Epidemiological profile of endoparasitoses in preschoolers and school children of the school district of Sinop - state of Mato Grosso

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ABSTRACT

Introduction: Protozoa and helminths cause enteroparasitoses, which constitute an important public health issue. Preschoolers and school children, who do not have a fully developed immune system, are more vulnerable to contamination by intestinal parasites because they are more exposed to risk factors, such as poor hygiene habits and crowding in closed places. The most common parasites affecting this age group include *Giardia lamblia*, *Ascaris lumbricoides*, *Trichuris trichiura*, and hookworms. **Objectives:** To evaluate the prevalence of intestinal parasites in preschoolers, school children, and sandboxes of government schools in the city of Sinop – state of Mato Grosso (MT). **Methods:** This cross-sectional, quantitative study with an experimental design was carried out from July 2015 to September 2016 and included preschoolers and school children aged 3 to 12 years, chosen by convenience sampling from government schools in the school district of the city of Sinop – MT; four schools were in the central region of Sinop, whereas seven schools, attended by children living in the suburban and rural areas, were far from the city center. Fecal samples were collected by the children's family and sent to the schools, from where they were transported to the laboratory for parasitological examination. Sand samples were collected from sandboxes in the play areas of the schools. More specifically,100 g of sand was collected by scraping one of the four quadrants or the center of the sandbox surface or deeper into the sandbox, totaling 10 samples/box. The parasitological methods spontaneous sedimentation described by Hoffmann, active migration described by Rugai, centrifugal-spontaneous flotation described by Faust, and spontaneous flotation described by Willis were used to analyze the fecal and sand samples. **Results:** A total of 646 fecal samples obtained from preschoolers and school children aged 3 to 12 years were evaluated; 21.05% of the samples tested positive for intestinal parasites. As for the sand samples, 100% tested positive for intestinal parasites. In all the fecal and sand samples that tested positive for intestinal parasites, *G. lamblia* predominated, followed by *Toxacara* sp, *Toxoplasma gondii*, *A. lumbricoides*, *Enterobius vermicularis*, *Hymenolepis nana*, *Strongyloides stercoralis*, hookworm, *Entamoeba coli*, *Endolimax nana*, and *Entamoeba hartmanni*, commensal amoebae of the large intestine, were also identified. **Conclusion:** Children aged 6 to 12 years were the most affected by enteroparasitoses. This may be related to poor hygiene habits, which puts these children at greater risk of contamination. The results agree with most epidemiological studies conducted in Brazil and show a high prevalence of enteroparasitoses in children.

Keywords: Parasites, Children, Sand, Feces.

INTRODUCTION

Enteroparasitoses constitute one of the leading public health issues in the world population and contribute to elevated morbidity and mortality rates, especially in emerging countries. In most cases, enteroparasitoses are transmitted orally, but infection may also occur by ingestion of water and food contaminated with parasitic forms. In Brazil, enteroparasitoses have wide geographic distribution and affect mainly children and adolescents aged between 3 and 18 years living in poor socioeconomic conditions. These parasitoses lead to deficits in physical development and cognition, malnutrition, and anemia[1-4].

Dogs and cats frequently circulate freely in children's play areas and leisure areas. If the feces of these animals contain parasites, they contaminate the soil and sand with helminth larvae and eggs and protozoan cysts and oocysts, causing diseases[5-7].

Giardia lamblia, *Ascaris lumbricoides, Trichuris trichiura*, and *Ancylostomas duodenalis* are the most common parasites in preschoolers and school children. Symptoms of contamination, which include diarrhea, abdominal pain, dyspepsia, anorexia, asthenia, weight loss, irritability,

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and sleep disturbances, are usually vague and non-specific, making clinical diagnosis difficult. Various mechanisms, such as mucosal lesion (*Giardia intestinalis*, *Necator americanus*, and *Strongyloides stercoralis*), alterations in bile salt metabolism (*Giardia intestinalis*), competition for food (*Ascaris lumbricoides*), intestinal exudation (*Giardia intestinalis*, *Strongyloides stercoralis*, *Necator americanus*, and *Trichuris trichiura*), promotion of bacterial proliferation (*Entamoeba histolytica*), and hemorrhage (*Necator americanus* and *Trichuris trichiura*) aggravate malnutrition[8-12].

