ACIN
ASOCIACIÓN COLOMBIANA DE INFECTOLOGÍA

infectio

ARTÍCULO ORIGINAL

Intestinal parasites in children and adolescents from rural communities of Manabí, Ecuador

Zulbey Chiquinquirá Rivero-de Rodríguez[1,2,*], Angela María Bracho-Mora[1,3], Angie Elicenia Mera-Bazurto[1,4], Veruska Pierina Castro-Ramírez[1,5], Francisco Javier Quiroga-Lucas[1,6], Nicole Anahí Montes-Romero[1,7]

Abstract

Introduction: Intestinal parasitosis is a public health problem that affects people of all ages and sexes; however, it occurs mainly in the first few years of life. This study aimed to identify the profile of intestinal parasites in children and adolescents from three rural communities in Manabí, Ecuador. These communities have never been evaluated parasitologically.

Materials and methods: An observational, descriptive, prospective, and cross-sectional study was designed, in which fecal samples were collected from children and adolescents, which were processed by direct coproparasitological examination and the concentration method with formalin-gasoline (Ritchie-Frick).

Results: Of the 154 individuals studied, 70 were parasitized (45.50%), of which 67.15% presented only one parasitic species. The main species detected were the chromist *Blastocystis* sp., *Endolimax nana*, and *Entamoeba coli*; only *Enterobius vermicularis* was found in 2.60% of the individuals. In relation to parasitism by age and sex, a higher prevalence of parasitized children aged 6–11 years was observed, without major differences in parasitism by sex (female 42.70% and male 48.10%). A significant association was found between polyparasitism and male sex as well as between parasitism and community, with the Frutillo community having the highest prevalence.

Discussion: A medium prevalence of intestinal parasites and a predisposition of these communities to infections caused by protozoa/chromists may be related to the ingestion of contaminated/untreated water.

Keywords: rural area, children, adolescents, intestinal parasites.

Parásitos intestinales en niños y adolescentes de comunidades rurales de Manabí, Ecuador

Resumen

Introducción: La parasitosis intestinal es considerada un problema de salud pública que afecta a personas de todas las edades y sexos; pero se presentan principalmente en los primeros años de vida. El objetivo de este estudio fue Identificar el perfil de parásitos intestinales en niños y adolescentes de tres comunidades rurales de Manabí, Ecuador. Dichas comunidades nunca habían sido evaluadas parasitológicamente con anterioridad.

Materiales y métodos: Se diseñó una investigación observacional, descriptiva, prospectiva y transversal, donde se recolectaron muestras fecales de niños y adolescentes, las cuales fueron procesadas mediante examen coproparasitológico directo y método de concentración con formol-gasolina (Ritchie-Frick).

Resultados: De los 154 individuos estudiados, se observó que 70 de ellos estaban parasitados (45,50%); de estos, el 67,15% presentó una sola especie parasitaria. Predominaron los protozoarios y cromistas sobre las especies de helmintos. Las principales especies detectadas fueron el cromista *Blastocystis* sp., *Endolimax nana* y *Entamoeba coli*; solo se encontró *Enterobius vermicularis* en 2,60% de los individuos. En relación con el parasitismo por edad y sexo, se determinó una mayor prevalencia de parasitados en los niños de 6 a 11 años (51,60%), sin mayores diferencias de los parasitados por sexo (femenino 42,70% y masculino 48,10%). Se determinó asociación significativa entre las variables poliparasitismo y sexo masculino, así como entre parasitismo y comunidad, siendo la comunidad del Frutillo la de mayor prevalencia.

Discusión: Se encontró una mediana prevalencia de parásitos intestinales y una predisposición de estas comunidades a las infecciones producidas por protozoos/cromistas, posiblemente relacionadas con la ingestión de agua contaminada/no tratada.

Palabras clave: zona rural, niños, adolescentes, parásitos intestinales.

