of enteroparasitosis and associated factors in children aged 5 to 10 years was identified. Of these, 134 students presented an enteroparasitic infection, with 95.71%, while 6 students, with 4.29% did not show any infection.

**Table 1. Distribution of sociodemographic variables in children with enteroparasitosis.**

Variables	Categories	Frequency	%
Genre	Male	68	50,7
	Female	66	49,3
Age	5 years	5	3,7
	6 years	20	14,9
	7 years	24	17,9
	8 years	29	21,6
	9 years	24	17,9
Geographical location	Urban	30	22,4
	Rural	104	77,6
Ethnicity	Mongrel	120	89,6
	White	11	8,2
	Afro-Ecuadorian	3	2,2
Grade EGB	Second grade	25	18,7
	Third grade of elementary school	23	17,2
	Fourth grade	28	20,9
	Fifth grade	23	17,2
	Sixth grade	18	13,4
Legal responsibilities	Seventh grade	17	12,7
	Mother and Father	88	65,7
	Mother	25	18,7
	Father	8	6,0
	Mother and maternal grandparents	5	3,7
	Mother and paternal grandparents	2	1,5
Area of profession of the head of household	Maternal grandparents	3	2,2
	Paternal grandparents	2	1,5
Graffar-Méndez-Castellanos Scale	Maternal uncles and aunts	1	0,7
	Administrative	35	26,1
	Non-administrative	99	73,9
Stratum 2	Stratum 2	10	7,4
	Stratum 3	27	20,1
Stratum 4	Stratum 4	96	71,6

**Table 2: Hygienic measures taken in children with enteroparasitosis**

Variables	Categories	Frequency	%
Washing hands before meals	Yes	17	12,7
	No	117	87,3
Do not wash hands after going to the bathroom.	Yes	71	53,0
	No	63	47,0
Lava los alimentos antes de consumirlos	Yes	45	33,6
	No	89	66,4
Boils water before drinking	Yes	28	20,9
	No	106	79,1
Total		134	100

**Table 3: Factors associated with the presence of enteroparasitic infections.**

Variables	Categories	Frequency	%
Presence of pets in the home	Yes	125	93,3
	No	9	6,7
Refrigerator	Yes	122	91,0
	No	12	9,0
Type of water ingested on a daily basis	Potable	51	38,1
	Piped	44	32,8
	Bottled	25	18,7
	Well	14	10,4
Excreta disposal	Toilet	102	76,1
	Septic tank	27	20,1
	Letrina	5	3,8
Total		134	100

**Table 4: Presence of parasites and their main parasitic groups**

Variables	Categories	Frequency	%
Type of parasitosis	Monoparasitosis	95	70,9
	Polyparasitosis	39	29,1
Type of parasite	Entamoeba histolytica cysts	95	70,9
	Eggs of ascaris lumbricoides + Cysts of entamoeba histolytica	39	29,1
Total		134	100

**Table 5: Symptomatology present in cases related to parasitic infections.**

Variables	Categories	Frequency	%
Acute diarrhea	Yes	58	43,3
	No	76	56,7
Accompanying symptoms	Lack of appetite	40	29,9
	Abdominal pain	34	25,4
	Nausea or vomiting	13	9,7
	None	47	35,1
Total		134	100

