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BOOKS AND POTENTIAL PARASITIC CONTAMINATION IN A UNIVERSITY LIBRARY IN THE NORTH OF ESPÍRITO SANTO

LIVROS E POTENCIAL CONTAMINAÇÃO PARASITÁRIA EM UMA BIBLIOTECA UNIVERSITÁRIA DO NORTE DO ESPÍRITO SANTO

LIBROS Y POTENCIAL CONTAMINACIÓN PARASITARIA EN UNA BIBLIOTECA UNIVERSITARIA DEL NORTE DE ESPÍRITO SANTO

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ABSTRACT

Enteroparasitosis is a serious public health problem worldwide. In Brazil, despite the relevance and topicality of the problem, few studies have carried out parasitological analyzes on surfaces. This study sought to carry out parasitological evaluations on books in the university library at Ceunes/UFES, São Mateus-ES. The method proposed by Graham, with modifications, popularly known as the tape method or duct tape method, which consists of affixing adhesive tape to tactile aids, was used to carry out the analysis. During the period from September 2022 to August 2023, 100 books were analyzed. Of a total of 300 samples obtained for analysis, 17 (5.67%) tested positive: 6 (35.29%) for *Entamoeba coli*, 5 (29.41%) for *Ascaris lumbricoides*, 2 (11.76%) for *Taenia* sp., 2 (11.76%) for *Hymenolepis nana*, and 2 (11.76%) for *Ancylostoma* sp. Considering that enteroparasitoses are intestinal infections transmitted through the ingestion of water, food, or contaminated hands, the results of this study alert us to the need to improve individual hygiene processes, given the significant finding of parasitic forms in textbooks widely used by students.

RESUMO

As enteroparasitoses representam um sério problema de saúde pública de cunho mundial. No Brasil, apesar da relevância e atualidade do problema são poucos os trabalhos que realizam análises parasitológicas em superfícies. Nesse sentido, o presente estudo buscou realizar avaliações parasitológicas em livros da biblioteca universitária do Ceunes/UFES, São Mateus-ES. Para a realização das análises foi utilizado o método proposto por Graham, com modificações, conhecido popularmente como método da fita ou método de fita durex, que consiste na aposição de fita adesiva em suportes de apoio táteis. Durante o período de setembro de 2022 a agosto de 2023 foram analisados 100 livros. De um total de 300 amostras obtidas para análises, 17 (5,67%) apresentaram resultados positivos, sendo 6 (35,29%) para Entamoeba coli, 5 (29,41%) para Ascaris lumbricoides, 2 (11,76%) para Taenia sp., 2 (11,76%) para Hymenolepis nana e 2 (11,76%) para Ancylostoma sp. Considerando que as enteroparasitoses são infecções intestinais transmitidas pela ingestão de água, alimentos ou através de mãos contaminadas, os resultados do presente estudo nos permitem alertar para a necessidade de melhoria dos processos de higienização individual, haja vista o encontro significativo de formas parasitárias em livros didáticos de amplo uso estudantil.

RESUMEN

La enteroparasitosis es un grave problema de salud pública en todo el mundo. En Brasil, a pesar de la relevancia y actualidad del problema, pocos estudios han realizado análisis parasitológicos en superficies. Teniendo esto en cuenta, este estudio buscó realizar evaluaciones parasitológicas en libros de la biblioteca universitaria de Ceunes/UFES, São Mateus-ES. Para la realización de los análisis se utilizó, con modificaciones, el método propuesto por Graham, popularmente conocido como método de la cinta adhesiva o método de la cinta Durex, que consiste en la fijación de cinta adhesiva en soportes de apoyo táctil. Entre septiembre de 2022 y agosto de 2023 se analizaron 100 libros. De un total de 300 muestras obtenidas para el análisis, 17 (5,67%) dieron positivo, 6 (35,29%) para Entamoeba coli, 5 (29,41%) para Ascaris lumbricoides, 2 (11,76%) para Taenia sp., 2 (11,76%) para Hymenolepis nana y 2 (11,76%) para Ancylostoma sp. Considerando que las enteroparasitosis son infecciones intestinales que se transmiten a través de la ingestión de agua, alimentos o manos contaminadas, los resultados de este estudio alertan sobre la necesidad de mejorar los procesos de higiene individual, dada la importante presencia de formas parasitarias en los libros de texto ampliamente utilizados por los estudiantes.