1 Universidad Técnica de Manabí, Portoviejo, Ecuador.
2 https://orcid.org/0000-0001-8658-7751
3 https://orcid.org/0000-0001-5749-9568
4 https://orcid.org/0009-0008-9806-8690
5 https://orcid.org/0009-0003-9209-9182
6 https://orcid.org/0009-0002-5983-5793
7 https://orcid.org/0009-0002-9212-1047
* Autor para correspondencia:
Correo electrónico: zulbeyrivero@gmail.com

Recibido: 17/02/2024; Aceptado: 15/10/2024

Cómo citar este artículo: Z.C. Rivero-de Rodríguez, *et al.* Intestinal parasites in children and adolescents from rural communities of Manabí, Ecuador. Infectio 2025; 29(1): 23-28

Introduction

Intestinal parasitosis is considered a public health problem that affects individuals of all ages and sexes; however, it occurs mainly in the first years of life, since this age group has not yet acquired the necessary hygienic habits to prevent it and has not developed immunity against the different types of parasites[1].

Numerous investigations have pointed out the association between poverty and health limitations, which is reflected in high parasite prevalence rates. In humans, intestinal parasitosis causes, among other gastrointestinal alterations, eosinophilic colitis, diarrhea, dysentery, decreased growth rate due to malabsorption syndrome, anemia, and modification of the intestinal microbiota, which in most cases leads to low intellectual performance and decreased work capacity in the affected individuals[2]. Clinical manifestations can vary from asymptomatic to severe cases, which rarely lead to death[3].

Parasitic infections are widespread, and their prevalence today is similar to that which existed 50 years or more ago in many regions of the world. This is because of the complexity of the epidemiological factors that condition them and the difficulty in controlling or eliminating these factors[4].

The prevalence in Ecuador is similar to that in other Latin American countries with similar climatic characteristics, unhealthy conditions, and poverty. In the country, unspecified intestinal parasitosis was among the main causes of outpatient morbidity in the Ministry of Public Health of Ecuador in 2016, and among the top ten causes of pediatric consultation[5], epidemiological differences existed depending on the area of the country studied.

Escobar et al.[6] studied 610 children under 12 years of age from San Luis-Chimborazo, in which 91.48% showed the presence of parasites, detecting 30.36% of *Entamoeba coli, Entamoeba histolytica* 19.02%, *Iodamoeba bütschlii* 2.79%, *Chilomastix mesnili* 3.93%, and *Giardia lamblia* 5.08%. Ramos and Fiallo[7] analyzed 50 individuals in the Flores parish of Riobamba canton, finding 100% of parasitized individuals, and detected Entamoeba histolytica as the main species. González et al.[8] performed a parasitological analysis of 296 individuals, residents in six communities of the San Andrés parish in Riobamba, and revealed that 98.2% of them were infected.

At the regional level, the number of cases is lower than those reported for other provinces. Durán et al. report for the Pajan canton (Manabí)[9], a 45.30% prevalence of intestinal parasites, with a predominance of the *Entamoeba* complex species with 26.50%, in the child population studied. Murillo et al.[10] demonstrated a 30.59% prevalence, with a predominance of monoparasitism, agreeing with the *Entamoeba* complex species as the most prevalent, when studying children from Jipijapa. Véliz et al.[11] studied 168 schoolchildren from Puerto Cayo, Machalilla, and Puerto López, and reported that the highest prevalence was detected in Machalilla (1.76%), Puerto López (0.67%), and Puerto Cayo (0.31%).

In the country, there is a varied prevalence of enteroparasites in the child population; however, children and adolescents from the rural area of Rocafuerte had not been previously evaluated by parasitological diagnosis; therefore, the present study was carried out in individuals from three rural communities of Rocafuerte, Ecuador.

Materials and methods

Study design:

An observational, descriptive, and cross-sectional study was designed, which was carried out from October 2022-February 2023, in rural communities of the Rocafuerte canton of the province of Manabí, Ecuador.

Study area:

The Rocafuerte canton is located in the western part of the Ecuadorian territory, central part of the Province of Manabí, at 0° 55" and 6" south latitude and 80° 26" 10" western longitude, bordering to the north with the cantons Sucre and Tosagua, to the south with Portoviejo, to the east with Junín and to the west with Portoviejo and Sucre. Its topography is flat, its maximum height is 215 m above sea level, the climate is relatively cool, and it has an average annual temperature of 25 °C. With an average rainfall of 163.5 mm and a relative humidity of 84%, it is classified as Tropical Thorny Mountain and Tropical Very Dry Forest. It covers 54 communities divided into three areas: upper, lower, and urban. Its main economic activities are related to the sale of creole sweets as well as agriculture, mainly planting corn and rice[12]. See Fig. 1

