

Contribution to the Diagnostic Study of Intestinal Parasitosis, Haiti

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Abstract

Parasitic intestinal diseases are widespread in the world with a higher prevalence in developing countries. They are generally a serious public health problem in tropical countries. In October 2020, a cross-sectional study was undertaken to determine the prevalence of intestinal parasites in patients visiting Fermathe Hospital in Haiti. Data were collected on stool results with the presence of parasites and we used systematic sampling for further information regarding patients with parasitology problems. A summary field survey was also carried out in the surrounding areas with more cases recorded such as Corail, Calbasse, Fort Jacques, Center / Marché Kenscoff, Doco, and Douret for direct observations of the inventory and voluntary interviews with the residents of the area on hygiene practices. The prevalence of intestinal parasites was 31.26% and the most common species were: *Endolimax nana* (39.13%), followed by *Blastocystis hominis* (14%), *Blastocystis hominis* / *Giardia* intestinales (12.07%), *Entamoeba coli* (5.31%), and others like *Iodamoeba butschlii*, *Ascaris lumbricoides* or combined parasites were less than 5%. The field survey revealed a strong relationship between parasitosis and drinking water, parasitosis, and place of defecation. Although there are health centers in the area, many people use self-medication or empiric therapy. The study highlights the important causes of gastrointestinal disorders that present themselves in this hospital and confirms intestinal parasitosis as a major public health problem in Haiti.

Keywords: Intestinal parasitosis, parasitic infestation, neglected tropical diseases, gastrointestinal diseases, Fermathe Hospital

Introduction

Parasitic intestinal diseases are widespread throughout the world but with a higher prevalence in developing countries. They are generally a serious public health problem in tropical countries [Bourée et al, 2015]. Intestinal parasitic diseases are considered as a major cause of morbidity, closely linked to poverty, poor personal hygiene, inappropriate handling of raw foods, lack of sanitation of residues, shortage of drinking water, and fecal contamination of the environment [Juárez et al, 2013]. In addition, intestinal parasitic infections have been found to have significant consequences on nutritional and cognitive status especially among kindergarten and school-aged children because of increased metabolic rate, chronic anaemia, anoxia, and diarrhea associated with heavy worm load [Ezeamama et al., 2005; Okolo et John, 2006; Tamramat et Olowu, 2008, Oluboyo et al., 2014]. The etiological agents of these conditions are diverse and can be classified biologically and morphologically into 3 large groups: protozoa, helminths, and fungi [Pitt and Barer, 2012].

Protozoa are unicellular beings endowed with movement [Cavalier-Smith, 2017]. Depending on the case, they move thanks to plasmopods (rhizopods), flagella, undulating membrane, or cilia [Ringo, 1967]. They appear in asexual or sexual potential, or mobile or encysted, intra or extracellular form [Anderson et al., 1985]. Helminths or worms are identified in adult form of both sexes, in larval, embryonic, or ovular form [Castro, 1996]. The fungi or micromycetes constitute a kingdom in their own right and are microscopic fungi identified in the form of isolated or grouped spores or free or tissue filaments [Cole, 1996]. Among them, the most incriminated classes are rhizopods including: *Entamoeba histolytica*, *flagella*, intestinal *Giardia*, as well as *Cryptosporidium spp.* *Cyclospora cayetanensis*, *Cytoisospora belli* and Microsporidia spp. in immunocompromised patients. [Kiani et al, 2016]. Intestinal parasitoses can be asymptomatic but they often give rise to mainly digestive symptoms (diarrhea), abdominal pain and various lesions [Hechenbleikne et McQuade, 2015]. In some cases, surgery may be necessary to treat serious complications caused by some parasites [Hesse, 2012].

Diseases linked to environmental contamination by microorganisms are numerous in developing countries, especially those caused by bacteria and protozoa transmitted by water [Savioli et al., 2006]. In Haiti, intestinal nematodes are frequent [Champetier de Ribes et al., 2005]. Cryptosporidiosis is responsible for 17% of acute diarrhea observed in children under 2 years of age and 30% of chronic diarrhea in patients infected with HIV in Haiti [Pape et al., 1987]. *Cryptosporidium parvum* has been detected in water samples analyzed in important cities of Haiti [Raccurt et al, 2006; Balthazard-Accou et al., 2009; Brasseur et al., 2011; Damiani et al, 2013; Balthazard-Accou et al., 2020]. Microbial waterborne diseases also are typically spread by fecal-contaminated drinking water or food [Cabral, 2010]. A cross-sectional study was conducted to determine the prevalence of bacteria and intestinal parasites in food handlers working with Cuban health workers in Haiti. Stool samples were taken from 56 food handlers, 26.8% of whom had bacterial pathogens such as: *Blastocystis spp.* (9%), *Vibrio cholerae O1* serotype Ogawa, *Aeromonas spp.* and *Giardia intestinalis*, each with 4%. In addition, the prevalence of intestinal parasites was 19.7% [Llanes et al, 2016].