INTRODUCTION

Enteroparasitosis is one of the most common diseases and represents a serious public health problem worldwide (Silva et al., 2011). In Brazil, a significant percentage of individuals are or have been infected with some parasitic disease (Barbosa et al., 2009), and among the forms of contamination, physical contact with contaminated surfaces has been increasingly reported in recent years (Andrade et al., 2017).

Intestinal parasites can be classified into two large groups: protozoa, which comprise approximately 60,000 known species and are divided into seven phyla: Apicomplexa, Ciliophora, Microspora, Labyrinthomorpha, Ascetospora, and Myxospora - of these, only the first four are of interest to human parasitology (Neves, 2005); and helminths, which constitute a very large group of animals, including free-living and parasitic species. They present parasites distributed in the phyla Platyhelminthes, Nematoda, and Acanthocephala (Neves, 2005).

Regarding protozoa, their morphology varies greatly depending on their evolutionary phase and the environment to which they are adapted. They can be spherical, oval, or even elongated. Some are covered in cilia, others have flagella, and there are even those that do not have any specialized locomotor organelles (Neves, 2016).

It is understood that the study of parasites is important for the community because it is a public health problem. Parasitological studies and analyses play a fundamental role in the identification and control of parasitic infections that affect both humans and animals. It is also essential in scientific research, contributing to the understanding of the biology of parasites and the discovery of new treatments and vaccines (Neves, 2016).

Considering the possibility of transmission of parasitic forms present on different surfaces (Damazio et al., 2015; Andrade et al., 2017; Costa et al., 2018; Miossi et al., 2021), the present study sought to perform parasitological analyses on book surfaces in the university library of the Centro Universitário Norte do Espírito Santo of the Universidade Federal do Espírito Santo (CEUNES/UFES), given that this place receives, on a daily basis, numerous individuals who handle books and other teaching materials.

METHODOLOGY

To carry out this work, the method proposed by Graham was used, with adaptations popularly known as the tape method or duct tape method, which consists of applying adhesive tape to tactile aids (Graham, 1941).

The research work was divided into three main stages: the first took place in October and November 2022, in which the books to be analyzed were scheduled and selected; the second stage (from October 2022 to June 2023) was for collecting the material; and the third was for analyzing the samples obtained using light microscopy, with the last two stages being carried out concomitantly. At the end of the study (July and August 2023), a second analysis of all the samples obtained was carried out to confirm the results.

In the first stage, the technical administrative staff of the CEUNES/UFES University Library were asked for authorization to collect samples from the books and for a spreadsheet and/or list containing the titles that were most requested at the location, up to the date of selection.

The request was accepted by the library management, resulting in a spreadsheet with the 100 books most frequently checked out by university students.

In the second stage, in a preparation process for the collections, the library staff was asked to collect ten books per day, following the list in ascending numerical order. Upon obtaining them, each microscope slide was cataloged, using masking tape and a pen, containing: an abbreviation of the title of the copy; an abbreviation of the author's name; a number (from 1 to 3) referencing which part of the book was most frequently collected for that sample, with the number 1 (one) corresponding to the collection at the beginning of the book, 2 (two) corresponding to the middle, and 3 (three) relating to the end of the copy; and finally, the code of the copy contained in the library system. This last one was necessary because there were several copies of the same book.

Once each slide was duly registered, the sample was collected, which consisted of quickly applying the gummed side of the tape to the upper right-hand edge (“ear”) of the book page, three times for each part of the copy. It is important to note that three samples were collected for each book, one at the beginning (near the cover), one in the middle, and one at the end of the copy studied. The samples were taken to the Parasitology and Clinical Hematology Laboratory of CEUNES/UFES to be analyzed under a light microscope.