Parasitological examinations encompass specific, sensitive, low-cost laboratory methods essential for diagnosing intestinal parasitosis. For diagnosis, demonstrating the presence of cysts, larvae, and eggs in feces is indispensable. If the presence of parasites is detected, treatment will be necessary, especially if we consider the risk factors associated with the increased prevalence of enteroparasitoses. A definitive cure is achieved after an average of three fecal samples, collected in three consecutive weeks, test negative for the parasite[8-10].

Most cases of enteroparasitoses are not diagnosed, which makes it difficult to determine their prevalence and control their transmission. The lack of epidemiological studies and the fact that the occurrence of enteroparasitoses in northern Mato Grosso state has not been demonstrated have prompted us to evaluate the prevalence of intestinal parasites in preschoolers (aged 3 to 5 years), school children (aged 6 to 12 years), and sandboxes in play areas of government schools in the school district of the city of Sinop – state of Mato Grosso (MT).

METHODS

Study type and target population

This transversal, quantitative study with an experimental design was conducted from July 2015 to September 2016. The city of Sinop, in the north of the state of Mato Grosso, has an estimated population of 148,960 inhabitants. Its school district encompasses 23 Nursery Schools (for preschoolers) and 19 Elementary/Middle Schools (for school children)[13]. Four government schools in the central region of Sinop – MT and seven government schools far from the city center and attended by children living in the suburban and rural areas were selected. The study included preschoolers (aged 3 to 5 years) and school children (aged 6 to 12 years); was authorized by the Health Department of the city of Sinop – MT; and was approved by the Research Ethics Committee of Hospital Júlio Muller of the Federal University of Mato Grosso (CAAE 29314614.0.0000.5541). The children's guardians were informed about the study and signed a Free Informed Consent. Then, the guardians received the collection flasks and were instructed about how to collect and store the fecal samples. The guardians sent the samples to the school on pre-scheduled days, and the samples were transported for analysis in the Laboratory of Parasitological and Microbiological Analyses of the Federal University of Mato Grosso, Sinop Campus, according to the instructions of Resolution RDC 20/2014 of the Board of Directors of the Brazilian Health Surveillance Agency.

Coproparasitological test

For the parasitological test, a single fecal sample was obtained from each preschooler or school child. The parasitological methods for a survey of parasite eggs, larvae, and cysts included spontaneous sedimentation described by Hoffmann[14], active migration described by Rugai[15], and centrifugal-spontaneous flotation described by Faust[16]. The test result reporting the presence or absence of protozoa and/or helminths was sent to the child's guardian for the child to receive adequate treatment.

Parasitological tests on sand samples

Sand samples were collected from sandboxes in the play areas of the selected schools. Three and five samples were collected from central and peripheral schools, respectively. For sample collection, an area of 2 m^2 was established in each sandbox. Then, 100 g of sand was collected by scraping one of the four quadrants or the center of the sandbox surface or deeper into the sandbox,

totaling 10 samples/box. The parasitological methods for the survey of parasite eggs, larvae, and cysts included spontaneous sedimentation described by Hoffmann[14], active migration described by Rugai[15], and spontaneous flotation described by Willis[17], conducted in duplicate. The test results reporting the presence or absence of protozoa and/or helminths were sent to the school for adequate treatment of the contaminated sand.

Statistical analyses

The studied variables were age range (preschoolers aged 3 to 5 years and school children aged 6 to 12 years), gender, etiological agent, sandbox in the play area, and government school location. To determine the statistical significance of the enteroparasitoses and their association with the variables, the Fisher test was used for the dichotomous variables, and the Pearson Chi-square test was used for the categorized variables. Significance was set at $p < 0.05$ by using the software Prism 8 (GraphPad®).

RESULTS

The epidemiological profile of the enteroparasitoses was evaluated in 646 fecal samples–338 and 308 samples were obtained from male and female preschoolers and school children aged 3 to 12 years, respectively. Of the 646 samples, 136 tested positive for intestinal parasites. Of these 136 samples, 25% and 75% were obtained from children attending government schools in the central and peripheral regions of Sinop – MT, respectively. There were no statistical differences in terms of gender or government school location. Nevertheless, positivity was greater in the samples obtained from school children (aged 6 to 12 years) of peripheral schools (57.35%; $p < 0.0287$) as compared to central schools (Table 1).