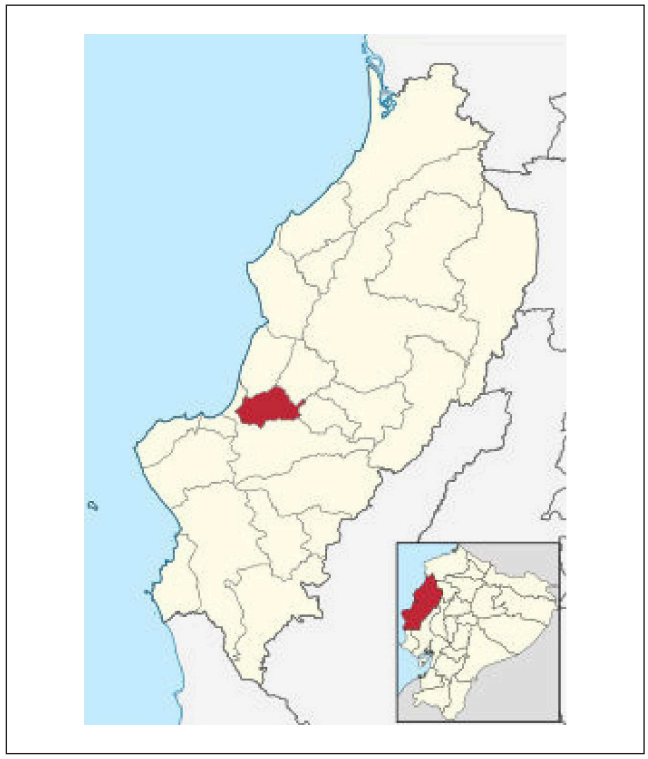

Figure 1. Location of Manabí in Ecuador and Rocafuerte within Manabí
Fountain: Wikipedia

Population and sample:
According to data from the Rocafuerte GAD and INEC (12,13), in El Frutillo, Higuerón, and El Cerrito, rural areas of the Rocafuerte canton, there are approximately 1564 individuals. The calculation of "n" for these communities was 310 people. In this study, only children and adolescents were worked with; therefore, approximately half of this figure was worked with, given the impossibility of knowing the exact number of children and adolescents. Using non-probabilistic convenience sampling, 154 individuals aged between 3 and 17 years were included and classified into age groups according to the Ministry of Public Health (14). Some of the boys included in the study belonged to the GAD Rocafuerte sports group.

Inclusion criteria:
Individuals of either sex, aged 2 to 17 years, who agreed to participate and had complete informed consent and assent.

Exclusion criteria:
Individuals under antiparasitic treatment, those who had received it one month prior to sample delivery, and individuals who did not deliver the amount of feces required for processing.

Sample processing:
Each participant was given a large, wide-mouth plastic container for collecting a fecal sample per individual included in the study, explained verbally and in writing the rules for properly obtaining the sample. All fecal samples were refrigerated during transportation and processed in the Microbiology and Parasitology Laboratory of the UTM, through direct coproparasitological examination with physiological saline and Lugol solution[15] on the same day of processing. Subsequently, a formaldehyde-gasoline (Ritchie-Frick) concentrate was prepared[16].

Statistical analysis:
For the analysis and interpretation of the data, a matrix was created in Excel® to tabulate the obtained data, and frequencies and percentages of the variables under study were obtained using descriptive statistics. For univariate analyses, the Chi-square test was used for the association between the variables age, sex, presence of parasites, and mono-and polyparasitism, with a p value <0.05, as a level of statistical significance, using the statistical package SPSS version 26.0 for Windows®.

Results

Of the 154 individuals studied (n=154), 79 (51%) were male and 75 (49%) were female, with an average age of 10.3±SD 3.2 years. A predominance of non-parasitized individuals was observed in 54.50% (84/154) of the parasitized individuals and 70/154 (45.50%) in the sectors studied. Although there was no significant difference (p>0.05), a greater number of parasitized individuals were determined in the male sex and age group of 6 to 11 years. Regarding the sector studied, a greater number of parasitized individuals was detected in El Frutillo, followed by Higuerón, and to a lesser extent El Cerrito, with a significant difference in relation to this variable and the presence of parasitized individuals (p=0.004) (Table 1).