RESULTS AND DISCUSSION

In this study, 100 books were analyzed, and 3 collections were made for each book, totaling 300 slides. Of the total slides analyzed, 17 (5.67%) presented positive results: 6 (35.29%) for *Entamoeba coli,* 5 (29.41%) for *Ascaris lumbricoides,* 2 (11.76%) for *Taenia* sp., 2 (11.76%) for *Hymenolepis nana*, and 2 (11.76%) for *Ancylostoma* sp. Although *E. coli* is not considered pathogenic, it acts as an excellent indicator of the population's hygienic conditions (Nascimento et al., 2010). In Table 1, we present the list of CEUNES/UFES textbooks most used by university students and the parasitic forms found.

Table 1. Parasitic forms in books from the CEUNES/UFES library, 2023

Title of the copy	Author	Result
1.Cálculo 1	Stewart, J.	Negative
2.Química: A Ciência Central	Brown, T. L.	Negative
3.Álgebra linear	Boldrini, J. L. Et al.	Negative
4.Princípios de Química: Questionando a Vida Moderna e o Meio Ambiente	Atkins, P. W.; Jones, L.	Negative
5.Tratado de fisiologia médica	Guyton, A. C.; Hall, J. E.	Negative
6.Física 1	Young, H. D.; Freedman, R. A.; Sears, F. W.; Zemansky, M. W.	Negative
7.A célula	Carvalho, H. F.; Pimentel, S. M. R.	Negative
8.Química orgânica	Bruice, P. Y.	Negative
9.Física 2	Young, H. D.; Ford, A. L. (Colab.).	Negative
10.Fundamentos de física	Halliday, D.; Resnick, R.; Walker, J.	Negative
11.Anatomia humana sistêmica e segmentar	Dangelo, J. G.; Fattini, C. A.	Negative
12.Física 3	Young, H. D.; Freedman, R. A.; Sears, F. W.; Zemansky, M. W.	Negative
13.Microbiologia: Volume 1: Conceitos e Aplicações	Pelczar, M. J.; Chan, E. C. S; Krieg, N. R.	Negative
14.Para entender a Terra	Press, F.	Negative
15.Física 4	Young, H. D.; Sandin, T. R.; Ford, A. L. (Colab.).	Negative
16.Fundamentos da termodinâmica	Sonntag, R. E.; Borgnakke, C.; Van Wylen, G. J.	Negative
17.Circuitos elétricos	Nilsson, J. W.; Riedel, S. A.	Negative