Table 1

Frequency of positivity for intestinal parasites in children according to gender, age range, and government school location in the city of Sinop – MT

	Government School			
Variables	Central Area n (%)	Peripheral Area n (%)	Total	p-value
Gender				0.2442
Male	19 (13.97)	48 (35.29)	67	
Female	15 (11.03)	54 (39.71)	69	
Aged Range				0.0287*
3 to 5 years	15 (11.03)	24 (17.65)	39	
6 to 12 years	19 (13.97)	78 (57.35)	97	
Type of Intestinal Parasite				0.001***
Protozoa	30 (22.06)	97 (71.32)	127	
Helminths	4 (2.94)	5 (3.68)	9	

n: number of samples. Statistical significance * $p < 0.05$, *** $p < 0.001$.

Among the 34 fecal samples obtained from children attending central schools, 35.29%, 26.47%, 26.47%, 5.88%, 2.94%, and 2.94% tested positive for *G. lamblia*, *E. coli, E. nana, E. vermicularis, A. lumbricoides*, and hookworm, respectively. Among the 102 fecal samples obtained from children attending peripheral schools, 42.16%, 37.25%, 14.71%, 0.98%, 2.94%, 0.98%, and 0.98% tested positive for *G. lamblia*, *E. coli, E. nana, E. hartmanni, A. lumbricoides*, *E. vermicularis*, and *H. nana*, respectively (Figura 1). There were no statistical differences among the evaluated schools. Nevertheless, the samples obtained from school children aged 6 to 12 years and attending peripheral schools presented higher positivity for *G. lamblia,* 29.41% ($p < 0.001$), as compared to the samples obtained from school children attending central schools (Figure 1).

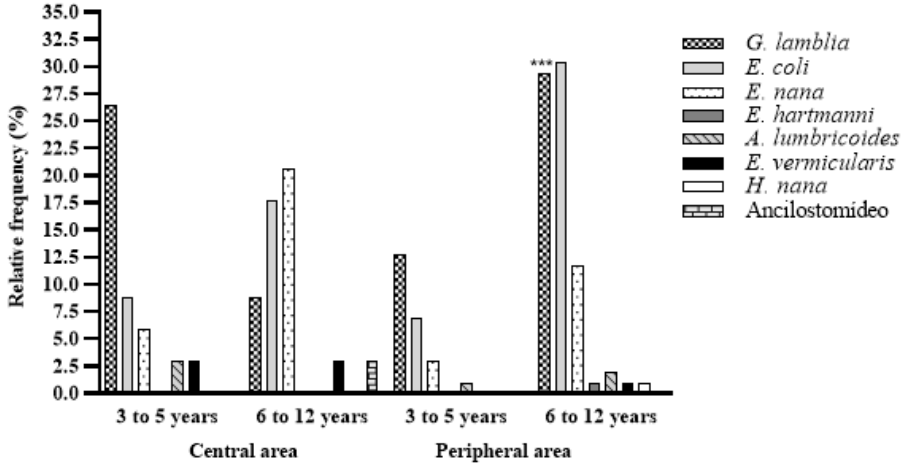

Figure 1: Positivity for protozoa and helminths in fecal samples according to age range and government school location in the city of Sinop – MT. *** Statistical significance $p < 0.001$.

Of the 80 sand samples collected from the play areas of three central schools and five peripheral schools in the city of Sinop – MT, 100% tested positive for *G. lamblia*, followed by 66.66% sand samples collected from central schools and 100% sand samples collected from peripheral schools that tested positive for *Toxocara* sp, 66.66% sand samples collected from central schools and 80% sand samples collected from peripheral schools that tested positive for *Toxoplasma gondii*, 33.33% sand samples collected from central schools and 60% sand samples collected from peripheral schools that tested positive for *A. lumbricoides*, and 33.33% sand samples collected from central schools that tested positive for *Strongyloides stercoralis* (Figure 2).