Regarding parasitic associations, the number of children with a single parasitic species was 47, representing a percentage of 67.14%, while there polyparasitized were 23 individuals (32.86%). In most cases, an association of two species of parasites was found (82.60%), with the association of four species (4.35%) being infrequent. All parasitic associations (2, 3, and/or 4 species) were observed in males, whereas in females, only two species were associated. When polyparasitism was compared by sex, a significant difference was observed (p=0.015).

Table 2 shows the parasitic species found, where the predominance of protozoan/chromist species over helminths is notable. Likewise, it is observed that the species *Blastocystis sp.* with 24.03%, followed by the commensals *Endolimax nana* and *Entamoeba coli* (13.64%/9.74%, respectively). Fourteen individuals with *Giardia lamblia* cysts (9.09%) and 6 with the *Entamoeba* complex (3.90%) were detected. Regarding intestinal helminths, *Enterobius vermicularis* was detected in only four individuals (2.6 %). Furthermore, at the community level, significant differences were found in the prevalence of *E. vermicularis* in Higuerón (p=0.006) and *E. coli* in El Cerrito (p=0.029).

Discussion

The prevalence of intestinal parasites (45.5%) is similar to that reported in other studies carried out in the country, where similar figures have been reported in the child population[17-20]. Likewise, the predominance of monoparasitized individuals was observed; a similar situation demonstrated by Cuenca et al.[20] in the child population in Paute, Ecuador, detecting a percentage of monoparasitized individuals of 63.64%. Other investigations carried out on the same population in other

Table 1. Sociodemographic characteristics and prevalence of parasites of children and adolescents from rural communities of Rocafuerte. Manabí

Characteristics	N	Parasitized 70 (45,5%)	Non-parasitized 84 (54,5%)	*p*
Age group (years)				*0,936*
0 to 5	10	4 (5,7)	6 (7,1)	
6 to 11	79	36 (51,4)	43 (51,2)	
12 to 17	65	30 (42,9)	35 (41,7)	
Sex				*0,498*
Male	79	38 (54,3)	41 (48,8)	
Female	75	32 (45,7)	43 (51,2)	
Place of origin				*0,004**
El Frutillo	66	33 (47,1)	33 (39,3)	
Higueron	44	26 (37,1)	18 (21,4)	
El Cerrito	44	11 (15,8)	33 (39,3)	

*Statistically significant

Table 2. Parasitic species[a] detected in children and adolescents from rural communities in Manabí, Ecuador

Especie parasitaria	Frecuencia n (%)	IC	EL Frutillo	El Cerrito	Hihuerón	p
Blastocytis sp.	37 (24.03)	17.5 - 31.6	19	5	13	0.067
Endolimax nana	21 (13.64)	8.6 - 20.1	10	3	8	0.267
Entamoeba coli	15 (9.74)	5.6 - 15.6	8	0	7	0.029*
Giarda lambia	14 (9.09)	5.1 - 14.8	6	5	3	0.760
Entamoeba complex	6 (3.90)	1.4 - 8.3	2	2	2	0.891
Chilomastix mesnili	1 (0.65)	0.0 - 3.6	1	0	0	0.511
Enterobius vermicularis	4 (2.60)	0.7 - 6.5	0	0	4	0.006*

*Statistically significant/[a]including parasitic associations

areas of the country also reported a greater number of individuals with a single parasitic species[9-11]. A low percentage of polyparasitized individuals was detected; however, the difference between mono-and polyparasitized individuals was significant according to sex.

The observed difference could be attributed to some activities carried out by male individuals, who are more exposed to an environment contaminated with parasitic forms. When investigating this, it was found that the majority of male children and adolescents attend sports schools promoted by the cantonal government, who could have greater contact with contaminated environments when carrying out sports activities, being a risk factor for acquiring intestinal parasites. However, risk factors should be evaluated in detail to provide definitive conclusions.

The most prevalent species was *Blastocystis sp.*, a microorganism belonging to the kingdom Chromist[21], while the most frequent protozoan was *Endolimax nana*. Other microorganisms detected in the fecal samples were *E. coli*, *G. lamblia*, *Entamoeba* complex, and *Chilomastix mesnili*, indicating that the main parasites carried by the individuals were protozoa/chromists. Of the helminths, *Enterobius vermicularis* was the only one diagnosed in four cases. It is important to note that 2 of the reported cases of *E. vermicularis* were identified through macroscopic fecal examination; since female adults were observed moving on the surface of the feces, this finding was fortuitous. This highlights the importance of performing a detailed macroscopic examination of the stool.

