Epidemiological profile of enteroparatism in riverine communities of the Brazilian Amazon

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ABSTRACT

In the Brazilian Amazon, there are few studies related to the epidemiological profile of enteroparasitism, especially with regard to riverine populations. For this reason, a retrospective study was carried out in five riverine communities in the municipality of Coari, in the middle Solimões-Amazonas, in a sample universe of 256 individuals. The results of the study showed a positivity of 67.57%, with monoparasitism by the species Ascaris lumbricoides being the most frequent. The analysis of the epidemiological variables related to enteroparasitic infection showed statistical significance ($p < 0.05$) for water piping, drinking water treatment, sanitary sewage and family income of less than one minimum wage, suggesting that the high prevalence may be associated with the poor economic and sanitary conditions in which the riverine populations of the Amazon Region live. Thus, considering that the high prevalence is directly related to the precarious sanitary and housing conditions and economic aspects in which the riverside dwellers live, the need for a sanitary policy to combat these infections is emphasized, respecting the cultural peculiarities of these populations with a view to community engagement, in order to successfully implement and develop programs to control these parasitic conditions.

Keywords: Enteroparasitosis, Epidemiology, Riverine Animals, Amazon.

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INTRODUCTION

Enteroparasites represent a serious public health problem worldwide, affecting mainly developing countries, and are neglected tropical diseases. According to the World Health Organization, it is estimated that about 1.4 billion individuals are infected with *Ascaris lumbricoides*, followed with little difference by *Trichuris trichiura* and hookworms (WHO, 2020).

Worldwide, enteroparasites have been little studied and researched due to the lack of exploratory studies of these data. This situation is not different from that found in Brazil, as reported by Ferraz *et al*. (2014), epidemiological studies are carried out in a fragmented manner due to the difficulties encountered in organizing large epidemiological surveys that contemplate all the regional and social characteristics involved.

The prevalence of intestinal parasite infections is one of the best indicators of the socioeconomic status of a population (FREI *et al*, 2008) and can be associated with several determinants, such as inadequate sanitation, fecal pollution of water and food consumed, socioeconomic factors, host age, and type of infecting parasite (GAMBOA *et al,* 2003).

In the national scenario, although Brazil has undergone changes in recent decades that have improved the quality of life of its population, intestinal parasitosis is still endemic in several areas of the country, especially in the North and Northeast regions, which show increases in the dissemination of these agents, due to the socioeconomic and sanitary conditions of their populations (FONSECA *et al,* 2010).

Enteroparasitic infections are considered diseases closely related to socio-sanitary conditions (MENEZES *et al*, 2013), so high prevalences fundamentally involve the sector of the human population that lives in precarious sanitation conditions, including housing, soil type and climatic variations, conditions that guide the daily life of riverside communities (SANTOS *et al*, 2010). Among these risk factors, basic sanitation in the Amazon riverine area seems to be the most predisposing indicator for parasitic infection, since one of the main routes of parasitic dissemination and contamination is through contaminated water (COURA *et al*, 1993).

A higher prevalence of enteroparasite infection is certainly associated with social, economic and cultural factors that provide favorable conditions for its expansion, especially in regions where environmental factors favor the maintenance of parasitic cycles, evidencing the need for studies on the epidemiological profile of enteroparasitosis (ARAÚJO, 2005).

In Brazil, few regions carry out studies on the epidemiology of enteroparasites, which makes it impossible to measure these diseases. In the northern region, epidemiological studies addressing the occurrence of intestinal parasites in Amazonian riverine populations are scarce, which makes it impossible to outline a better dimensioning and elaboration of control measures by the competent authorities, so the objective of this study was to survey the epidemiological profile of

enteroparasitism in five riverside communities of the municipality of Coari in the middle Solimões, aiming to contribute to the knowledge of the epidemiological panorama of these diseases in the Brazilian Amazon.