18.Princípios elementares dos processos químicos	Felder, R. M.; Rousseau, R. W.	Negative
19.Um curso de cálculo	Guidorizzi, H. L.	Negative
20.Química orgânica	Solomons, T. W. Graham; Fryhle, Craig B.	**Positive (*Aancylostoma* sp. Larva)**
21.Química geral	Russell, J. B.	Negative
22.Princípios de bioquímica	Lehninger, A. L.; Cox, M. M.; Nelson, D. L.	Negative
23.Histologia básica	Junqueira, L. C. Uchoa; Carneiro, J.	Negative
24.Algoritmos numéricos	Campos, F. F.	Negative
25.Física 5	Resnick, R.; Halliday, D.	Negative
26.Introdução à genética	Griffiths, A. J. F.	**Positive (*Taenia* sp. Eggs)**
27.Noções de probabilidade e estatística	Magalhães, M. N.; Lima, A. C. P.	Negative
28.Álgebra linear com aplicações	Anton, H.; Rorres, C.	Negative
29.Fundamentos de química analítica	Skoog, D. A.	Negative
30.Geometria analítica	Steinbruch, A.; Winterle, P.	Negative
31.Biologia vegetal	Raven, P. H.; Evert, R. F.; Eichhorn, S. E.	Negative
32.Diagnósticos de Enfermagem da NANDA-I: Definições e Classificação - 2021-2023	Nanda International	Negative
33.Shriver & Atkins química inorgânica	Atkins, P. W. Et al.	Negative
34.Elementos de engenharia das reações químicas.	Fogler, H. S.	**Positive (*Entamoeba coli Cysts*)**
35.Introdução à mecânica dos fluidos.	Fox, R. W.; Mcdonald, A. T.; Pritchard, P. J.	Negative
36.Cálculo 1	Thomas, G. B.	Negative
37.Invertebrados	Brusca, R. C.; Brusca, G. J.	Negative
38.Sistemas de Produção: Conceitos e Práticas para Projetos e Gestão da Produção Enxuta	Antunes, J.	**Positive (*Ascaris lumbricoides* Eggs)**
39.Química geral e reações químicas	Kotz, J. C.; Treichel, P. Weaver, G. C.	Negative
40.Equações diferenciais elementares e problemas de valores de contorno	Boyce, W. E.; Diprima, R. C.	Negative
41.Rang & Dale farmacologia	Rang, H. P. Et al.	Negative
42.Fundamentos de matemática elementar - Volume 3: Trigonometria	Iezzi, G.	Negative
43.Evolução	Ridley, M.	Negative
44.Fundamentos da biologia celular	Alberts, B.	Negative
45.Engenharia de reservatórios de petróleo	Rosa, A. J.; Carvalho, R. S.; Xavier, J A. D.	Negative
46.Fundamentos de matemática elementar, 3	Iezzi, G.	**Positive (*Ascaris lumbricoides* Eggs)**
47.Cálculo.	Salas, S. L.; Hille, E.; Etgen, G. J.	Negative
48.Química inorgânica não tão concisa	Lee, J. D.	Negative
49.Tratado de enfermagem médico-cirúrgica	Brunner, L. S.; Smeltzer, S. C. O'connell (Ed.).	Negative
50.Decifrando a terra	Teixeira, W. (Org.).	Negative
51.Iniciação à lógica matemática	Alencar Filho, E.	Negative
52.Biologia celular e molecular	Junqueira, L. C. U.; Carneiro, J.	Negative
53.Fundamentos de engenharia de petróleo	Thomas, J. E. (Org.).	Negative
54.Histologia básica	Junqueira, L. C. U.; Carneiro, J.	Negative
55.Cálculo com geometria analítica	Swokowski, Earl W.	Negative
56.Físico-química	Atkins, P. W.; Paula, J.	Negative
57.Fundamentos de matemática elementar, 1	Iezzi, G.; Murakami, C.	Negative
58.Geometria analítica	Steinbruch, A.; Winterle, P.	Negative
59.Zoologia dos invertebrados	Barnes, R. D.; Ruppert, E. E.; Fox, R. S.	Negative
60.Geometria analítica	Camargo, I.; Boulos, P.	Negative
61.Dispositivos eletrônicos e teoria de circuitos	Boylestad, R. L.; Nashelsky, L.	Negative
62.Introdução à termodinâmica da engenharia química	Smith, J. M.; Abbott, M. M.; Van Ness, H. C.	Negative
63.Botânica-organografia	Vidal, W. N.; Vidal, M. R. R.	Negative
64.Cálculo	Thomas, G. B.	Negative
65.Fundamentos de física	Halliday, D.; Resnick, R.; Walker, J.	Negative