**Table 6: Polyparasitosis and its relationship with sociodemographic characteristics.**

Variables	Categories	Polyparasitosis		Chi-2 (p)
		Yes	No	
		N %	N %	
Genre	Male	17 (25,0)	51 (75,0)	1,127 (0,288)
	Female	22 (33,3)	44 (66,7)	
Year	5 years	2 (40,0)	3 (60,0)	1,996 (0,850)
	6 years	8 (40,0)	12 (60,0)	
	7 years	6 (25,0)	18 (75,0)	
	8 years	7 (24,1)	22 (75,9)	
	9 years	7 (29,2)	17 (70,8)	
	10 years	9 (28,1)	23 (71,9)	
Ethnicity	Mongrel	35 (29,2)	85 (70,8)	0,044 (0,978)
	White	3 (27,3)	8 (72,7)	
	Afro-Ecuadorian	1 (33,3)	2 (66,7)	
Grade EGB	Second grade	9 (36,0)	16 (64,0)	3,191 (0,671)
	Third grade of elementary school	8 (34,8)	15 (65,2)	
	Fourth grade	6 (21,4)	22 (78,6)	
	Fifth grade	8 (34,8)	15 (65,2)	
	Sixth grade	5 (27,8)	13 (72,2)	
	Seventh grade	3 (17,6)	14 (82,4)	
	Geographical location	Urbana	6 (20,0)	
Rural	33 (31,7)	71 (68,3)		
Area of profession of the head of household	Administrative	13 (37,1)	22 (62,9)	1,484 (0,223)
	Non-administrative	26 (26,3)	73 (73,7)	
Socioeconomic level according to Graffar-Mendez Castellano scale	Stratum 2	3 (30,0)	7 (70,0)	3,700 (0,296)
	Stratum 3	10 (37,0)	17 (63,0)	
	Stratum 4	25 (26,0)	71 (74,0)	
	Stratum 5	1 (100,0)	0 (0,0)	

**Table 7: Distribution of polyparasitosis and its relationship with socioeconomic variables.**

Variables	Categories	OR	IC 95%
Gender	Male	0,66	0,31-1,41
	Female		
Age	5-7 years	1,30	0,60-2,80
	8-10 years		
Grade EGB	Segundo-Cuarto de básica	1,18	0,55-2,53
	Quinto-Séptimo de básica		
Geographic location	Urbana	0,53	0,20-1,44
	Rural		
Area of profession of the head of household	Administrative	1,65	0,73-3,76
	Non-administrative		
Socioeconomic level Graffar- Mendez Castellano	Estrato 2-3	1,47	0,65-3,32
	Estrato 4-5		

**Tabla 8: Poliparasitosis y su relación con factores higiénicos asociados**

Variables	Categories	Polyparasitosis		Chi-2 (p)
		Sí	No	
		N %	N %	
Washing hands before meals	Yes	1 (5,9)	16 (94,1)	5,089 (0,024) *
	No	38 (32,5)	79 (67,5)	
Do not wash hands after going to the bathroom.	Yes	30 (42,3)	41 (57,7)	12,654 (0,000) *
	No	9 (14,3)	54 (85,7)	
Washes food before eating	Yes	13 (28,9)	32 (71,1)	0,002 (0,969)
	No	26 (29,2)	63 (70,8)	
Boil water before drinking	Yes	1 (3,6)	27 (96,4)	11,184 (0,001) *
	No	38 (35,8)	68 (64,2)	
Type of water ingested on a daily basis	Potable	18 (35,3)	33 (64,7)	1,624 (0,654)
	Piped	11 (25,0)	33 (75,0)	
	Bottled	6 (24,0)	19 (76,0)	
	Well	4 (28,6)	10 (71,4)	
Presence of pets in the dwelling	Present	36 (28,8)	89 (71,2)	0,084 (0,772)
	Not present	3 (33,3)	6 (66,7)	
Type of floor in the dwelling	Cement	13 (24,5)	40 (75,5)	9,306 (0,025) *
	Wood	9 (19,6)	37 (80,4)	
	Ceramic	13 (46,4)	15 (53,6)	
	Earth	4 (57,1)	3 (42,9)	
Type of wall in the dwelling	Cement	18 (25,0)	54 (75,0)	10,147 (0,017) *
	Brick or block	14 (38,9)	22 (61,1)	
	Adobe	7 (50,0)	7 (50,0)	
	Wood	0 (0,0)	12 (100,0)	
Refrigerator	Yes	34 (27,9)	88 (72,1)	1,008 (0,315)
	No	5 (41,7)	7 (58,3)	
Excreta disposal	Toilet	30 (29,4)	72 (70,6)	0,209 (0,901)
	Septic tank	8 (29,6)	19 (70,4)	
	Latrine	1 (20,0)	4 (80,0)	