METHODOLOGY

This is a cross-sectional, analytical and retrospective study, through the analysis of data obtained and linked to the research project approved within the scope of proposals submitted to the Research Program for SUS/Shared Management in Health, Public Notice 007/2009, in the Agreement signed with the Ministry of Health – MS, the National Council for Scientific and Technological Development (CNPq) and the Government of the State of Amazonas. through the Foundation for Research Support of the State of Amazonas - FAPEAM and in partnership with the Department of Health of the State of Amazonas - SUSAM. The study was submitted to the evaluation and approval opinion of the Research Ethics Committee of UFAM, and approved according to CAAE 0299011500010.

The analyzed sample included 256 individuals, aged from 01 to 85 years, randomly selected, and residing in the riverside communities of Itapéua, Saubinha, Nossa Senhora do Livramento, São José do Saúba and Grande Vitória, located in the municipality of Coari in the middle Solimões, in the state of Amazonas. Due to the distance between the riverside communities and the city of Coari, the project team went to the communities for home visits that aimed to explain the importance of the study and seek acceptance in the participation, as well as for the collection of samples and for the delivery of the results.

The epidemiological survey was carried out with the application of a socio-environmental questionnaire, with questions aimed at identification, obtaining data on socioeconomic, hygienic and sanitary conditions, in addition to the parasitic symptoms presented.

The coproparasitological analysis was performed according to the method of Faust *et al* (1938) and Hoffman, Pons and Janer (1934). For each fecal sample, 3 scan slides were used, and the test was repeated for each negative result in order to give a greater margin of safety to the results.

The data obtained in the parasitological survey were analyzed using appropriate statistical tests to detect or not the differences between the sample proportions among the group under study. The computer program used was BioEstat 5.0 (AYRES, 2000) and the statistical significance was accepted at the level of 95%.

RESULTS

The analyses of the population universe studied are represented in **table 01**, and reveal the sample stratification by riverine communities. The$_{\text{total N}}$ consisted of 256 individuals, with the

communities of Itapéua (67/256) and Saubinha (66/256) having the highest number of samples. Regarding the enteroparasitic analysis, the prevalence of 67.7% (173/256) of positivity and 32.53% of negativity was obtained. The communities with the highest percentage of enteroparasitized individuals were Itapéua (82.1%) and São José do Saubá (81.1%), while the highest percentage of negative individuals (55%) was observed in the community of Nossa Senhora do Livramento.

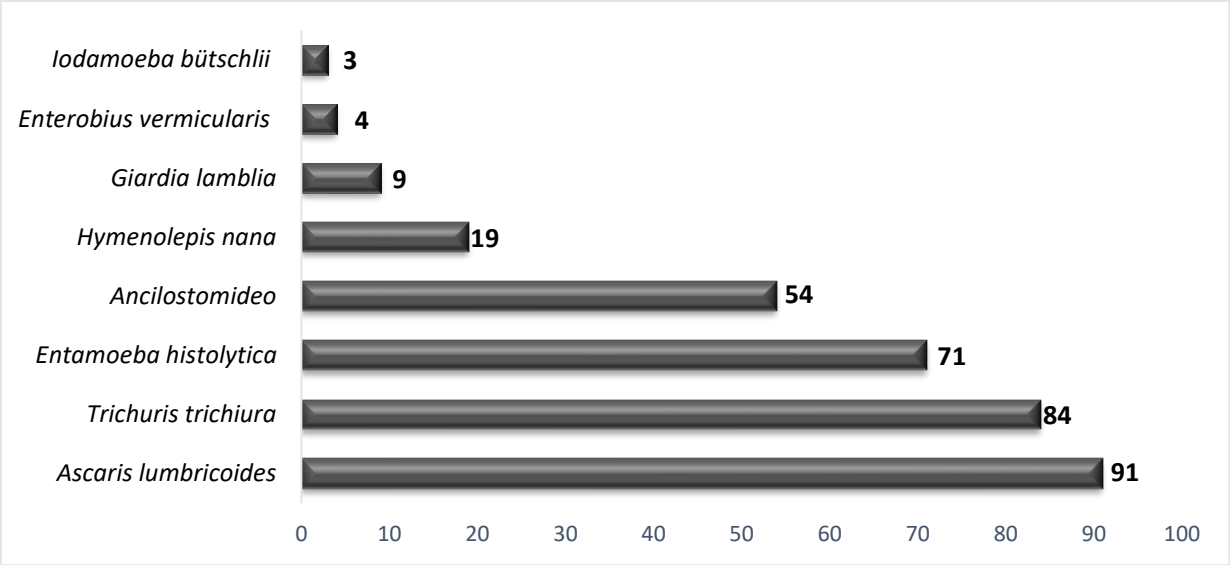
TABELA 01- Prevalência (%) dos Quadros Parasitários nas Comunidades Ribeirinhas da Amazonia Brasileira.

