African Journal of Biology and Medical Research
ISSN: 2689-534X
Volume 7, Issue 1, 2024 (pp. 47-54)
www.abjournals.org

SOIL PARASITES CONTAMINATION OF JETTIES IN RIVERS STATE, NIGERIA

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Cite this article:

Eze C.N., Olayiwola B.M. (2024), Soil Parasites Contamination of Jetties in Rivers State, Nigeria. African Journal of Biology and Medical Research 7(1), 48-54. DOI: 10.52589/AJBMR-AVW8XI5D

Manuscript History

Received: 22 Oct 2023

Accepted: 15 Dec 2023

Published: 20 Feb 2024

ABSTRACT: *The present study evaluated the Soil Parasites Contamination of Onne jetty, Abuloma jetty, Andoni jetty and Bonny jetty in Rivers State, Nigeria. A total of 200 soil samples from jetties within 0-2cm deep were collected in clean polythene using trowel. Soil samples were analysed using magnesium sulphate floatation and modified Baermann technique for the presence of soil parasites (protozoans and helminths). Out of the two hundred (200) sampled soil from the four jetties, one hundred and fifty-six 156 (78.0%) soil were contaminated with parasites. Bonny jetty had the highest soil contamination 46 (92%) followed by Abuloma 42 (84.0%), Onne 38 (76.0%), Andoni had the least soil contamination 30 (60.0%). However, there was no significant difference in the four jetties (P>0.05). Abuloma jetty had the highest parasites contamination 426 (39.48%), followed by Bonny jetty 296 (27.43%), Andoni jetty 194 (17.98%) and Onne jetty with the least parasite contamination 163 (15.11%). Thirteen soil parasites were recovered: Ascaris lumbricoides had the highest prevalence of 300 (27.8%), followed by Hookworm 164 (15.2%), Balantidium coli 152 (14.09%), Entamoeba histolytica 140 (12.97%), Entamoeba coli 100 (9.27%), Schistosoma mansoni 66(6.12%), Fasciola spp 56 (5.19%), Schistosoma japonicum 42 (3.89%), Strongyloides stercoralis 22 (2.04%), Isospora spp. 21 (1.95%), Toxocara spp 8 (0.74%), Trichuris trichiura 6 (0.56%) and Taenia spp 2 (0.19) with the least prevalence. There was no significant difference among the soil parasites recovered in the four jetties. The findings also showed that Ascaris lumbricoides had the highest average abundance and means intensity of 1.5 (75±42.77epg), followed by Hookworm with average abundance and intensity of 0.82 (41±24.69epg)), Taenia spp 0.01 (0.5±0.5) with the least abundance and intensity.*

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INTRODUCTION

Soil-transmitted helminth infection remains a serious public health issue globally with over 1.5 billion people infected [13]. Soil-transmitted parasites are organisms transmitted to humans through contact with or ingestion of contaminated soil. Such parasites complete their life cycle in soil where immature eggs require a period of development to become infective [2]. The main soil-transmitted helminthiasis includes infections with roundworm (*Ascaris lumbricoides*, hookworm (*Ancylostoma duodenale* and *Necator americanus*), and whipworm (*Trichuris trichiura*) [13]. More than 1.5 billion people, or 24% of the world's population, are infected with soil-transmitted helminth infections worldwide [13]. Infections are widely distributed in tropical and subtropical areas, with the greatest numbers occurring in sub-Saharan Africa, Latin America, China and East Asia [13]. Approximately 807 - 1,121 million, 604 - 795 million, 576 - 740 million people are infected with *Ascaris lumbricoides*, *Trichuris trichiura* and Hookworm respectively in the world [4]. In Nigeria, the number of children (pre-SAC and SAC) requiring preventive chemotherapy for soil-transmitted helminthiases were 45,205,565 [13]. Poor water and sanitation practices are major risk factors for the distribution, infection, and prevalence of STH [9]. Imalele *et al.* (2021) stated that specific occupations such as engagement in agricultural pursuits and behaviors (scavenging/picking scraps from dumpsites) influence the intensity of soil-transmitted helminth infections. Some jetties in Nigeria have been identified with refuse dumps and open defecation by the people living alongside jetties, people working on ships and the passengers. These have led to the contamination of soil found around jetties. However, studies on STH have largely focused on the prevalence and intensity of STH infections, especially among children [7]. There is little or no information on parasites loads of soils around jetties in Rivers State, Nigeria.