Statistically significant value (\*)

**Table 9: Distribution of polyparasitosis and its relationship with associated factors.**

Variables	Categories	OR	IC 95%
Washing hands before meals	Yes	0,13	0,17-1,01 *
	No		
Do not wash hands after going to the bathroom.	Yes	4,39	1,88-10,25 *
	No		
Washes food before eating	Yes	0,98	0,44-2,16
	No		
Boils water before drinking	Yes	0,66	0,09-0,50 *
	No		
Presence of pets in the home	Yes	0,80	0,19-3,41
	No		
Refrigerator	Yes	0,54	0,16-1,82 *
	No		

Statistically significant value (\*)

**Table 10: Acute diarrheal symptoms and their relationship with polyparasitosis and accompanying symptoms.**

Variables	Categories	Acute Diarrhea		Chi-2 (p)
		Yes	No	
Polyparasitosis	Yes	29 (74,4)	10 (25,6)	21,639 (<0,001) *
	No	29 (30,5)	66 (69,5)	
Lack of appetite	Lack of appetite	18 (45,0)	22 (55,0)	50,18 (<0,001) *
	Abdominal pain	27 (79,4)	7 (20,6)	
	Nausea or vomiting	10 (76,9)	3 (23,1)	
	None	3 (6,4)	44 (93,6)	

Statistically significant value (\*)

**Table 11: Influence of hygiene habits on the incidence of polyparasitosis.**

Variables	Categories	Adjusted odds ratio	p
		*(IC95%)	
Does not wash hands after going to the bathroom.	Yes	4,39 (1,88-10,25)	<0,001 *
	No	1,00	-
Boils water before drinking	Yes	0,06 (0,009-0,50)	0,009 *
	No	1,00	-

Statistically significant value (\*)

**Table 12: Risk of acute diarrhea in patients with polyparasitic infections.**

Variables	Categories	Adjusted odds ratio	p
		*(IC95%)	
Polyparasitosis	Sí	6,60 (2,84-15,30)	<0,001 *
	No	1,00	-

Statistically significant value (\*)

Source: Collection of surveys and data from the coproparasitic examination.

Elaboration: Authors' own

## Discussion

Enteroparasitosis is considered a public health problem in Ecuador, especially in rural areas such as the community of Guapán. The present study reports a prevalence of 95.71% in children aged 5 to 10 years, a figure significantly higher than that reported in other regions of the country. A study in children aged 1 to 10 years in an urban center of the city of Quito reported a prevalence of 34.87% (21.54%), they had monoparasitism, and 26 (13.33%) polyparasitism (8).

In an investigation carried out in Manabí, the overall prevalence was 45.30%, with a predominance of monoparasitism. These data contrast with the high prevalence found in Guapán, suggesting particular local conditions that favor the transmission of intestinal parasites(9).

The high prevalence observed in Guapán could be related to specific local factors, such as sanitation conditions, limited access to drinking water and poor hygienic practices. In a study of schoolchildren in the urban area of Jipijapa canton, a prevalence of 30.59% was found, associated with factors such as consumption of untreated water and the presence of domestic animals (10). In the present study, the high prevalence in rural areas (77.6%) compared to urban areas (22.4%) reinforces the notion that living conditions, such as limited access to adequate sanitation and drinking water, are key determinants in the transmission of enteroparasitosis.

The prevalence of parasitosis in children from families of low socioeconomic strata (71.6% in stratum 4) highlights the strong influence of socioeconomic factors in the exposure to conditions that favor parasitic transmission.

In the present study it was observed that only 12.7% of the children washed their hands before meals, and 53.0% did not wash their hands after going to the bathroom. This is similar to those reported in the study by Aguaiza-Pichasaca et al. which included children aged 5 to 12 years in indigenous schools in the province of Cañar, Ecuador, where it was reported that 21% of the children washed their hands before and after eating, and 32% did so after going to the toilet (11).