Haiti is the most underserved country in the western hemisphere in terms of water and sanitation infrastructure [WHO/UNICEF, 2012]. Protecting the health of the Haitian population through access to safe drinking water and sanitation is a long-standing challenge in Haiti [Gelting et al., 2013]. This work aims to carry out a retrospective epidemiological study over the period from January 2018 to January 2019 at Fermathe Hospital to estimate the frequency of intestinal parasitoses diagnosed in this health institution. and

to determine the main socio-demographic characteristics of the residents of this zone.

Methodology

Brief presentation of the study area

The commune of Kenscoff is located in the West Department in Haiti, 12 km from Pétion-ville and 24 km from Port-au-Prince. It occupies an area of 208.23 km² and bounded to the north by Pétion-Ville, to the south by Belle-Anse and Marigot, to the west by Carrefour and Jacmel, and the east by Croix-des-Bouquets. Located on the northern slope of the Massif de la Selle, between 600 meters (Morne Calvaire around Pétion-Ville) and at an altitude of more than 2000 meters (Morne la Visite). This commune has five communal sections: Nouvelle Touraine, Sourçailles, Grand Fond, Belle Fontaine, Bongars, and several communal sections.

The present research work is a retrospective cross-sectional epidemiological study that was carried out at Fermathe Hospital from January 2018 to January 2019. Fermathe hospital located at Fermathe 62 (commune of Kenscoff) on the campus of the Mission Baptiste Conservatrice of Haiti (MBCH), has 40 hospital beds and offers all basic services. Its emergency service operates 24 hours a day.

Methods

In this study, quantitative and secondary data are collected through a questionnaire on the laboratory results of patients from the logbooks of the hospital laboratory. These patients were hospitalized people or others who visited the hospital, and who presented signs and symptoms such as abdominal pain and/or diarrhea, vomiting, fever, anal itching, nocturnal tooth grinding, and malnutrition in children. The Lugol staining technique is used to carry out laboratory examinations.

After collecting the data of stool results showing the presence of parasites, we used interval sampling, with a difference of 5 people between each selected unit which is included in the sample Ke up to the total population. N: 207. A summary field survey was also carried out in neighboring areas with more cases recorded such as Corail, Calabash, Fort Jacques, Center / Marché Kenscoff, Doco, and Douret for direct observations of the state of the premises and voluntary interviews with the inhabitants of the zone on the hygiene practices in progress in the zone.

Qualitative and primary data on the socio-demographic conditions of the population are collected using the information provided at the time of the commemorative collection. Volunteer interviews are conducted at assembly stations in the community with the aid of multi-skilled community health workers in the area (ASCP), assigned to Fermathe Hospital before the

awareness session on hygiene practices. Through this questionnaire, information on hygiene practices, drinking water, place of defecation, washing of fruits and vegetables before consumption, and others). For direct observation, field visits were carried out and an overview of the houses, the environment, and the children's way of life or behavior (barefoot, even playing on the ground, and others).

Limits

This study is based solely on secondary data from tests carried out in the Fermathe hospital laboratory.

Data analysis and processing

All the results of the logbooks of the stool examinations with the presence of parasites were recorded and recorded in an Excel file and analyzed by the R software to determine the most frequent type of parasites. Data from volunteer interviews and direct observations are collected employing a questionnaire applied to each volunteer living in areas with more cases of parasitosis. The Excel program is applied for data recording and the R software is used for the descriptive analysis of the results with univariate and bivariate analyzes relating to the presence of intestinal parasitosis and hygiene practices.

Interference analysis is used to test the independence of variables to check whether any supposed relationships between said variables are not due to pure stochastic effects. For this, Pearson's chi-square tests were applied and calculated Cramer's V (or even phi) to measure the strength of association of the variables taken in pairs. The problem with the test is to assess the gap between the data effectively and a model of independence. The latter, as its name suggests, certifies that no statistical relationship exists between the variables of interest. And when the difference between the 2 models is statistically significant, we can assume an association between said variables at a given critical threshold.