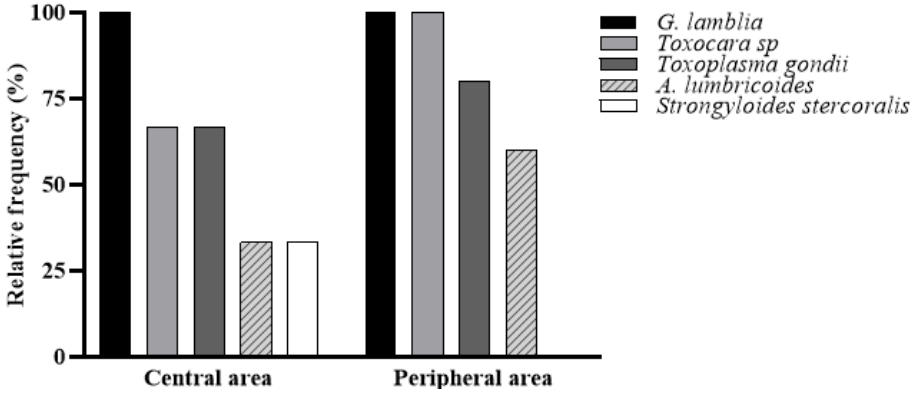

Figure 2: Frequency of positivity for protozoa and geohelminths in sand samples according to government school location.

DISCUSSION

Because temperature and moisture conditions in tropical countries favor the occurrence of enteroparasitoses, these diseases are among the most common and frequent diseases in children aged less than 12 years living in these countries and constitute a major public health issue[1-5].

Here, an evaluation of the epidemiological profile of enteroparasitoses conducted on 646 fecal samples obtained from preschoolers and school children showed that 21.05% tested positive for enteroparasites. Similar data (19.42% positivity for enteroparasites) were found for fecal samples obtained from children aged 3 to 5 years attending government Nursery Schools in Sinop – MT in 2012[2]. Alves et al.[3] reported similar positivity for enteroparasites (27.3%) in children aged 4 to 5 years attending a government Nursery School in Rondonópolis – MT. In Tangará da Serra – MT, 1596 medical records were analyzed, and the positivity for intestinal parasites was 51.4%[4]. According to Santos and Merlini[8], parasitic infections affect various populations, but prevalence is higher in younger children; that is, preschoolers and school children. When we related the positivity for intestinal parasites to gender (female: 50.73% positivity; male: 49.26% positivity), there were no statistical differences, corroborating with the data found by Reuter et al.[9].

In our study, school children (aged 6 to 12 years) attending peripheral government schools presented a greater prevalence of intestinal parasites (57.35%; $p < 0.0287$) as compared to school children attending central government schools. Alves et al.[10] reported similar results—65% positivity for enteroparasites in fecal samples obtained from children aged 6 to 10 years living in the Cajueiro rural settlement in Parnaíba – Piauí.

G. lamblia was the most prevalent (40.44%) protozoan in the fecal samples obtained from preschoolers and school children. Our data agreed with Faleiros et al.[11], Biscegli et al.[12], and Cantuária et al.[13], who reported a greater positivity for *G. lamblia* cysts in fecal samples obtained from preschoolers and school children.

As for commensal protozoa, *E. coli* was the most prevalent (34.55%). Commensal protozoa and pathogenic parasites have similar transmission mechanisms and serve as indicators of the sociosanitary conditions. Therefore, commensal protozoa can be used as a parameter to measure the degree of fecal contamination that children are exposed to[18].

We found similar results when we compared the total number of protozoa and helminths identified in the fecal samples obtained from preschoolers and school children attending central and peripheral government schools in Sinop – MT to findings concerning children living in Alegre and Descanso – state of Santa Catarina and Crato – state of Ceará[21]. It is noteworthy that not only socioeconomic conditions, education level, and basic sanitation, but also practices underlying food preparation and consumption, availability of suitable vectors, and intimate association with animals contribute to the emergence of parasitic infections[22-24].

All the sand samples (100%) collected from sandboxes of the play areas of the selected schools tested positive for *G. lamblia*, followed by 66.66% of sand samples collected from central schools and 100% of sand samples collected from peripheral schools that tested positive for *Toxocara* sp, 66.66% of sand samples collected from central schools and 80% of sand samples collected from peripheral schools that tested positive for *Toxoplasma gondii*, 33.33% of sand samples collected from central schools and 60% sand samples collected from peripheral schools that tested positive for *A. lumbricoides*, and 33.33% of sand samples collected from central schools that tested positive for *Strongyloides stercoralis*. Our results corroborated with the results achieved by other researchers who evidenced high positivity for enteroparasites in sandboxes of Nursery and Elementary/Middle Schools, thereby demonstrating another means of contamination—contact with soil/sand during play time[5-7]. Araújo[6] (2008) showed that 37.5% of the children who had access to the play area of a Nursery School in the city of Campo Grande/MT were contaminated with cutaneous *Larva migrans*.