It highlights the importance of hand washing in reducing gastrointestinal infections (12). Likewise, 33.6% of the children reported washing food before consumption and only 20.9% reported boiling water before drinking it. According to the research by Girma and Aemiro, the low adoption of these hygienic practices highlights the need for educational and public health interventions in the community to improve these behaviors and reduce the prevalence of enteroparasitosis (13).

On the other hand, the vast majority of children (93.3%) live in homes with pets, which contributes to the high prevalence of enteroparasite infections (14). Regarding the type of water consumed, only 38.1% of the children ingest drinking water, while 32.8% consume piped water and 10.4% well water, indicating that a considerable part of the population does not have constant access to safe water; this limited access to drinking water, together with the disposal of excreta in septic tanks (20.1%) and latrines (3.8%), highlights the precarious living conditions that could be facilitating the transmission

of intestinal parasites in this community (16,17,18).

However, the fact that 5.2% of dwellings still have dirt floors is of concern, since these floors can be a reservoir for parasites, facilitating the transmission of enteroparasitic infections (19).

Most of the parasitic infections identified corresponded to monoparasitosis, with a prevalence of 70.9%, indicating that many children are infected by a single type of parasite. *Entamoeba histolytica* was the most common parasite, present in 70.9% of cases, suggesting its relevance as a pathogen in the community. In addition, 29.1% of polyparasitosis was detected, cases in which the children had coinfection of *Ascaris lumbricoides* eggs together with *Entamoeba histolytica* cysts. For their part, Hailu and Ayele conducted a study in 645 children aged 6 to 15 years in Ethiopia, in which they observed that 52.9% presented at least one parasite, of which 18.1% were *Entamoeba histolytica* (20).

The finding of a high prevalence of *Entamoeba histolytica* and the presence of co-infections with *Ascaris lumbricoides* highlights the need for improved community health interventions (21).

The analysis of symptoms associated with enteroparasitosis shows that 43.3% of affected children presented acute diarrhea, indicating that this is a prevalent symptom in this population. As for accompanying symptoms, lack of appetite was reported in 29.9% of cases, followed by abdominal pain in 25.4%. The presence of symptoms such as acute diarrhea, lack of appetite and abdominal pain in children with enteroparasitosis highlight the need for timely clinical diagnosis (22,23).

Polyparasitosis was associated with lack of hand washing before meals ( $p = 0.024$ ) and lack of hand washing after using the toilet ( $p = 0.000$ ). Likewise, boiling water before consumption showed a strong association with a lower prevalence of polyparasitosis ( $p = 0.001$ ), indicating that proper water treatment is essential to prevent parasite transmission. Importantly, when evaluating the joint regression model on the presence of polyparasitosis, it was observed that the lack of hand hygiene after using the toilet and not boiling water were significantly related to polyparasitosis ( $p < 0.05$ ). In this regard, Murillo-Acosta et al. affirm that the conditions of the water consumed by children is a determining factor in the presence or absence of parasitosis (24).

The type of housing infrastructure also showed significant associations with the prevalence of polyparasitosis; children living in dwellings with earthen ( $p = 0.025$ ) and ceramic floors, as well as in those with adobe or brick walls ( $p = 0.017$ ), had a higher prevalence of polyparasitosis compared to those in dwellings with cement floors and cement walls. Approximately, in the study by Candela et al. (2023) in Argentina, it was observed that environmental conditions (including housing condition and construction materials) were significantly related to parasitosis ( $p < 0.001$ ); also, children walking barefoot on dirt were more likely to acquire intestinal infections due to parasites than those with cement floors ( $p < 0.001$ ) (25). These findings suggest that housing conditions play an important role in exposure to parasites, probably because certain materials facilitate the accumulation and spread of pathogens (26).