			QUADRO PARASITÁRIO			
COMUNIDADE	**N Amostral**	**%**	**POSITIVO**	**%**	**NEGATIVO**	**%**
SÃO JOSÉ DO SAUBÁ	37	100%	30	81,1%	07	18,9%
NOSSA SENHORA DO LIVRAMENTO	40	100%	18	45%	22	55%
GRANDE VITÓRIA	46	100%	30	65,22%	16	34,78%
SAUBINHA	66	100%	40	60,6%	26	39,4%
ITAPÉUA	67	100%	55	82,1%	12	17,9%
N TOTAL	***256***	***100%***	***173***	***67,57%***	***83***	***32,53%***

FONTE: GUIMARÃES J., 2024

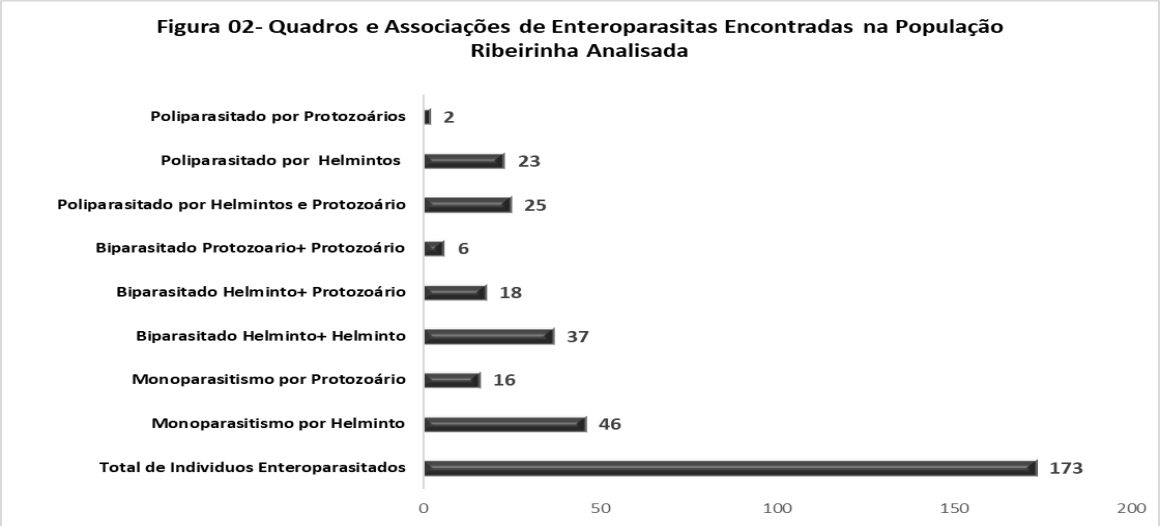
The main enteroparasites found in the analyzed sample are shown in **Figure 01**, with the most prevalent being helminthic infections by *Ascaris lumbricoides* (91/173) and *Trichuris trichiura (*84/173). Among the protozoa, amebiasis prevailed (71/173).

Figure 01 - Enteroparasites Found in the Riverine Population Studied.



Source: Guimarães J. (2024)

The enteroparasitic pictures and associations are shown in **Figure 02**. Of the 173 (67.57%) parasitized individuals, it was observed that helminth monoparasitism was the most frequent (n=46). Associations of biparasitism and polyparasitism occurred in the following quantitative order: helminth biparasitism n=37, helminth + protozoan biparasitism n= 18; Helminth polyparasitism + Protozoa n= 25.



Source: Guimarães J. (2024)

The analyses referring to the epidemiological variables possibly associated with enteroparasitism in the investigated population are presented in **Table 02**, among the variables studied and the categories exposed, the following were included: Gender, age, housing structure, water piping, drinking water treatment, sanitary sewage and family income.