The high prevalence of protozoan/chromist species compared to helminth species is notable; this is important, since fecal concentration procedures were used, which increases the possibility of the recovery of evolutionary forms of helminths[22]. This is relevant since many of the publications carried out in the country only include fecal microscopic examination, which has a low sensitivity compared to concentration methods[22-24]. When compared with previous studies of intestinal parasitosis in children from Ecuador, it is observed that the predominance of protozoa in fecal samples is common[9-11,17,25]. Thus, this study supports the idea that protozoan/chromist parasitosis is a public health problem at regional and national levels, more so than helminth infections. An explanation for this could be the transmission of protozoa/chromists through drinking water as a risk factor. Water resources are one of the problems faced by the population of the Rocafuerte canton, both in quantity and quality. The lower area, being crossed by the Portoviejo and Chico Rivers, has water throughout the year, but due to the pollution of the rivers, the water is of poor quality. In the upper area, on the other hand, they only have water in winter and if the winter is good, they can store water for the rest of the year. According to INEC 2022[13], 80.4% of Rocafuerte receives water from the public network, and the remainder receives water through other means of supply, such as wells, rivers, springs, delivery cars, and rain.

González et al.[26] parasitologically evaluated irrigated, piped, and stagnant water from an agricultural area of the Ecuadorian Andes, finding in the three types of water, protozoans (70.56%), followed by chromists (40.65%) and helminths (13.08%). Among the transmissible parasites, the following stand out: *Blastocystis spp.* (40.65%), free-living amoeba (5.61%), *and Entamoeba spp.* (8.41%), *Giardia duodenalis* (6.54%), *Balantidium spp.* (13.51%), *Cryptosporidium spp.* (17.76%), *Cyclospora spp.* (3.74%), *Cystoisospora spp.* (2.34%), *Eimeria spp.* (13.55%), *Dibothriocephalus spp.* (0.47%), and nematode larvae (13.08%). This study demonstrates the probability of ingesting contaminated or untreated water in some communities in Ecuador.

It is important to note that *Blastocystis sp.* has been identified as the main microorganism detected in the feces of children, a place that was previously occupied by *Giardia intestinalis*, which was always identified as the most frequent protozoan in this age group[27-29]. De la Torre et al.[30], when evaluating the fecal matter of 153 children from the Ambato canton, Ecuador, point

out an important predominance of protozoa/chromists, with the most frequent causal agent being *Blastocystis sp.* (47.60%), followed by *Entamoeba coli* (32.03%) and *Endolimax nana* (28.01%). In their study, Llerena et al.[31] evaluated schoolchildren from semi-rural areas in Ecuador, pointing out *Blastocystis sp.* (10%) as the most common species, followed by *Endolimax nana* (3.7%) and *Entamoeba complex* (2.5%), which is similar to the present study. A recent publication on schoolchildren from Chimborazo and Guayas determined that the main parasites detected were *Blastocystis* 39.2% and *E. vermicularis* (16.7 %)[32].

It is worth highlighting the significant difference found between the prevalence of enteroparasites per community studied, with Frutillo being the one that presented the highest percentage. The parents of the children in this sector stated that they had not been to the doctor lately and had not given them antiparasitic treatment in the last 6 months, while in the other communities (El Cerrito and Higuerón), they reported having dewormed the children and adolescents months ago, the reason for which these findings could be attributed. However, it is necessary to investigate the risk factors that may influence the increase in cases in this sector.

Statistical differences were observed between the parasitic species and communities. *Enterobius vermicularis* was detected only in Higuerón, which suggests overcrowding conditions in this sector, as this is one of the risk factors for this parasitosis[32-36]. However, it should be clarified that, to have a real conclusion of this situation, appropriate laboratory procedures for this parasite (plastic tape method/Graham test) and a community survey must be carried out. Although a significant difference was also detected in relation to *E. coli*, owing to the absence of cases in the El Cerrito community, in general terms, this community presented the lowest number of cases of intestinal parasitism.

Knowing the species of intestinal parasites carried by children and adolescents in Rocafuerte is essential to guarantee their health and well-being. Early detection of these infections allows for timely treatment and prevents complications such as malnutrition, developmental delay, anemia, learning problems, and other conditions that negatively impact an individual's quality of life. Education about hygiene habits and access to diagnostic and control methods is essential to combat these infections and ensure optimal physical and cognitive development in children and adolescents.