In addition, a strong association was observed between acute diarrhea and the presence of polyparasitosis ( $p = <0.001$ ), suggesting that acute diarrhea is more prevalent in individuals with polyparasitosis. The significant relationship between acute diarrhea and other gastrointestinal symptoms, such as abdominal pain ( $p = <0.001$ ), reinforces the importance of these symptoms as clinical indicators of parasitic infections. Similarly, in the study conducted by Wasihun et al. in a sample of 610 children in northern Ethiopia, a relationship was observed between parasitosis and the presence of acute diarrhea ( $p = 0.000$ ), as well as between parasitosis and the combination of other secondary symptoms such as nausea and vomiting ( $p < 0.001$ ) (27). These findings emphasize the need for comprehensive approaches that improve hygienic practices and living conditions to reduce the burden of parasitic diseases in this community of children (28).

Intestinal parasitosis caused by amebiasis and ascariasis leads to significant clinical complications and educational repercussions, especially in children in developing regions (29). Amebiasis, caused by *Entamoeba histolytica*, can manifest from mild symptoms to fulminant colitis, and in severe cases, lead to amoebic liver abscesses that can be complicated by perforations and spread to other organs, increasing mortality if not adequately treated (30).

On the other hand, ascariasis, caused by *Ascaris lumbricoides*, is associated with malnutrition,

anemia, and growth retardation, negatively affecting the cognitive development and school performance of children. These parasitic infections not only pose a medical challenge but also perpetuate cycles of poverty by limiting educational opportunities and the overall development of the affected populations (31).

The need for urgent public health interventions is emphasized, focusing on improving sanitary conditions and educating on hygienic practices. Studies have shown that the implementation of deworming programs and health education can significantly reduce the prevalence of these infections. Additionally, it is essential to improve access to drinking water and basic sanitation to prevent the transmission of intestinal parasites.

El presente estudio evidencia una prevalencia alarmantemente alta de enteroparasitosis en niños de la comunidad de Guapán, superando las cifras reportadas en otras regiones del país. Este hallazgo subraya la necesidad de implementar estrategias integrales de salud pública que aborden los factores ambientales y conductuales que contribuyen a la transmisión de estas infecciones. Las prácticas higiénicas deficientes, como no lavarse las manos antes de las comidas y después de ir al baño, así como no hervir el agua antes de beberla, fueron factores relevantes en la prevalencia de estas infecciones.

Finalmente, los síntomas clínicos como diarrea aguda y dolor abdominal fueron identificados como indicadores clave de infecciones múltiples por parásitos. La fuerte asociación entre estos síntomas y la poliparasitosis resalta la necesidad de una vigilancia médica rigurosa y la implementación de estrategias de prevención y tratamiento en esta población vulnerable.

## Conclusions

The present study evidences an alarmingly high prevalence of enteroparasitosis in children from the community of Guapán, surpassing the figures reported in other regions of the country. This finding underscores the need to implement comprehensive public health strategies that address the environmental and behavioral factors contributing to the transmission of these infections. Poor hygiene practices, such as not washing hands before meals and after using the bathroom, as well as not boiling water before drinking it, were relevant factors in the

prevalence of these infections.

Finally, clinical symptoms such as acute diarrhea and abdominal pain were identified as key indicators of multiple parasitic infections. The strong association between these symptoms and polyparasitism highlights the need for rigorous medical surveillance and the implementation of prevention and treatment strategies in this vulnerable population.

## Peer review

The manuscript underwent blind peer review and was promptly approved by the Editorial Team of the INSPILIP journal.

## Availability of Data and Materials

The data supporting the findings of this study are available upon request from the corresponding author.

## Conflicts of Interest

The authors declare that they have no conflicts of interest.

## Authors' Contributions

All authors equally contributed to the different phases of the research process.