Regarding the age group, statistically significant differences were found when associated with parasitism. There was a predominance of children in the analyzed population (n=141), with a higher number (93/173) of enteroparasitized patients in this age stratification.

When comparing females and males, it was observed that there was a predominance of females with 165/256 representatives. Statistically significant differences were obtained when this variable was associated with parasitic infection.

The analysis of the housing conditions of the riverside population showed that most of the houses are structured in 207/256 wood, although when this variable was related to parasitic infection, no statistically significant difference was obtained.

Among the 173 enteroparasitic individuals, statistical significance was observed for the association of the parasitic condition with the variables water piping, drinking water treatment, sanitary sewage and family income of less than one minimum wage. It was possible to observe high frequencies of parasitism among individuals who did not have water pipes, who used direct supply of river water, with a percentage of 74.5%. Regarding water treatment before consumption, 77.67% who reported not treating the water consumed were enteroparasitic. It was interesting to note the prevalence of 81.91% of positivity among individuals who did not have sanitary sewage and septic tank.

Tabela 02- Análise das Variáveis Epidemiológicas Associadas ao Enteroparasitismo na População Ribeirinha Estudada.

	Enteroparasitismo Positivo		Enteroparasitismo Negativo			Estatística
Variável	**n**	**%NT**	**n**	**%NT**	**NT**	
Idade						
0 -17	93	**65,96%**	48	**34,04%**	141	***X²= 97.834***
18-85	80	**69,56%**	35	**30,44%**	115	****(p)= <0.0001***
Total	**173**	**67,58%**	83	**32,4%**	**256**	
Sexo						
Masculino	60	**65,93%**	31	**34,07%**	91	***X²= 98.687***
Feminino	113	**68,48%**	52	**31,52%**	165	****(p)= <0.0001***
Total	**173**	**67,58%**	**83**	**32,42%**	**256**	
Estrutura da Moradia						
Madeira	134	**64,73%**	73	**35,27%**	207	Teste G de
Tijolos	12	**66,7%**	6	**33,3%**	18	Williams=
Palha	17	**80,95%**	4	**19,5%**	21	10.0750
Taipa	10	**100%**	-	**-**	10	*(p)= 0.0179*
Total	**173**	**67,58%**	**83**	**32,42%**	**256**	
Água: Canalização Interna						
Sim	35	**49,3%**	36	**50,7%**	71	***X²= 14.988***
Não	138	**74,6%**	47	**25,4%**	185	****(p)= <0.0002***
Total	**173**	**67,58%**	**83**	**32,42%**	**256**	
Tratamento da água de consumo						
Sim	20	**33,9%**	39	**66,1%**	59	***X²= 39.694***
Não	153	**77,67%**	44	**22,33%**	197	****(p) = <0.0001***
Total	**173**	**67,58%**	**83**	**32,42%**	**256**	
Esgoto sanitário: Canalizado e fossa séptica						
Sim	10	**17,55%**	47	**82,45%**	57	***X²= 83.782***
Não	163	**81,91%**	36	**18,09%**	199	****(p) = <0.0001***
Total	**173**	**67,58%**	**83**	**32,42%**	**256**	
Renda Familiar						
≤ 1 salário mínimo	168	**77,06%**	50	**22,94%**	218	***X²= 60.318***
≥ 1 salário mínimo	05	**13,16%**	33	**86,84%**	38	****(p)= <0.0001***
Total	**173**	**67,58%**	**83**	**32,42%**	**256**	

FONTE: GUIMARÃES J., 2024

DISCUSSION

The results obtained from the high prevalence of enteroparasitic diseases in all riverine communities studied showed correspondence with other epidemiological studies of intestinal parasitosis carried out in Brazil ((FONSECA, 2010); (HURTADO & ALENCAR, 2005); (SAINTS *et al.*, 2010); (VISSER *et al*, 2011)).