It is worth noting that enteroparasites may harm preschoolers and school children, significantly delaying growth and cognitive development[1-4].

Adherence to the present project was low because fecal sample collection depended on the children's guardians. When fecal or sand samples tested positive for enteroparasites, the results were sent to the Health and Education Departments of the city of Sinop – MT, and the implementation of programs for controlling parasitic diseases was suggested to prevent parasitoses. In addition, measures to reduce contamination, like covering sandboxes with a tarp while not in use, keeping sandboxes inside a fence, treating sandboxes with 30% calcium chloride and 10% sodium hypochlorite weekly, and mixing surface and deeper sand and sand exposed to the sun with non-exposed sand were recommended.

CONCLUSION

Our results showed 71.32% positivity for enteroparasites in school children, aged 6 to 12 years. These results agreed with most epidemiological studies conducted in Brazil and demonstrate the need for adopting prophylactic sanitary education measures for preventing and controlling intestinal parasitoses in government schools of Sinop – MT.

REFERENCES

1. Rocha A, Mendes RA, Barbosa CS. *Strongyloides* spp e outros parasitos encontrados em alfaces (*Lactuca sativa*) comercializados na cidade do Recife, PE. Rev Patol Trop. 2008; 37(2):151-160. https://doi.org/10.5216/rpt.v37i2.5046
2. Muchiutti B, Lima LLA, Gabriel D, Escobar M, Garcia FMP, Lima A. Prevalência de Parasitoses Intestinais em Crianças de Creches no Município de Sinop-MT. Scientific Electronic Archives. 2013, 2: 19-22.
3. Alves KL, Soares RP, Dias LJS, Pratavieira TRS, Ferro MM, Corrêa CRA et. al. Enteroparasitismo e características socioambientais de crianças de uma creche de Mato Grosso. Rev. Bras. Pesq. Saúde. 2013; 15(4): 63-8. https://doi.org/10.21722/rbps.v15i4.7600
4. Tiago PV, Costa M S, Perassolo V, Souza EM, Gomes M. Prevalência de parasitoses intestinais em pacientes da unidade mista de saúde em Tangará da Serra, Mato Grosso, Brasil. Revista de Ciências Agro-Ambientais. 2005; 3: 117-124.
5. Rodrigues MM, Araújo A, Machado D, Fonseca FAR, Ribeiro Júnior MA. A Importância das Condições de Higiene em Áreas de Recreação Infantil Maria Margarida. Anais do 2º Congresso Brasileiro de Extensão Universitária, Belo Horizonte, 2004.
6. Araújo NS, Rodrigues CT, Cury MC. Helmintos em caixas de areia em creches da cidade de Uberlândia, Minas Gerais. Rev Saúde Pública. 2008; 42: 150-53. http://dx.doi.org/10.1590/S0034-89102008000100021.
7. Figueiredo MIO, Wendt EW, Santos HT, Moreira CM. Levantamento sazonal de parasitos em caixas de areia nas escolas municipais de educação infantil em Uruguaiana, RS, Brasil. Rev Patol Trop. 2012; 41(1):36-46. http://doi.org/10.5216/rpt.v41i1.17744.
8. Santos AS, Merlini LS. Prevalência de enteroparasitose na população do município de Maria Helena, Paraná. Ciência e Saúde Coletiva. 2010; 15(3): 899-905. https://doi.org/10.1590/S1413-81232010000300033.
9. Reuter CP, Silva Furtado LBF, da Silva R, Pasa L, Klinger EI, Santos CE et al. Frequência de parasitoses intestinais: um estudo com crianças de uma creche de Santa Cruz do Sul – RS. Revista do Departamento de Educação Física e Saúde e do Mestrado em Promoção da Saúde da Universidade de Santa Cruz Do Sul – Cinergis. 2015; 16(2):142-47. http://dx.doi.org/10.17058/cinergis.v16i2.6426.
10. Alves FV, Souza AC, Guimarães HR, Amorim ACS, Cruz MA, Santos BS. Aspectos epidemiológicos das enteroparasitoses em crianças domiciliadas em um assentamento rural no nordeste brasileiro. Rev Elet Ac Saúde. 2014; 6(3): 666-76.
11. Faleiros JMM, Gallo G, Silva MMK, Raful R, Nasorri AR, Pipino LFR et al. Ocorrência de enteroparasitoses em alunos da escola pública de ensino fundamental do município de Catanduva (São Paulo, Brasil). Rev Inst Adolfo Lutz. 2004; 63: 243-47.
12. Biscegli TS, Romera J, Candido AB, dos Santos JM, Candido ECA, Binotto AL. Estado nutricional e prevalência de enteroparasitoses em crianças matriculadas em creche. Rev Paul Pediatr. 2009; 27(3): 289-95. https://doi.org/10.1590/S0103-05822009000300009.
13. Cantuária FD, Cocco J, Bento RRL, Ribeiro F. Avaliação de parasitoses intestinais em escolares do ensino fundamental no município de Coração de Jesus em Minas Gerais Brasil. RBAC. 2011; 43(4): 277-83.
14. Hoffman WA, Pons JA, Janer JL. The sedimentation concentration method in schistosomiasis. Puerto Rico. Journal of Public Health. 1934; 9: 281-8.
15. Rugai E, Mattos T, Brisola AP. Nova técnica para isolar larvas de nematoides das fezes - modificação do método de Baermann. Rev Inst Adolfo Lutz. 1954; 14: 5-8.
16. Faust EC, Sawitz W, Tobie J, Odom V, Peres C, Lincicome DR. Comparative efficiency of various technics for the diagnosis of Protozoa and helminths in feces. J. Parasit. 1939; 25(3): 241-62.