MATERIALS AND METHODS

Study Design

This study was carried out in four selected jetties in Rivers State, Nigeria. Onne jetty, Abuloma jetty, Andoni Jetty and Bonny Jetty. Fifty (50) Soil samples were collected from each of the jetties in one sampling occasion for parasitological analysis.

Study Area

This study was conducted in four 4 selected jetties (Onne jetty, Bonny jetty, Abuloma jetty and Andonni jetty) in Rivers State, Nigeria. Onne is a town and a large cargo port in southern Nigeria. It is a principal transportation spot of the whole region of Africa, with the capacity to receive large cargo ships (over 60,000 tons). The latitude of Onne, Nigeria is 4.723816, and the longitude is 7.151618. Bonny (or Ibani) is an island town and a Local Government Area in Rivers State of Nigeria. It was a major trading post of the Eastern Delta with the population of 16,868. The latitude of Bonny, Nigeria is 4.4516, and the longitude of 7.17074. Abuloma is a town located in Port Harcourt local government of Rivers State. The latitude of Abuloma, Nigeria is 4.770855 and the longitude is 7.060831. Andoni is a Local Government Area in Rivers state, Nigeria. Its headquarters is in Ngo town. It has an area of over 233 km and a population of over 311,500 at the last census. The latitude of Andoni, Nigeria is 4.4727 and the longitude is 7.3826.

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Sample Collection

About 200g of soil sample (0-2 cm deep) from 25 different ecologically relevant spots was collected into clean, tied, well labeled polythene bags with the aid of trowel. The samples were taken to the laboratory for analysis of the presence and number of helminths eggs and larvae. The soil was kept at room temperature until processed

Sample Analysis

The samples were analyzed using magnesium sulfate floatation and Baermann technique.

Magnesium Sulfate Floatation

About 100g of soil of each of the 100 soil samples taken from jetties were weighed and passed through a coarse sieve to remove stone and other undesirables, then transferred to a 50ml volumetric flask. To each of the soil, 2 volumes of 30% sodium hypochlorite (Calcium hypochlorite) fluid was added to concentrate the egg as well as a disinfectant, vigorously stirred and allowed to stand for 30 minutes. This mixture was further diluted to the 50ml mark and mixed again. Coarse particles were strained out by passing through a mesh cloth (gauze) into a centrifuge tube and spun at 3000 revolutions per minute (rpm) for 2 minutes. The supernatant was discarded. The deposit was resuspended in magnesium sulfate floatation fluid of specific gravity (S.G) 1.3, and centrifuge again for another 2 minutes at 3000 rpm. The floatation fluid in the centrifuge tube was then filled up to form a positive meniscus and a coverslip was superimposed on it and left to stand for 5 minutes. The coverslip was then lifted with a swift action and placed on a glass slide and examined microscopically for the presence of cysts, eggs and larvae under x10 and x40 objective lens.

Modified Baermann Technique

Soil nematode extraction for larvae were carried out using the modified Baermann technique as described by Collender *et al.* (2015). The setup consists of a modified funnel with a short piece of rubber tubing attached to the stem and a clamp closure. The funnel was supported uprightly and filled with water. Approximately 20g of soil was placed on top of a filter paper on top of wire gauze. The enclosed soil sample was placed in the Baermann funnel (filled with distilled water). The larvae migrated through the filter paper into the water in the funnel. The larvae settled at the bottom of the funnel by gravity and were collected after 48-72 hours. The suspension was viewed under the microscope for the presence of nematodes.