It should be noted that this research was a descriptive study; therefore, the potential determining factors that allowed infection with parasites were not analyzed, nor were the clinical manifestations of the participants, which can be considered a limitation of the project.

In conclusion, the medium prevalence of parasitosis found in this study reflects the predisposition of these communities to intestinal parasites produced by protozoa/chromists, possibly related to the ingestion of contaminated/untreated water in the population studied.

Ethical considerations

The research project was evaluated and approved by the Ethics and Research Committee on Human Beings (CEISH) of the Technical University of Manabí under the code CEISH-UTM-INT_23-3-4_ZRR.

Protection of persons and animals. The authors declare that there are no experiments with humans or animals for elaboration of this project.

Protection of vulnerable populations. As this research involved minors, the assent and informed consent of their parents and/or representatives was used.

Confidentiality. The authors declare that they have followed the protocols of the institution of origin of the patients for the publication of data, and the document does not contain data that allows them to be identified.

Privacity. The confidentiality of participants' identities and any identifying information was maintained throughout the course of the study.

Financing. The authors have no external funding to declare.

Conflicts of Interest: The authors declare no conflicts of interest regarding the publication of this manuscript.

Acknowledgments. To the GAD of Portoviejo and the people of the evaluated communities

Authors´ contribution. ZR participated in conceptualization, obtaining primary information sources, executing the research, designing the methodology, project administration, processing samples, supervision, review, editing, and approval of the final version. AB, AM, VC, FQ, NM participated in obtaining and processing samples, conceptualization, literature search, executing the research, editing, and approval of the final review. All authors contributed to read and approved the version of the submitted manuscript.

References

1. Cedeño-Reyes JC, Cedeño-Reyes MB, Parra-Conforme WG, Cedeño Caballero JV. Prevalencia de parasitosis intestinal en niños, hábitos de higiene y consecuencias nutricionales. Dom. Cien. 2021;7(4):273-92. http://dx.doi.org/10.23857/dc.v7i4.2421
2. Gamboa MI, Osen BA, Corbalán VV, Butti MJ, Lagala F and Radman NE. Intestinal Parasites in a Vulnerable Population in the Province of Buenos Aires, Argentina. EC Gastroenterology and Digestive System. 2023; 10(1):26-40.
3. Carvajal-Lucas L, Murillo-Zabala A. Parasitosis intestinales y estado nutricional en escolares. Revista Científica FIPCAEC. 2022. 7(4):1065-92. Disponible en: https://fipcaec.com/index.php/fipcaec/article/view/674
4. Mora L, Segura M, Martínez I, Figuera L, Salazar S, Fermín, I. Parasitosis intestinales y factores higiénicos sanitarios asociados en individuos de localidades rurales del estado Sucre. Kasmera. 2009;37(2):148-56. Disponible en: http://ve.scielo.org/scielo.php?script=sci_arttext&pid=S0075-52222090002000006&lng=es&nrm=iso. ISSN 0075-5222