In studies conducted by Santos *et al.* 2010, in pediatric populations bordering Coari-AM, *A. lumbricoides* and *T. trichiura* were the most commonly found helminths. The transmission of these enteropathogens most frequently found in the population, especially the riverine population, is associated with different factors, including the water consumed directly from the river without treatment, care in the preparation and consumption of food and personal hygiene habits, and since the main form of transmission of these parasites is the fecal-oral route, and due to the similarity in the transmission of these infectious agents, this may be the associative link of the high prevalence observed in most parasite studies carried out in Brazil (FONSECA, 2010; HURTADO & ALENCAR, 2005; SILVA *et al*, 2009).

The parasitic pictures and associations raised in this study revealed that monoparasitism by helminths was the most frequent, these results corroborate those observed in research conducted by Santos in 2017 and by Soares *et al* in 2020, who report that the predominance of monoparasitism may be related to the fact that the parasites compete for the same space, excluding one of the species, or is related to the infected environment with distinct species.

The epidemiological survey revealed that some variables in the present study are related to enteroparasitism. Some factors favor the transmission and acquisition of these pathogens, such as the origin of the water for consumption, water treatment, type of cesspool, sanitation and family income. Poor hygiene habits, associated with inefficient basic sanitation, favor soil and water source contamination, keeping the parasite prevalence high in these communities (SOARES et al, 2018).

Studies conducted by Zaiden *et al.* 2008, concluded that school-age children are the most susceptible, as they represent a high-risk group for infections by parasites transmitted through soil and water, and because they are in a period of intense physical growth and rapid metabolism, resulting in increased nutritional needs, and the organism is an ideal place for the growth and maturation of the parasite, because the supply of vital elements is constant and abundant (SILVA *et al*, 2015). Our findings are consistent with these studies, since in our study it was in this age group that the highest number of positive individuals was found. This high number can also be associated with typical behaviors of this age, such as inadequate hygienic and sanitary habits and intimate and constant contact with contaminated soil.

In relation to gender, the high prevalence observed among females can be partly explained by the fact that the greater number of individuals who agreed to participate in this study belonged to the

female reference, and mainly because culturally women seek self-care, extending it to their offspring. Men undergo fewer tests, this seems to occur because the culture of society reaffirms the belief that men do not need prophylaxis and care (GOMES *et al*, 2007).

The statistically significant differences obtained for the association between enteroparasitism and the origin of drinking water, water treatment, type of cesspool, sanitation and family income reveal that these socioeconomic indicators demonstrate a close and linear correlation with parasite acquisition, showing that individuals belonging to the poorest quartile of the population studied were more likely to become infected and develop an enteroparasitic condition. This is in agreement with studies by Ferreira *et al*, 2005 and Prado *et al*, 2001, which highlight a significant relationship between these variables.

In addition, the parasites identified in the study have mechanisms of fecal-oral transmission, which indicates environmental contamination by fecal waste, which is plausible of acceptance, when considering the precarious sanitary conditions obtained from the epidemiological survey carried out in these communities. In this study, 74.6% of the research participants did not have water pipes, 77.67% did not perform treatment in the drinking water and 81.91% did not have a sewage system and septic tank. Considering the small size of the communities and the high pulviometric index of the Amazon region, contamination by river waste is an obvious consequence, obtained from the epidemiological characteristics surveyed in this study, effectively contributing to the high frequency of parasitosis observed in this population. These findings reinforce the need for prophylactic actions to promote and educate health, infrastructure and basic sanitation. (MARA *et al*, 2010)

In areas where financial precariousness is high, a higher risk of pathologies is expected (FERREIRA *et al*, 2005). In this research, the high number of parasitized individuals, who reported having a family income of less than one minimum wage/month, shows that individuals with low income and low social class, who live in areas of inadequate collective and personal hygiene conditions, are the most susceptible to intestinal parasite diseases, evidencing the way that these economic conditions, They determine various aspects of life and directly influence the health-disease process. (SANTOS *et al*, 2019).

CONCLUSION

Considering the joint analysis of epidemiological data and the high prevalence of enteroparasitism, there is a direct relationship between these parasites and the variables of precarious sanitary conditions and economic aspects in which the riverside communities studied live. Thus, the need to implement a health policy to combat these infections is emphasized.

In this context, it is necessary to promote immediate intervention programs with regard to the combat, control and treatment of these parasites. These policies need to have as their central imprint,

health education actions that culminate in changes in the hygiene habits of riverside dwellers; In addition to improvements in housing conditions and basic sanitation, in order to successfully implement and develop programs to control these infections.