Results and discussion

The results relate to the nature, number or frequency of the parasites in the stool

Of the 662 stool examinations performed during the study period at Fermathe Hospital, 207 samples presented one or more intestinal parasites or a percentage of 31.26% (207/662).

The rate of infestation in women (118/207 cases; 57%) is higher than that of men (89/207 cases; 43%). The average age of patients with the presence of parasites in the stool is 33 years. The results show the presence of parasites isolated or in combination, among which one can count *Endolimax nana*,

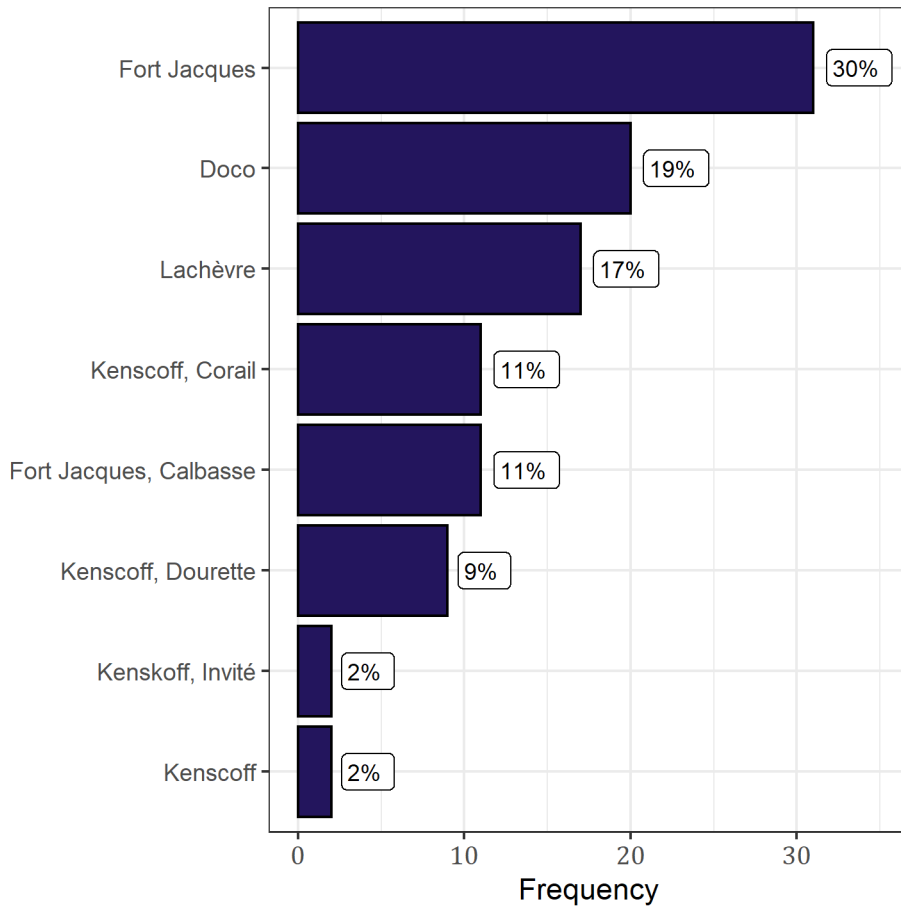
Entamoeba coli, *Entamoeba histolytica*, *Blastocystis hominis*, *Giardia intestinalis*, *Iodamoeba butschlii* and *Ascaris lumbricoides*. The most common intestinal parasite is *Endolimax nana* (39.1 %) and second is *Blastocystis hominis* (14%). (See Tab. 1)

Table 1: Frequency of parasites identified in stool at Fermathe hospital

Name of Parasitosis	Effective	%
<i>Endolimax nana</i>	81	39.1
<i>Blastocystis hominis</i>	29	14
<i>Blastocystis hominis</i> / <i>Giardia intestinalis</i>	25	12.1
<i>Entamoeba coli</i>	11	5.3
<i>Iodamoeba butschlii</i>	9	4.3
<i>Ascaris lumbricoides</i>	9	4.3
<i>Entamoeba coli</i> / <i>Endolimax nana</i>	8	3.9
<i>Giardia intestinalis</i>	6	2.9
<i>Endolimax nana</i> / <i>Iodamoeba butschlii</i>	6	2.9
<i>Entamoeba histolytica</i>	4	1.9
<i>Endolimax nana</i> / <i>Entamoeba coli</i> / <i>Giardia intestinalis</i>	4	1.9
<i>Giardia intestinalis</i> / <i>Endolimax nana</i>	3	1.4
<i>Blastocystis hominis</i> / <i>Entamoeba coli</i> / <i>Endolimax nana</i>	3	1.4
<i>Entamoeba coli</i> / <i>Iodamoeba butschlii</i>	2	1
<i>Ascaris lumbricoides</i> / <i>Endolimax nana</i>	2	1
<i>Iodamoeba butschlii</i> / <i>Entamoeba coli</i> / <i>Endolimax nana</i>	2	1
<i>Entamoeba histolytica</i> / <i>Endolimax nana</i>	1	0.5
<i>Ascaris lumbricoides</i> / <i>Blastocystis hominis</i>	1	0.5
<i>Ascaris lumbricoides</i> / <i>Giardia intestinalis</i>	1	0.5
Total	207	99.9