5. Ministerio Salud Pública. Perfil de Morbilidad Ambulatoria 2016. Disponible en: https://public.tableau.com/profile/darwin5248#!/vizhome/Perfildemorbilidadambulatoria2016/Men?publish=yes
6. Escobar S, Cando V, Albuja A, Fiallos S, Hernández L. Prevalencia de parasitosis intestinal y su relación con la desnutrición en niños menores de 12 años de la parroquia San Luis – Chimborazo. Tesla Revista Científica. 2023;3(1):e160. https://doi.org/10.55204/trc.v3i1.e160
7. Ramos-Mancheno A, Fiallos-Ayala X. Incidencia de la Parasitosis Intestinal en la población de la Comunidad de Caliata, Ecuador. Dom. Cien. 2023;9(1):391-403. https://doi.org/10.23857/dc.v9i1
8. González-Ramírez LC. Robalino-Flores X, De la Torre E, Parra-Mayorga P, Prato JG, Trelis M, et al. Influence of environmental pollution and living conditions on parasite transmission among indigenous Ecuadorians. Int. J. Environ. Res. Public Health. 2022;19:6901. https://doi.org/10.3390/ijerph19116901
9. Durán Y, Rivero-Rodríguez Z, Bracho-Mora A. Prevalencia de parasitosis intestinales en niños del Cantón Paján, Ecuador. Kasmera. 2019;47(1):44-9
10. Murillo-Zavala A, Rivero Z, Bracho-Mora A. Parasitosis intestinales y factores de riesgo de enteroparasitosis en escolares de la zona urbana del cantón Jipijapa, Ecuador. Kasmera. 2020;48(1):e4813858. https://doi.org/10.5281/zenodo.3754787
11. Véliz T, Castro J, Pincay E, Chinga J. Parasitosis intestinales en niños de Puerto Cayo y Puerto López en Manabí, Ecuador. Dominio de las ciencias. 2020. 6(2):1049-67. https://doi.org/10.23857/dc.v6i2.1497
12. Gobierno Autónomo Descentralizado Rocafuerte. Actualización 2016. Disponible en: https://app.sni.gob.ec/sni-link/sni/PORTAL_SNI/data_sigad_plus/sigadplusdocumentofinal/1360001360001_PDyOT-ACTUALIZACION%20GAD%20ROCAFUERTE_29-12-2016
13. Instituto Nacional de Estadísticas y Censos. Año 2022. https://app.powerbi.com/view?r=eyJrIjoiNWUzMjQwOWMtZjFhOS00NjczLTk0YTItNjcwZmRmY2YxMjkyIiwidCI6ImYxNThhMmU4LWNhZWMtNDQwNi1iMGFiLWY1ZTI1OWJkYTExMiJ9
14. Ministerio de Salud Pública. Modelo de atención integral del Sistema Nacional De Salud. Subsecretaría Nacional de Gobernanza de la Salud Pública. Dirección Nacional de Articulación del SNS y Red. Modelo de Atención Integral de Salud Familiar Comunitario e intercultural. 2012. Disponible en: https://www.kimirina.org/images/kimirina/documentos/publicaciones/Manual_Modelo_Atencion_Integral_Salud_Ecuador_2012-Logrado-ver-amarillo.pdf
15. Botero M, Restrepo D. Parasitosis Humanas 6 ed. Corporación para Investigaciones Biológicas (CIB). Medellín, Colombia. 2016. p. 735
16. Giraldo J, Guatibonza A. Comparación de sensibilidad y especificidad de dos técnicas de diagnóstico directo: Kato–Katz-Saf y Ritchie–Frick (Formol Gasolina) en examen coproparasitológico para la identificación de estadios infectivos de geohelmintos en población infantil. Rev. Med. 2017;25(2):22-41. Disponible en: http://www.scielo.org.co/scielo.php?script=sci_arttext&pid=S0121-52562017000200022&lng=en&nrm=iso
17. Flores P, Prieto C, Aspiazu K, Peña S, Jaramillo M. Epidemiología de las infecciones por parásitos intestinales en el cantón Nabón, Ecuador. Facultad de Ciencias de la Salud-UNEMI. 2022; 6(10): 51-7. https://doi.org/10.29076/issn.2602-8360vol6iss10.2022pp51-57
18. Cando V, Escobar S, Espinoza C, Caluña E. Prevalencia de parasitosis intestinales y su posible relación con estados anémicos en los niños que acuden a los centros de educación inicial. European Scientific Journal. 2017;13(27):113-30. https://doi.org/10.19044/esj.2017.v13n27p113
19. Barona J, Chaquinga A, Brosard E. Parasitismo intestinal en niños menores de cinco años del cantón Sucúa, provincia de Morona Santiago, Ecuador. 2013. Available at: http://repositorio.utmachala.edu.ec/bitstream/48000/6704/1/TESIS.pdf
20. Crespo J, Álvarez P. Prevalencia de parasitosis intestinales en la población rural del cantón Loja, Ecuador. Rev. Salud. 2011. https://doi.org/10.1590/S1982-00542011000300007