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## Bibliographic references

1. Sánchez J, Gelena C, Maria D, Miguel S. Nivel de conocimiento sobre parasitosis intestinal en madres, padres y cuidadores, Cotopaxi, Ecuador. *Revista Cubana de Reumatología* [Internet]. 2023 Jan 29 [cited 2024 Aug 17];25(1):4–9. Available from: <https://revreumatologia.sld.cu/index.php/reumatologia/article/view/1107>
2. Fauziah N, Aviani JK, Agrianfanny YN, Fatimah SN. Intestinal Parasitic Infection and Nutritional Status in Children under Five Years Old: A Systematic Review. *Trop Med Infect Dis* [Internet]. 2022 Nov 1 [cited 2024 Feb 15];7(11):371. Available from: [/pmc/articles/PMC9697828/](https://pubmed.ncbi.nlm.nih.gov/39697828/)
3. Baena D, Fajardo A, Flórez J, Cardona J. Prevalencia de parasitismo intestinal y sus

factores asociados en publicaciones indexadas de Colombia: revisión sistemática 2000-2017. *Revista Investigaciones Andina* [Internet]. 2019 Aug 30 [cited 2024 Feb 29];21(39):97–115. Available from: <https://revia.areandina.edu.co/index.php/IA/article/view/1558>

4. Zuta N, Arcelia R, Manuel M, Verónica B. Impacto de la educación sanitaria escolar, hacinamiento y parasitosis intestinal en niños preescolares. *Revista de Investigación en Comunicación y Desarrollo* [Internet]. 2019 Jun 18 [cited 2024 Aug 17];10(1):47–56. Available from: <https://comunicacionunap.com/index.php/rev/article/view/329/181>

5. Romero-Ramírez SC, Romero-Ramírez SC. Caracterización epidemiológica de la parasitosis intestinal. *Revista Arbitrada Interdisciplinaria de Ciencias de la Salud Salud y Vida* [Internet]. 2022 Jan 1 [cited 2024 Aug 20];6(11):35–43. Available from: [http://ve.scielo.org/scielo.php?script=sci\\_arttext&pid=S2610-80382022000100035&lng=es&nrm=iso&tlng=es](http://ve.scielo.org/scielo.php?script=sci_arttext&pid=S2610-80382022000100035&lng=es&nrm=iso&tlng=es)

6. Murillo A, Rodríguez de Rivero Z, Bracho A. Parasitosis intestinales y factores de riesgo de enteroparasitosis en escolares de la zona urbana del cantón Jipijapa, Ecuador. *Kasmera* [Internet]. 2020 [cited 2024 Feb 27];48:1–5. Available from: <https://zenodo.org/records/3754787>

7. Jiménez Cordero S, Guevara Solera A, Monge Cordero L. Perfil de parasitosis intestinal, laboratorio clínico área de salud La Unión, primer semestre 2019. *Revista Médica Sinergia*, ISSN 2215-4523, ISSN-e 2215-5279, Vol 4, No 12, 2019 (Ejemplar dedicado a: December; e324) [Internet]. 2019 [cited 2024 Aug 20];4(12):1. Available from: <https://dialnet.unirioja.es/servlet/articulo?codigo=7399474&info=resumen&idioma=SPA>

8. Portilla Guerrero SN, Peñafiel Villarreal CR. Identificación de parásitos que prevalecen en niños de 1 a 10 años: Un estudio observacional de un centro único urbano. *Rev Ecuat Pediatr*. 2023;24(2):101-106. doi:10.52011/217. Disponible en: <https://rev-sep.ec/index.php/johs/article/view/217> Rev-Sep

9. Durán-Pincay, Y., Rivero-Rodríguez, Z., & Bracho-Mora, A. (2019). Prevalencia de parasitosis intestinales en niños del Cantón Paján, Ecuador.