66.Análise real	Lima, Elon L.	**Positive (*Ascaris lumbricoides* Eggs)**
67.Físico-química	Atkins, P. W.; Paula, J.	Negative
68.Ecologia	Odum, E. P.	Negative
69.Elementos de engenharia das reações químicas	Fogler, H. Scott.	**Positive (*Ancylostoma* sp. Eggs)**
70.Sistemas digitais	Tocci, R. J.; Widmer, N. S.; Moss, G. L.	Negative
71.Princípios das operações unitárias	Foust, A. S.	Negative
72.Fundamentos de física	Halliday, D.; Resnick, R.; W. J.	Negative
73.Introdução à mecânica dos fluidos	Fox, R. W.; Mcdonald, A. T.; Pritchard, P. J.	Negative
74.A meta	Goldratt, E. M.; Cox, J.	**Positive (*Entamoeba coli Cysts*)**
75.A economia da natureza	Ricklefs, R. E.	Negative
76. C completo e total	Schildt, H.	**Positive (*Entamoeba coli Cysts*)**
77.Geometria analítica	Reis, G. L.; Silva, V. V.	**Positive (*Ascaris lumbricoides* Eggs)**
78.Princípios de análise instrumental	Skoog, D. A.; Holler, F. J.; Nieman, T. A.	Negative
79.Álgebra linear e aplicações	Callioli, C. A.; Costa, R. C. F.; Domingues, H. H.	**Positive (*Hymenolepis nana* Eggs)**
80.Epidemiologia	Pereira, M. G.	Negative
81.Farmacologia	Katzung, B. G. (Ed.).	**Positive (*Entamoeba coli Cysts*)**
82.Química orgânica	Solomons, T. W. G.; Fryhle, C. B.	Negative
83.Geometria analítica	Steinbruch, A.; Winterle, P.	Negative
84.Química analítica quantitativa elementar	Baccan, N. Et Al.	Negative
85.Introdução à genética	Griffiths, A. J. F.	Negative
86.Fundamentos de matemática elementar, 9	Dolce, O.; Pompeo, J. N.	Negative
87.Fundamentos de físico-química.	Castellan, G. W.	**Positive (*Taenia* sp. Eggs)**
88.Princípios de termodinâmica para engenharia	Moran, M. J.; Shapiro, H. N.	Negative
89.Engenharia das reações químicas	Levenspiel, O.	Negative
90.Embriologia	Garcia, S. M. L.; Fernandez, C. G. (Org.).	**Positive (*Entamoeba coli Cysts*)**
91.A vida dos vertebrados	Pough, F. H.; Heiser, J. B.; Janis, C. M.	Negative
92.Farmacologia	Katzung, B. G. (Ed.).	**Positive (*Ascaris lumbricoides* Eggs)**
93.Física	Cutnell, J. D.; Johnson, K. W.	Negative
94.Química orgânica	Solomons, T. W.; Fryhle, C. B.	Negative
95.Microbiologia de Brock	Madigan, M. T.; Martinko, J. M.; Parker, J.	Negative
96.Fundamentos de físico-química	Castellan, G. W.	**Positive (*Hymenolepis nana* Eggs)**
97.Geologia sedimentar	Suguio, K.	Negative
98.Cálculo	Stewart, J.	Negative
99.Fundamentos de genética	Snustad, D. P.; Simmons, M. J.	Negative
100.Fisiologia vegetal	Kotz, J. C.;Treichel,.; Weaver, G. C.	Negative

Intestinal parasites are related to sanitary conditions and represent an important public health problem in underdeveloped countries (Santos & Merlini, 2010).

The presence of parasitic forms on surfaces is a widely studied phenomenon and can be influenced by several hygienic factors, as observed by Gonzaga and collaborators (2023), when carrying out parasitological analyses of vegetables sold in supermarkets in the municipality of Santarém-PA. The parasitological records presented in the samples were 80% in lettuce, 60% in green onions, and 56% in cabbage, and the main parasites found were *Entamoeba coli*, *Endolimax nana*, *Entamoeba histolytica*, *Ancylostoma* sp., and *Strongyloides stercoralis*.

Miossi and collaborators (2021), when studying the presence of parasitic forms on surfaces of public transport vehicles in the city of São Mateus - ES, observed the contamination of 50% of the vehicles analyzed. The main parasites and commensals found were *Balantidium coli*, *Iodamoeba butschlii*, and *Entamoeba coli*.