Statistical Analysis

Data were analyzed statistically with the Statistics package for Social Sciences (SPSS) version 20 for ANOVA test. Bar chart

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RESULTS

Out of the two hundred (200) sampled soil from the four jetties, one hundred and fifty-six 156 (78.0%) soil samples were contaminated with parasites. Bonny soil had the highest contamination 46 (92%) followed by Abuloma 42 (84.0%), Onne 38 (76.0%), Andoni had the least contamination 30 (60.0%). However, there was no significant difference in the four jetties (P>0.05). Out of the 1079 soil parasites species recovered from the jetties, Abuloma jetty had the highest prevalence of soil parasites species 426 (39.48%), followed by Bonny jetty with prevalence of 296 (27.43%), Andoni jetty 194 (17.98%) and Onne jetty with the least prevalence of 163 (15.11%) Table 1. Thirteen soil parasites were found and identified: protozoans cysts comprising *Entamoeba histolytica, Entamoeba coli, Balantidium coli and* helminth eggs/larvae comprising *Ascaris lumbricoides,* Hookworm, *Trichuris trichuiria, Schistosoma mansoni, Schistosoma japonicum, Fasciola spp; Toxocara spp., isospora spp; Taenia spp; Strongyloides stercoralis*. *Ascaris lumbricoides* had the highest prevalence of 300 (27.8%), followed by Hookworm 164 (15.2%), *Balantidium coli* 152 (14.09%), *Entamoeba histolytica 140* (12.97%), *Entamoeba coli 100* (9.27%), *Schistosoma mansoni 66*(6.12%), *Fasciola spp 56* (5.19%), *Schistosoma japonicum 42* (3.89%), *Strongyloides stercoralis 22* (2.04%), Isospora spp. 21 (1.95%), *Toxocara spp 8* (0.74%), *Trichuris trichuiria 6* (0.56%) and *Taenia spp 2* (0.19) with the least prevalence. However, there was no significant difference among the soil parasites recovered (P>0.05).

Table 3 showed the distribution of the various soil parasites across Andoni jetty, Onne jetty, Abuloma jetty and Bonny Jetty. Based on the distribution of the parasites across the jetties, Hookworm, *Balantidium coli* and *Fasciola sp.* were the most encountered across the jetties. They were distributed across all the four jetties. Followed by *Ascaris lumbricoides, Entamoeba histolytica, Entamoeba coli, Trichuris trichiuria, Isospora sp.* encountered in three jetties. *Ascaris lumbricoides, Entamoeba histolytica, Entamoeba coli, Trichuris trichiuria* were not encountered in Onne jetty, *Isospora sp.* was not encountered in Bonny jetty. *Schistosoma mansoni* was not encountered in Abuloma jetty and Bonny jetty, *Toxoxara sp.* was not encountered in Onne jetty and Abuloma jetty. *Strongyloides stercoralis* and *Schistosoma japonicum* were the least encountered, found only in Abuloma jetty and Andoni jetty respectively. Abundance and intensity of soil parasites across the jetties showed that *Ascaris lumbricoides* had the highest average abundance and intensity of 1.5 (75±42.77epg), followed by Hookworm with average abundance and intensity of 0.82 (41±24.69epg), *Balantidium coli* 0.76 (38±13.93) *Entamoeba histolytica* 0.7 (35±17.82), *Entamoeba coli* 0.5 (25±15.2), *Schistosoma mansoni* 0.33 (16.5 ±9.54), *Fasciola spp* 0.28 (14±10.03), *Schistosoma japonicum* 0.21 (10.5± 10.5), *Strongyloides stercoralis 0.11* (5.5±5.5), *Isospora spp*. 0.104 (5.25 ±2.06), *Toxocara spp* 0.04 (2±1.41), *Trichuris trichuiria* 0.03 (1.5± 0.5) and *Taenia spp* 0.01 (0.5±0.5epg) with the least prevalence (Table 4).