*Kasmera*, 47(1), 44–49. <http://produccioncientificaluz.org/index.php/kasmera>

10. Murillo-Zavala, A. M., Rivero, Z. C. R. de, & Bracho-Mora, A. M. (2020). Parasitosis intestinales y factores de riesgo de enteroparasitosis en escolares de la zona urbana del cantón Jipijapa, Ecuador. *Kasmera*, 48(1), e48130858–e48130858. <https://doi.org/10.5281/ZENODO.37547870>

11. Aguaiza M, Piñero Maria, Contreras Jose, Quintero A. Prevalencia de parasitosis intestinal, condiciones socio-sanitarias y estado nutricional de niños indígenas de Ecuador. *Kasmera* [Internet]. 2022 [cited 2024 Feb 27]; Available from: <https://doi.org/10.5281/zenodo.5824422>

12. Khan KM, Chakraborty R, Brown S, Sultana R, Colon A, Toor D, et al. Association between Handwashing Behavior and Infectious Diseases among Low-Income Community Children in Urban New Delhi, India: A Cross-Sectional Study. *Int J Environ Res Public Health* [Internet]. 2021 Nov 28;18(23):1–14. Available from: <https://doi.org/10.3390/ijerph182312535>

13. Girma A, Aemiro A. Prevalence and Associated Risk Factors of Intestinal Parasites and Enteric Bacterial Infections among Selected Region Food Handlers of Ethiopia during 2014-2022: A Systematic Review and Meta-Analysis. *The Scientific World Journal* [Internet]. 2022;2022(7786036):1–14. Available from: <https://doi.org/10.1155/2022/7786036>

14. Diakou A, Deak G, Veronesi F. Pets, Wildlife and Parasites. *Pathogens* [Internet]. 2023;12(11):1–6. Available from: <https://doi.org/10.3390/pathogens12111310>

15. Lalitha C. Contamination of Refrigerator is A Threat For Onfections. *International Journal of Advance Research* [Internet]. 2019;5(2):1514–7. Available from: <https://www.ijariit.com/manuscripts/v5i2/V5I2-1901.pdf>

16. Zonta ML, Cociancic P, Oyhenart EE, Navone GT. Intestinal parasitosis, undernutrition and socio-environmental factors in schoolchildren from Clorinda Formosa, Argentina. *Revista de Salud Pública* [Internet]. 2019 Mar 1;21(2):224–31. Available from: <https://revistas.unal.edu.co/index.php/revsaludpublica/article/view/73692>