The results obtained in this study emphasize the real and immediate need for the implementation of prophylactic and care actions, which culminate in cultural changes in the riverside population, with the establishment of detectable effects on the hygienic habits already crystallized in the daily lives of these communities. Behavioral changes in the community are necessary to achieve improvements in the overall health status of these individuals, both in the transmission of enteroparasitosis and/or in the transmission of other infectious diseases.

REFERENCES

1. Araújo, C. F., & Fernández, C. L. (2005). Prevalência de parasitoses intestinais na cidade de Eirunepé, Amazonas. *Revista da Sociedade Brasileira de Medicina Tropical*, 38(1), 69-69. https://doi.org/10.1590/s0037-86822005000100016

2. Ayres, M., Ayres Jr, R. M., Ayres, D. L., & Santos, A. S. (2000). *BioEstat 5.0: aplicações estatísticas nas áreas das ciências biológicas e médicas*. Belém: Sociedade Civil Mamiraua.

3. Coura, J. R., Willcox, H. P. F., Albuquerque, B. C., Lorenzi, A. G., Barroso, D. E., Lalama, E. M. E., Gonçalves, E. G. R., Guerra, J. A. Ó., Vacamarin, M. A., & Sá-Neto, R. P. (1993). Aspectos epidemiológicos, sociais e sanitários em áreas do Médio Solimões. I. Estudo nas localidades de São Francisco do Laranjal, Aranaí e São Lázaro do Surubim, Município de Coari, Amazonas. *Anais da Academia Nacional de Medicina*, 153, 122-126.

4. Faust, E. C., et al. (1938). A Critical Study of Clinical Laboratory Technics for the Diagnosis of Protozoan Cysts and Helminth Eggs in Feces. *American Journal of Tropical Medicine and Hygiene*, 18(2), 169-183.

5. Ferraz, R. R. N., Barnabé, A. S., Porcy, C., Júnior, A. D., Feitosa, T., & Figueiredo, P. M. (2014). Parasitoses intestinais e baixos índices de Gini em Macapá (AP) e Timon (MA), Brasil. *Cadernos de Saúde Coletiva*, 22(2), 173-176.

6. Ferreira, G. R., & Andrade, C. F. S. (2005). Alguns aspectos socioeconômicos relacionados a parasitoses intestinais e avaliação de uma intervenção educativa em escolares de Estiva Gerbi, SP. *Revista da Sociedade Brasileira de Medicina Tropical*, 38, 402-405.

7. Fonseca, E. O. L., Teixeira, M. G., Barreto, M. L., Carmo, E. H., & Costa, M. C. N. (2010). Prevalência e fatores associados às geo-helmintíases em crianças residentes em municípios com baixo IDH no Norte e Nordeste brasileiros. *Cadernos de Saúde Pública*, 26(1), 143-152. https://doi.org/10.1590/S0102-311X2010000100015

8. Frei, F., Juncansen, C., & Ribeiro-Paes, J. T. (2008). Levantamento epidemiológico das parasitoses intestinais: viés analítico decorrente do tratamento profilático. *Cadernos de Saúde Pública*, 24(12), 2919-2925. https://doi.org/10.1590/s0102-311x2008001200021

9. Gamboa, M. I., Basualdo, J. A., Córdoba, M. A., Pezzani, B. C., Minvielle, M. C., & Lahitte, H. B. (2003). Distribution of intestinal parasitoses in relation to environmental and sociocultural parameters in La Plata, Argentina. *Journal of Helminthology*, 77, 15-20.

10. Gomes, R., Nascimento, E. F., & Araujo, F. C. (2007). Por que os homens buscam menos os serviços de saúde do que as mulheres? As explicações de homens com baixa escolaridade e homens com ensino superior. *Caderno de Saúde Pública*, 23, 565-574.

11. Hoffman, W. A., Pons, J. A., & Janer, J. L. (1934). Sedimentation concentration method in schistosomiasis. *Public Health*, 9, 283-298.