Sociodemographic characteristics

Figure 1 shows the Geographical distribution of the people interviewed in the localities of the commune of Kenscoff served by the Fermathe hospital.



Data source: Parasitosis prevalence survey / FERMATHE, Haiti / Jan. 12-13, 2021

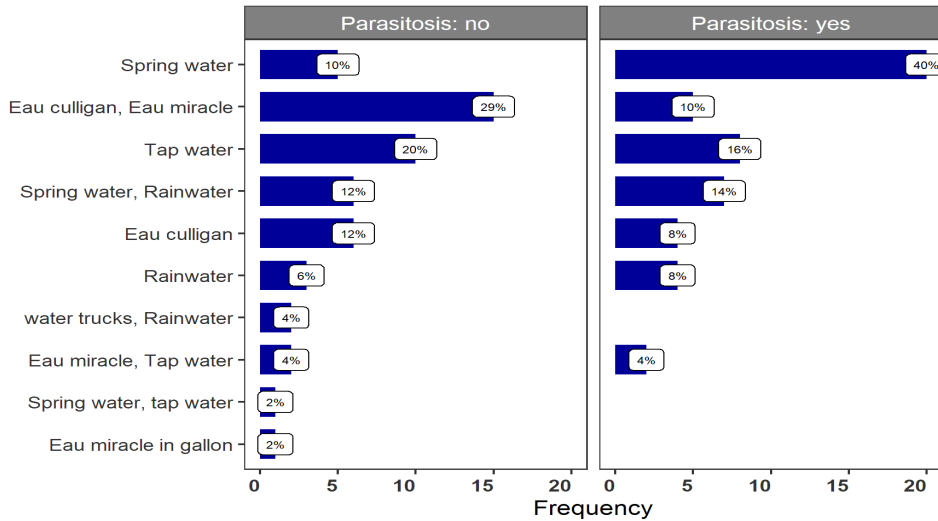
Figure 1: Distribution of interviewees by geographic area

Sociodemographic and hygienic characteristics of people who have been the subject of voluntary observations or interviews

The hygienic parameters considered mainly refer to drinking water, water for domestic use (handwashing, food), hand washing, and instead of defecation. (Fig. 2, 3, 4).

The distribution of the sample according to the quality of drinking water and the prevalence of parasitosis is presented in Figure 2.

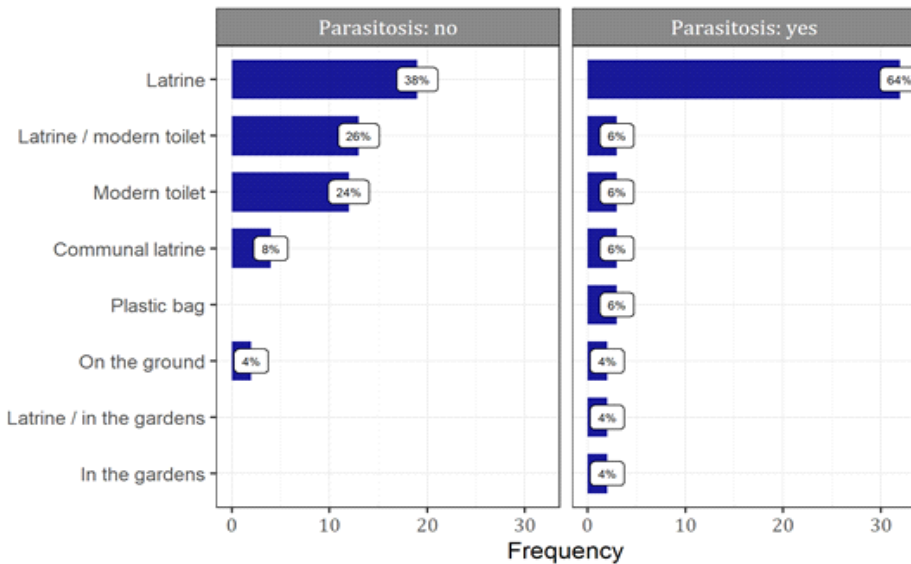
Note that among the various services mentioned in this study, which offer drinking water to the population, the water supplied by Culligan is the only product whose conservation packaging and hygiene measures are respected.