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Table 1: Soil parasites contamination across the four jetties

Jetty	Number of soil samples examined	Number of soil samples contaminated (%)	% contamination
Bonny	50	46	92%
Andoni	50	30	60%
Onne	50	38	76%
Abuloma	50	42	84%
Total	200	156	78%

P=0.477

	Soil parasites species
Abuloma	426 (39.48%)
Bonny	296 (27.43%)
Andoni	194 (17.98%)
One	163 (15.11%)
Total	1079

Table 2: Overall Soil parasites recovered across the four jetties

PARASITES	**TOTAL NO(%)**
Entamoeba histolytica	140 (12.97%)
Entamoeba coli	100 (9.27%)
Ascaris lumbricoides	300 (27.8%)
Balantidium coli	152 (14.09%)
Hookworm	164 (15.2%)
Schistosoma mansoni	66 (6.12%)
Schistosoma japonicum	42 (3.89)
Fasciola spp	56 (5.19%)
Toxocara sp.	8 (0.74%)
Strongyloides stercoralis	22 (2.04%)
Trichuris trichiuria	6 (0.56%)
Isospora sp.	21 (1.95)
Teania sp.	2 (0.19%)
Total	1079

P>0.05

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Table 3: Distribution of soil parasites across the four jetties

Parasite	Bonny	Andoni	Onne	Abuloma	Total
EH	74 (52.86%)	10 (7.14%)	0 (0%)	56 (40%)	140 (12.97%)
EC	30 (30%)	4 (4%)	0 (0%)	66 (66%)	100 (9.27%)
AL	144 (48%)	2 (0.67%)	0 (0%)	154 (51.33%)	300 (27.8%)
BC	22 (14.47%)	50 (32.89%)	9 (5.92%)	71 (46.71%)	152 (14.09%)
HW	14 (8.54%)	36 (21.95%)	112 (68.29%)	2 (1.22%)	164 (15.2%)
SM	0 (0%)	32 (48.48%)	34 (51.52%)	0 (0%)	66 (6.12%)
SJ	0 (0%)	42 (100%)	0 (0%)	0 (0%)	42 (3.89%)
FS	2 (3.57%)	6 (10.71%)	4 (7.14%)	44 (78.57%)	56 (5.19%)
TS	6 (75%)	2 (25%)	0 (0%)	0 (0%)	8 (0.74%)
SS	0 (0%)	0 (0%)	0 (0%)	22 (100%)	22 (2.04%)
TT	2 (33.33%)	2 (33.33%)	0 (0%)	2 (33.33%)	6 (0.56%)
IS	0 (0%)	8 (38.1%)	4 (19.05%)	9 (42.86%)	21 (1.95%)
Taenia	2 (100%)	0 (0%)	0 (0%)	0 (0%)	2 (0.19%)
Total	296 (27.43%)	194 (17.98%)	163 (15.11%)	426 (39.48%)	Grand Total: 1079

Key= (EH= *Entamoeba histolytica*, EC= *Entamoeba coli*, AL= *Ascaris lumbricoides*, BC= *balantidium coli*, HW= hookworm *sp*, SM= *Schistosoma mansoni*, SJ= *Schistosoma japonicum*, FS= *Fasciola sp*; TS= *Toxocara sp*; SS= *Strongyloides stercoralis*, TT= *Trichuris trichiura*, IS= *Isospora sp*; *Taenia= Taenia sp*