12. Hurtado-Guerrero, A. F., Alencar, F. H., & Hurtado-Guerrero, J. C. (2005). Ocorrência de enteroparasitas na população geronte de Nova Olinda do Norte Amazonas, Brasil. *Acta Amazonica*, 35(4), 487-490.

13. Mara, D., Lane, J., Scott, B., & Trouba, D. (2010). Sanitation and health. *PLOS Medicine*, 7(11).

14. Menezes, R. A. O., Gomes, M. S., Brabos, F. H., Brito, G. C., Proietti Junior, A. A., & Couto, A. A. (2013). Intestinal Parasites in resident population in humid area in Macapa, Amapa, Brazil. *Revista de Biologia e Ciências da Terra*, 13(2), 10-18.

15. Pedrazzani, E. S., Mello, D. A., Pizzigatti, C. P., Pripas, S., Fucci, M., & Santoro, M. C. M. (1989). Helmintoses intestinais. III – Programa de educação e saúde em verminose. *Revista de Saúde Pública*, 23, 189-195.

16. Prado, M. da S., et al. (2001). Prevalência e intensidade da infecção por parasitas intestinais em crianças na idade escolar na cidade de Salvador (Bahia, Brasil). *Revista da Sociedade Brasileira de Medicina Tropical*, 34(1), 99-101.

17. Santos, F. S., Gama, A. S. M., Fernandes, A. B., Reis Junior, J. D. D., & Guimarães, J. (2010). Prevalência de enteroparasitismo em crianças de comunidades ribeirinhas do Município de Coari, no médio Solimões, Amazonas, Brasil. *Revista Pan-Amazônica de Saúde*, 1(4), 23-28. https://doi.org/10.5123/S2176-62232010000400004

18. Santos, P. H. S., et al. (2017). Prevalence of intestinal parasitosis and associated factors among the elderly. *Revista Brasileira de Geriatria e Gerontologia*, 20(2), 244-253.

19. Santos, T. V., Santos, R. de C. M., & Martins, V. H. S. (2019). Prevalência e aspectos epidemiológicos de enteroparasitoses em crianças no Brasil. *Research, Society and Development*, 8(6), e20861042. https://doi.org/10.33448/rsd-v8i6.1042

20. Silva, E. F., Silva, E. B., Almeida, K. S., Sousa, J. J. N., & Freitas, F. L. C. (2009). Enteroparasitoses em crianças de áreas rurais do município de Coari, Amazonas, Brasil. *Revista de Patologia Tropical*, 38(1), 35-43.

21. Silva, P. H. M., Lima, W. F., Castro, T. M. B. Q., & Sousa, L. G. (2015). Contaminação do solo de áreas de recreação infantil de creches públicas por *Ancylostoma* sp. e *Toxocara* sp. em Teresina-PI. *Revista Interdisciplinar*, 8(4), 93-98.

22. Soares, A. L., Oliveira, E. A. N., & Souza, I. F. A. C. (2018). A importância da educação sanitária no controle e prevenção ao *Ascaris lumbricoides* na infância. *Caderno de Graduação - Ciências Biológicas e da Saúde - FACIPE*, 3(3), 22.

23. Soares, I. A., Zotti, A. P., Gnoatto, E. S., Pletsch, F., & Brock, G. M. C. (2020). Parasitoses intestinais em crianças de centros municipais de educação infantil. *Varia Scientia - Ciências da Saúde*, 6(1), 9-17.

24. Visser, S., Giatti, L. L., Carvalho, R. A. C., & Guerreiro, J. C. H. (2011). Estudo da associação entre fatores socioambientais e prevalência de parasitose intestinal em área periférica da cidade de Manaus (AM, Brasil). *Ciência e Saúde Coletiva*, 16(8), 3481-3492.

25. World Health Organization (WHO). (2020). Soil-transmitted helminth infections. Geneva: WHO. Disponível em: https://www.who.int/news-room/fact-sheets/detail/soil-transmitted-helminth-infections

26. Zaiden, M. F., Santos, B. M. O., Cano, M. A. T., & Nascif, L. A. Jr. (2008). Epidemiologia das parasitoses intestinais em crianças de creches de Rio Verde-GO. *Medicina (Ribeirão Preto)*, 41(2), 182-187.