21. Infante P, Diaz G. Prevalencia de parasitosis intestinales en la población infantil de la parroquia Chanchán, Cantón Manta, Provincia de Manabí, Ecuador. Revista de Ciencias Médicas. 2020;16(1):70-75. https://www.medigraphic.com/pdfs/medicas/medicas-16-01-14.pdf
22. Bastidas G, Malavé C, Bastidas D. Blastocystis sp. puesta al día sobre su papel parasitario. Gac Med Bol 2019;42(2):182-88.
23. Carrasco-Solano F, Santa Cruz-López C, Vergara-Espinoza M, Sánchez-Fernández M. Comparación de técnicas coproparasitológicas para el diagnóstico de geohelmintos intestinales en niños Lambayecanos. Gac Med Bol. 2023.46(1): 72-6. https://doi.org/10.47993/gmb.v46i1.636
24. Autier B, Gangneux JP, Robert-Gangneux F. Evaluation of commercial concentration methods for microscopic diagnosis of protozoa and helminths in human stool samples in a non-endemic area. Microorganisms 2022;10:1237. https://doi.org/10.3390/microorganisms10061237
25. Aquino J, Vargas G, López B, Neri E, Bernal R. Comparación de dos nuevas técnicas de sedimentación y métodos convencionales para la recuperación de parásitos intestinales. Rev Latinoamer Patol Clin. 2012;59(4): 233-242
26. Andrade I, Muñiz G, Álava N, Cerezo B. Prevalencia de parasitosis intestinal en escolares de 5 a 9 años del barrio Las Peñas de la ciudad de Guayaquil. Bol. Malariol. y Sal. Amb. 2020;LXI(2):185-94. http://dx.doi.org/10.52808/bmsa.7e5.612.007
27. González-Ramírez L, Falconí-Ontaneda F, Yaucén-Rodríguez M, Romero-Zapata C, Parra-Mayorga P, García-Rios C et al. Dispersión hídrica de enteroparásitos en una zona agropecuaria de gran altitud, en Los Andes Ecuatorianos. Kasmera. 2020;48(2):e48231698. https://doi.org/10.5281/zenodo.3938528
28. Chávez V, Huapaya P, Espinoza Y, Huaman A, Kanashiro D. Prevalencia de enteroparásitos y desnutrición infantil en un centro educativo del distrito del Rimac-Lima. Rev Per Med trop UNMSM. 2001;8: 81-5.
29. Fuentes M, Galíndez L, García D, González N, Goyanes J, Herrera E, et al. Frecuencia de parasitosis intestinales y características epidemiológicas de la población infantil de 1 a 12 años que consultan al Ambulatorio Urbano Tipo II de Cerro Gordo. Barquisimeto, estado Lara. Enero-junio 2007. Kasmera. 2011;39(1):31-42.
30. Melo A, Nascimento E, Nogueira T, Nunes T, Almeida J, Santos S, et al. Parasites in South Bahia: Focus on Giardiasis and Ascariasis among Preschoolers of Itabuna. Int J Heal Scien. 2015;3(1):61-75.
31. De la Torre-Fiallos A, Pacha-Jara A, Caiza-Vega. Parasitosis intestinales en niños del cantón Ambato, Ecuador. Medicina & Laboratorio. 2023;27:345-56. https://doi.org/10.36384/01232576.686
32. Llerena M, López A, Martínez R, Mayorga E. Prevalencia de parasitosis intestinal en escolares de zonas semirrurales del Ecuador II. Bol. Malariología y Salud Ambiental. 2022; LXII(3): 397-402
33. Tapia-Veloz E, Gozalbo M, Guillen M, Dashti A, Bailo B, Köster PC, et al. (2023). Prevalence and associated risk factors of intestinal parasites among schoolchildren in Ecuador, with emphasis on the molecular diversity of Giardia duodenalis, Blastocystis sp. and Enterocytozoon bieneusi. PLoS Negl Trop Dis 17(5): e0011339. https://doi.org/10.1371/journal.pntd.0011339
34. Eyayu T, Kiros T, Workineh L, Sema M, Damtie S, Hailemichael W, et al. Prevalence of intestinal parasitic infections and associated factors among patients attending at sanja primary hospital, northwest Ethiopia: An institutional-based cross-sectional study. PLoS ONE. 2021;16(2):e0247075 https://doi.org/10.1371/journal.pone.0247075
35. Rivero MR, De Angelo C, Feliziani C, et al. Enterobiasis and its risk factors in urban, rural and indigenous children of subtropical Argentina. Parasitology. 2022;149(3):396-406. https://doi.org/10.1017/S0031182021001955
36. Hamarsheh, O. Epidemiology of enterobiasis in Palestine. Al-Quds J Acad Res 2021;1(1):63-67 https://doi.org/10.47874/2021p5