Table 4: Abundance and intensity of soil parasites across the jetties

Parasite	Bonny	Andoni	Onne	Abuloma	Average Abundance	Intensity (mean ± SE) (epg)
EH	1.48	0.2	0	1.12	0.7	35 ± 17.82
EC	0.6	0.08	0	1.32	0.5	25 ± 15.2
AL	2.88	0.04	0	3.08	1.5	75 ± 42.77
BC	0.44	1	0.18	1.42	0.76	38 ± 13.93
HW	0.28	0.72	2.24	0.04	0.82	41 ± 24.69
SM	0	0.64	0.68	0	0.33	16.5 ± 9.54
SJ	0	0.84	0	0	0.21	10.5 ± 10.5
FS	0.04	0.12	0.08	0.88	0.28	14 ± 10.03
TS	0.12	0.04	0	0	0.04	2 ± 1.41
SS	0	0	0	0.44	0.11	5.5 ± 5.5
TT	0.04	0.04	0	0.04	0.03	1.5 ± 0.5
IS	0	0.16	0.08	0.18	0.105	5.25 ± 2.06
Taenia	0.04	0	0	0	0.01	0.5 ± 0.5
Total	5.92	3.88	3.26	8.52		

Key= (EH= *Entamoeba histolytica*, EC= *Entamoeba coli*, AL= *Ascaris lumbricoides*, BC= *balantidium coli*, HW= hookworm *sp*, SM= *Schistosoma mansoni*, SJ= *Schistosoma japonicum*, FS= *Fasciola sp*; TS= *Toxocara sp*; SS= *Strongyloides stercoralis*, TT= *Trichuris trichiura*, IS= *Isospora sp*; *Taenia= Taenia sp*

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DISCUSSION

The descriptive cross-sectional study revealed a high prevalence of soil parasites in the four jetties. From the results obtained, it has been established that thirteen species of soil parasites eggs and larvae can be found in all the four jetties sampled. Studies had long described soil parasites (protozoans and helminths) infections to be among the common infections globally [13], and particularly predominant in the tropics where hot, humid climate, poor sanitation and personal hygiene, poverty and ignorance still prevail [8]. The occurrences of all these parasites have been reported in various parts of Nigeria [1]. Results obtained showed that *Ascaris lumbricoides* had the highest prevalence 300 (27.8%), followed by Hookworm 164 (15.2%), and *Taenia sp.* with the least prevalence 2 (0.19%). The high prevalence of *Ascaris lumbricoides* in this study agreed with the study of Imalela *et al.* (2021).

Ascaris ova are spread through the agents of flood and coprophagous animals and can thus be transported to locations far from the defecation site. Moreover, the well protected eggs can withstand harsh environmental conditions and can remain in the environment for a longer period. Prevalence of hookworm in this study is low compared with the other studies in various parts of Nigeria where hookworm prevalence is higher than *Ascaris lumbricoides* prevalence rate; Hassan and Oyebamiji (2018) reported soil fecal contamination rates of 1940 (74.4%) in public primary schools in Ibadan metropolis. Eze and Sam (2021) reported infection rates of 91.4% among refuse disposal workers in Port Harcourt, Nigeria. Poor sanitary disposal of human feces and indiscriminate defecation are the principal factors in the etiology of Hookworm infections. As long as ecological conditions are favorable in the defecating areas, the larvae of hookworm remain quiescent in the moisture films of contaminated soil until contact with a suitable host is made where it penetrates through the skin. Also, seasonal factors like rainfall, temperature and humidity are important factors in the transmissions of this intestinal parasite [11]. The prevalence rate of *Balantidium coli*, *Entamoeba histolytica* and *Entamoeba coli* is similar to a study conducted by Udoh *et al* (2019) in refuse dumps and Abattoir wastes in Ile-Ife, Nigeria. However, the prevalence rate of *Balantidium coli* in this study is higher. *Taenia spp* had the least prevalence rate of *Taenia spp* is also similar to the study of Udoh *et al.* (2019).

Abuloma jetty had the highest prevalence and this can be attributed largely to the deplorable state of environmental hygiene and a high level of open defecation around the jetty by people living alongside. Also, by the passengers traveling across due to lack of toilet facilities and indiscriminate dumping of refuse around the jetty. This was observed during sampling occasions. The high abundance and intensity of *Ascaris lumbricoides* followed by hookworm shown in this study is similar to a study conducted by Chukumwa *et al. (2019).* Activities of the individuals living around may contribute to the abundance and intensity of these soil parasites in the jetties.

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