17. Cuenca-León K, Sarmiento-Ordóñez J, Blandín-Lituma P, Benítez-Castrillón P, Pacheco-Quito EM. Prevalencia de parasitosis intestinal en la población infantil de una zona rural del Ecuador. *Bol Malariol Salud Ambient* [Internet]. 2021;61(4):596–602. Available from: <https://docs.bvsalud.org/bibliore-f/2022/09/1395573/367-1316-1-pb.pdf>
18. Kaminsky RG, Aguilar M, Zepeda CAJ. Perfil epidemiológico y parasitosis intestinales en tres comunidades atendidas por organización no gubernamental, Tegucigalpa, Honduras. *Rev Med Hondur* [Internet]. 2022;90(2). Available from: <https://doi.org/10.5377/rmh.v90i2.1516>
19. Heylen D, Day M, Schunack B, Fourie J, Labuschagne M, Johnson S, et al. A community approach of pathogens and their arthropod vectors (ticks and fleas) in dogs of African Sub-Sahara. *Parasit Vectors* [Internet]. 2021 Dec 16;14(576):1–20. Available from: <https://doi.org/10.1186/s13071-021-05014-8>
20. Hailu GG, Ayele ET. Assessment of the prevalence of intestinal parasitic infections and associated habit and culture-related risk factors among primary schoolchildren in Debre Berhan town, Northeast Ethiopia. *BMC Public Health* [Internet]. 2021 Dec 9;21(112):1–12. Available from: <https://doi.org/10.1186/s12889-020-10148-y>
21. Kassaw MW, Abebe AM, Tlaye KG, Zemariam AB, Abate BB. Prevalence and risk factors of intestinal parasitic infestations among preschool children in Sekota town, Waghimra zone, Ethiopia. *BMC Pediatr* [Internet]. 2019 Nov 14;19(437):1–10. Available from: <https://doi.org/10.1186/s12887-019-1774-2>
22. Espinosa Tigre RM, Coral Bastidas DI, Calvopiña Sarmiento ES, Lemache Manobanda SK, Tejedor Morocho AM. La parasitosis intestinal y su incidencia en el crecimiento de infantes. *LATAM Revista Latinoamericana de Ciencias Sociales y Humanidades* [Internet]. 2023;4(2):3671–86. Available from: <https://doi.org/10.56712/latam.v4i2.863>
23. Vera Chamorro JF, Sánchez Franco C, Vargas Sandoval M, Mora Quintero DV, Riveros López JP, Sarmiento Quintero F, et al. Consenso colombiano de la enfermedad inflamatoria intestinal pediátrica. *Rev Colomb Gastroenterol* [Internet]. 2023 Oct 2;38(Supl No. 1):1–75. Available from: <https://revistagastrocol.com/index.php/rcg/article/view/943>
24. Murillo-Acosta WE, Murillo-Zavala AM, Celi-Quevedo K V., Zambrano-Rivas CM. Parasitosis intestinal, anemia y desnutrición en niños de Latinoamérica: Revisión Sistemática. *Kasmera* [Internet]. 2022;50(e5034840). Available from: <https://doi.org/10.5281/zenodo.5816437>
25. Candela E, Goizueta C, Sandon L, Muñoz-Antoli C, Periago MV. The Relationship Between Soil-Transmitted Helminth Infections and Environmental Factors in Puerto Iguazú, Argentina: Cross-Sectional Study. *JMIR Public Health Surveill* [Internet]. 2023;9(e41568):1–14. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/37934580>
26. Younis LG, Kroeger A, Joshi AB, Das ML, Omer M, Singh VK, et al. Housing structure including the surrounding environment as a risk factor for visceral leishmaniasis transmission in Nepal. *PLoS Negl Trop Dis* [Internet]. 2020 Mar;14(3:e0008132):1–13. Available from: <https://doi.org/10.1371/journal.pntd.0008132>
27. Wasihun AG, Teferi M, Negash L, Marugán J, Yemane D, McGuigan KG, et al. Intestinal parasitosis, anaemia and risk factors among pre-school children in Tigray region, northern Ethiopia. *BMC Infect Dis* [Internet]. 2020 Dec 27;20(379):1–11. Available from: <https://doi.org/10.1186/s12879-020-05101-8>
28. Gupta R, Rayamajhee B, Sherchan SP, Rai G, Mukhiya RK, Khanal B, et al. Prevalence of intestinal parasitosis and associated risk factors among school children of Saptari district, Nepal: a cross-sectional study. *Trop Med Health* [Internet]. 2020 Dec 24;48(73):1–9. Available from: <https://doi.org/10.1186/s41182-020-00261-4>
29. Gutiérrez CE, Jaras Horno MA, Aro C, Gómez Colussi AF, Belén Cheirano M, Soledad Rodríguez É, Vera Garate MV, García Efron G, Adrián Guerrero S. Intervención educativa como estrategia de prevención de parasitosis intestinales y valoración del estado enteroparasitológico en centros de desarrollo infantil de la ciudad de Santa Fe, Argentina. *Rev Argent Microbiol*. 2025 Jan-Mar;57(1):8-13. Spanish. doi: 10.1016/j.ram.2024.07.002. Epub 2024 Sep 2. PMID: 39227267.

30. Ahmed M. Intestinal Parasitic Infections in 2023. *Gastroenterology Res.* 2023 Jun;16(3):127-140. doi: 10.14740/gr1622. Epub 2023 Jun 11. PMID: 37351081; PMCID: PMC10284646.

31. Maia MM, Fausto MA, Vieira EL, Benetton ML, Carneiro M. Intestinal parasitic infection and associated risk factors, among children presenting at outpatient clinics in Manaus, Amazonas state, Brazil. *Ann Trop Med Parasitol.* 2009 Oct;103(7):583-91. doi: 10.1179/000349809X12459740922417. PMID: 19825280. Spanish. doi: 10.1016/j.ram.2024.07.002. Epub 2024 Sep 2. PMID: 39227267.