Data source: Parasitosis prevalence survey / FERMATHE, Haiti / Jan. 12-13, 2021

Figure 2: Distribution of the sample according to the quality of drinking water and the prevalence of parasitosis

Figure 3 shows the distribution of the sample according to the place of defecation and the prevalence of parasitosis.



Data source: Voluntary interview / FERMATHE, Haiti / Jan. 12-13, 2021

Figure 3: Distribution of the sample according to the place of defecation and the prevalence of parasitosis

Note that concerning personal hygiene, there is more than one answer per person. For hand washing on the one hand, and washing fruits, salads, and vegetables, on the other hand, before consumption, 88.5% and 92.9%

respectively answered positively to these questions. 50.5% of the inhabitants of the area replied that they were familiar with people who suffer from parasitosis with the following clinical manifestations: abdominal pain, diarrhea, anal pruritus in children, polydypsia, nocturnal teeth grinding, and others. On the other hand, 61.4% of them report having been treated with traditional medicines at home without having attended a hospital center.

Figure 4 summarizes the analysis of the prevalence of parasitosis from handwashing.

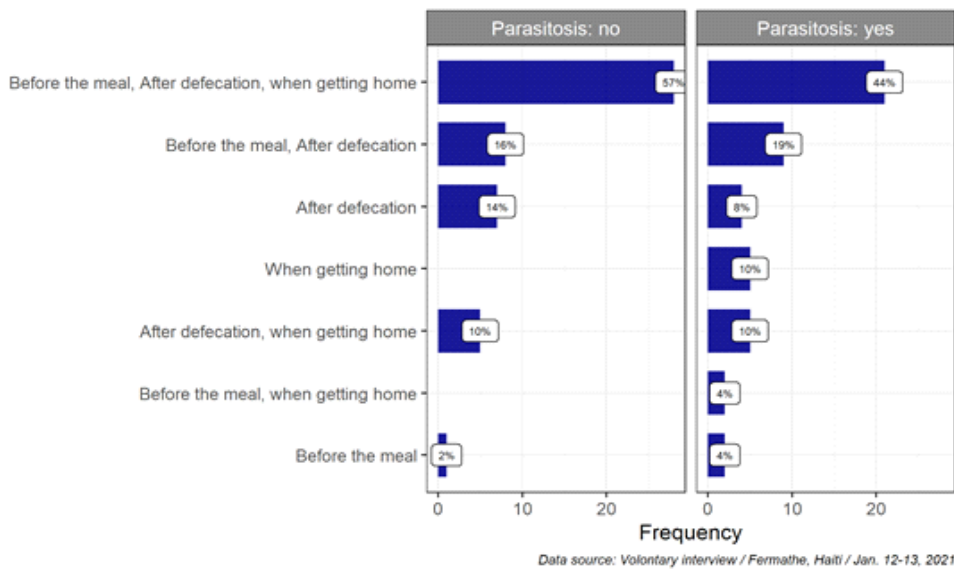
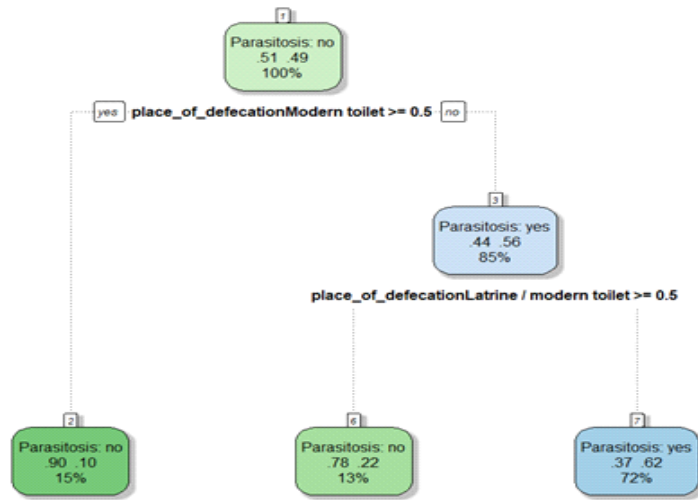


Figure 4: Prevalence of parasitosis and the habit of washing hands

The schematic representation of the CART model of the relationship between the site of defecation and the possibility of parasitosis is shown in Figure 5.