17. Willis HH. A simple levitation method for the detection of hookworm ova. Medical Jornal of Australia. 1921; 8: 375- 6.

18. Machado ER, Santos DS, Costa-Cruz JM. Enteroparasites and commensal among children in four peripheral districts of Uberlândia, State of Minas Gerais. Rev Soc Bras Med Trop. 2008; 41(6):581-5. https://doi.org/10.1590/S0037-86822008000600007.

19. Rocha RAP, Pàgio RB, Miranda AEB, Pereira FEL, Maciel ELN. Determinantes das parasitoses intestinais em população infantil de assentamentos rurais do município de Alegre, ES. Revista Brasileira de Pesquisa em Saúde. 2012; 14(1): 26-35.

20. Oro D, Joproski GK, Oro NA, Sbardelotto C, Seger J. Prevalência de parasitas intestinais em crianças de Descanso-Santa Catarina-Brasil. Unoesc & Ciência- ACBS. 2010; 1(2): 151-6.

21. Vasconcelos IAB, Oliveira JW, Cabral FRF, Coutinho HDM, Irwin Rose Alencar Menezes. Prevalência de parasitoses intestinais entre crianças de 4-12 anos no Crato, Estado do Ceará: um problema recorrente de saúde pública. Acta Scientiarum Health Sciences. 2011; 3(1): 35-41. doi: 10.4025/actascihealthsci.v33i1.8539.

22. Capuano DM, Rocha GM. Ocorrência de parasitas com potencial zoonótico em fezes de cães coletadas em áreas públicas do município de Ribeirão Preto, SP, Brasil. Rev Bras Epidemiologia. 2006; 9(1): 81-6. https://doi.org/10.1590/S1415-790X2006000100010.

23. Zaiden MF, Santos BMO, Cano MAT, Nascif Júnior LA. Epidemiologia das parasitoses intestinais em crianças de creches de Rio Verde - GO. Medicina (Ribeirão Preto). 2008; 41(2): 182-87. https://doi.org/10.11606/issn.2176-7262.v41i2p182-187.

24. Borges,WF, Marciano FM, Oliveira HB. Parasitos intestinais: elevada prevalência de *Giardia lamblia* em pacientes atendidos pelo serviço público de saúde da região sudeste de Goiás, Brasil. Rev Pat Trop. 2011; 40(2): 149-57. https://doi.org/10.5216/rpt.v40i2.14940

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2. P.A.: Help with enteroparasite identification in fecal samples and manuscript drafting
3. T.S.A.A.: Sand sample collection and analysis
4. N.S.C.: Help with enteroparasite identification in fecal samples
5. C.B.: Help with enteroparasite identification in fecal samples
6. F.C.D: Research project development, identification of enteroparasites in fecal and sand samples, drafting of exam results, manuscript drafting.

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