On the other hand, Gonçalves and Paludo (2018) performed parasitological analyses on the soil of public squares in a city in Rio Grande do Sul, Brazil. With their research, they found that 43.3% of the samples were positive for some parasitic structure. Of the positive samples, 80.8% presented helminth larvae. Regarding the occurrence of eggs, the highest prevalence was of hookworm eggs (19.2%), followed by *Toxocara* spp. (13.5%).

No less important, Damazio and collaborators (2015) and Costa and collaborators (2018) evaluated the presence of parasitic forms on the surfaces of banknotes and the results found reinforce the possibility of parasitic transmission through contact with contaminated surfaces.

Ascarididae family, subfamily Ascaridinae, is frequently found in populations, whose species of great veterinary importance is represented mainly by *A. lumbricoides* Linnaeus 1758, a parasite of the small intestine of humans (Neves, 2016). According to the researcher, *A. lumbricoides* is found in almost every country in the world and occurs with varying frequency due to climatic and environmental conditions and, mainly, the level of socioeconomic development of the population. In the case of adult worms of this species, in low-intensity infections (three to four worms), the host does not present clinical manifestations. In medium infections, 30 to 40 worms, or massive infections, 100 or more worms, the host may manifest a spoliating action caused by the worm's feeding, toxic action related to the action of the parasite's antigens and host antibodies, in addition to the mechanical manifestation, which may cause irritation in the intestinal wall, as well as obstruction due to the parasites' coiling (Neves, 2016).

Taeniasis is a disease caused by the presence of the adult form of *Taenia solium* or *Taenia saginata* in the small intestine of its definitive host, humans (Camilo et al., 2019), whose infection occurs through the ingestion of undercooked pork or beef, contaminated water, and food (Pereira et al., 2006). Therefore, people who prepare food and taste the meat before cooking and individuals who eat meals outside the home are more prone to taeniasis (Pfuetzenreiter & Pires, 2000).

Hymenolepis nana is a tapeworm with a practically cosmopolitan distribution, more frequent in warm climates (Rocha et al., 1981), and areas with high population density, such as daycare centers, schools, and prisons. In endemic areas, there are often high rates of patients infected by the parasite (Neves, 2016). The number of people infected by *H. nana* in the world is estimated at 50 to 75 million, with a prevalence of 5 to 25% in children in endemic areas (Neves, 2016). Transmission occurs from person to person, generally without the presence of an intermediate host, through the ingestion of parasite eggs eliminated in the feces of the hosts (Rocha et al., 1981). According to Milward de Andrade and Campos (1968), "most authors agree that human infections are not usually accompanied by clinical manifestations.

The appearance of disorders is associated with the age of the patient and the number of worms harbored. Symptoms attributed to children are agitation, insomnia, irritability, diarrhea, abdominal pain, and nervous symptoms rarely occur, the most distressing of which are epileptic attacks in various forms, including cyanosis, loss of consciousness, and convulsions."

Hookworms are helminths of great importance in the universal context, given that it has been estimated that around 900 million people are parasitized by *A. duodenale* and *N. americanus,* and that of this population, 60 thousand die annually (Neves, 2016).

The results demonstrate the reality of the transmission processes of parasitic forms through surfaces and make us reflect and seek mechanisms that assist in the processes of prevention and control of parasitic transmission. Considering that intestinal parasites represent a public health problem and that most organisms found in the present study are pathological agents, it is important to emphasize the constant need for attention to the processes of parasitic transmission and their control mechanisms.

FINAL CONSIDERATIONS

Considering that parasitic transmission can occur through contaminated hands and the presence of parasitic forms in the textbooks analyzed reinforces this mechanism, it is important to emphasize the need to wash hands regularly with soap and water, especially before meals and after using the bathroom. It is suggested that sinks be installed to sanitize the hands of library users before handling books. Also, the results indicate the need to carry out educational campaigns among students and other individuals who use the CEUNES/UFES library to reinforce the importance of means of preventing and controlling parasitic diseases.

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