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Figure 5: Schematic representation of the CART model of the relationship between the site of defecation and the possibility of parasitosis

In this study, the frequencies of protozoa and helminths are higher than those described in the study carried out in Turbaco [Villafañe-Ferrer, 2016]. In both cases, the most frequent parasite is *Endolimax nana*, i.e. 26.5%) in Turbaco, and 39.13% (Fermathe, Haiti).

Blastocystis hominis is one of the protozoa isolated with the highest frequency in patients at Fermathe Hospital (14%), which does not differ from the study carried out at Turbaco, and from another study conducted for determining the prevalence of bacteria and intestinal parasites in food handlers working with Cuban health workers in Haiti (Llanes, 2011). This protozoan is transmitted through contaminated water and food, and its frequency is linked to defecation on the ground, poor environmental sanitation, poor hygiene practices, and overcrowding. A study carried out in Côte d'Ivoire on the effects of hygiene and defecation behaviors on the presence of helminths and intestinal protozoan infections in Taabo revealed that age, sex, socioeconomic status, hygiene, and defecation behavior are determinants for the proliferation of helminths and intestinal protozoan infections [Schmidlin et al, 2013]. Indeed, it was revealed that in this region, only one in five households had access to latrines and that, as a result, open defecation was common. These conditions were met in certain areas of the municipality of Kenscoff, which probably influenced the high percentage of parasites and the results of the CART model. However, basically, 51% of the individuals used by the algorithm have intestinal parasites; the remaining 49%, no. At the first

partitioning, if the place of household defecation is "modern toilet", the probability that there is no individual suffering from an intestinal parasitosis is 90% against 9% for there to be. Note that 15% of the total sample is used at this node. On the other hand, if the household does not have a modern toilet, the probability that no individuals are suffering from an intestinal parasitosis drops to 56% compared to 44% who do not. Note that 85% of the sample is used at this level. Descending the tree, we see that if the household does not have a modern toilet (as the only place for defecation), but has both at the same time (latrine and modern toilet), the probability that there is no of an individual suffering from an intestinal parasitosis is 78% against 22% for it. Whereas, if the household has neither a modern toilet (as the only place for defecation) nor a "modern toilet and toilet", the probability that there are individuals without intestinal parasites is 37% against a 62% chance it will. Note that the proportion of the sample used is 72%.

The female sex was more affected by the presence of cysts or vegetative forms of protozoa and/or roundworm eggs in the stool, i.e. 57% of patients with an average age of 33 years, although several studies demonstrate the relationship between intestinal parasites and anemia in pregnant women, it can be noted in this study that the majority of women are women of childbearing age. The hygiene practices of the inhabitants of the area are similar to those observed in other studies carried out in Alabama by McKenna in 2017 and other countries of Latin America. [McKenna et al, 2017].

The population of this commune makes great use of medicinal plants or natural potions for the treatment of worms such as boulo (name given to an antiparasitic plant), a fusion of herbal tea from the roots of plants with an antiparasitic effect, but this practice should be supported. by in-depth studies comparable to the study carried out on the anthelmintic properties of traditional African and Caribbean medicinal plants: Identification of extracts with potent activity against *Ascaris suum* in vitro. [Williams et al, 2016].

Conclusion

The results of this study indicate that intestinal parasitic infections or infestations are important causes of gastrointestinal disturbances and are present in the study area. These results at least confirm that these infections remain a major public health problem in Haiti. Thus, effective control programs to reduce the prevalence and incidence of intestinal parasitic infections should be considered in public health policies.

Author Contributions: Conceptualization of the study – Daphnée Michel et Max François Millien. Writing of the original study protocol – Daphnée Michel. Review of the protocol - Max François Millien and Evens Emmanuel. Preparation of the data collection tool – Daphnée Michel.

Validation of the data collection tool - Max François Millien and Evens Emmanuel. The data collection, the processing of data and their analysis - Daphnée Michel, Ammchise Apply, Daphénide St Louis and Lucainson Raymond. Writing of the first draft of the paper – Daphnée Michel. Review, editing and revised version - Max François Millien, Ketty Balthazard-Accou and Evens Emmanuel. All authors have read and agreed to the published version of the manuscript.

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