SOIL FAECAL POLLUTION AND THE RISK OF HOOKWORM INFECTION IN AREAS OF IBADAN, NIGERIA.

A. A Hassan and *M. O. Shittu
Department of Zoology, University of Ibadan Ibadan.
*Oyo State Solid Waste Disposal Management Board, Ministry of Environment and Water Resources.
Oyo State Secretariat, Ibadan.

Abstract

Soil samples were randomly collected from 25 different observed and suspected human communal defecation locations within Ibadan. All the soil types encountered namely, sand, sandy loam, Sandy, clay loamy, and loamy sand enhanced hookworm larval propagation. The organic matter content showed a decrease with depth. The surface layer soil samples supported hookworm larval growth while the sub soil layer with the same amount of organic matter content as the surface soil layers showed a net zero larval growth. The overall average of 11 x 10^3 hookworm larvae per gram of soil sample showed a high level of hookworm infestation of the soil. The assessment of food vendor trainee revealed a 36% hookworm infection out of which 80% had low level of awareness of hookworm disease. Furthermore, 75% had no knowledge of transmission of the disease and no evidence of toilet facility was found in their homes. The lack of standard public toilets where they are available at all and lack of knowledge of hookworm disease have contributed to the complexity of the problem of possible spread of hookworm infection in the study area.

Introduction

Hookworm has long been an endemic soil transmitted helminth in Nigeria (Oyerinde, 1982) and is generally referred to as an enemy within. Hookworm disease is predominantly associated with sanitary and environmental conditions which favour development of the eggs and larval infections (Ukoli, 1990; Symth, 1996). The disease accounts for an appreciable retardation and adverse effects in the growing child (Lorenzo, 1996) who is most at risk of infection and hence the greatest victim of indiscriminate faecal disposal. It has been reported that 36% of children under 5 years old are underweight, while 59% of Nigerian population are enrolled in primary school (UNICEF, 1997). This is a very high percentage of the Nigerian human population. These vulnerable age groups become increasingly the targets of pollution and hazards during relaxation and recreational activities as they spend greater portion of their time away from parental care.

This study was therefore designed to examine the level of soil faecal pollution and the risk of spread of hookworm infection around dwelling places and associated river banks, schools' recreational grounds in Ibadan city. It is hoped that this will aid in creating greater awareness on intestinal soil transmitted helminthiasis in the city towards control.

Materials and method

Study site: Twenty-five observed and suspected communal defecation points around waterways, shaded grounds, refuse dumping sites, school building surroundings, bush paths and open lands in hideout locations, covering five local government areas in Ibadan city namely, Ibadan North, Ibadan North West, Ibadan South West, Ibadan South east, Ibadan North East were selected. Five locations were selected per local government area (Figures 1 and 2).

B. Enviromental Microbial Hazards and Risk Analysis

Soil Sampling: Three samples per sampling point were collected at varying depths: surface layer (0-5cm), subsoil middle layer (10-15cm) and subsoil deep layer (25-30cm) between the hours of 8 am and 12 noon, using a soil auger. Soil samples were taken to the laboratory in sterile cellophane bags for further investigations.

Soil Sample Examination: Analysis was carried out within two hours of collection. Soil texture, organic matter and organic carbon contents were determined as recommended by the United States Department of Agriculture, (USDA, 1976). Soil hookworm larval population counts were carried out using a modification of the Baerman's technique as was described by Cort, Augustine and Payne (1921).Hookworm larvae were identified using descriptions detailed out by Gilles (1996).

Stool Sampling: To predict the risk of spread of hookworm infection to the population most at risk of infection, stool samples were obtained from 100 interviewed school food vendors trainee in Ibadan city. Stool examinations for hookworm infection were carried out using concentration methods (Stoll, 1962). Individuals positive for hookworm infections were subjected to qualitative epidemiological investigations, using a questionnaire followed by a visit to their houses to determine sanitary habits and sanitation status.

Results

Soil Survey: Four soil texture namely, sand, loamy sand, sandy loam and sandy clay loam were observed based on the quantity of sand, clay and silt in the soil samples (Table 1). The sandy loam soil type was the most frequently occurring while the least occurring was the sandy clay loam soil.

All the soil samples collected were found to harbour an average of 11×10^3 hookworm larvae per gram of soil. Details of the range of hookworm larval population count for each site is shown in Table 2. The highest was recorded at Gbaremu market ($6.1 - 84 \times 10^3$) in Ibadan North local government while the lowest count was recorded at Aleshinloye market ($0.1 - 2.4 \times 10^3$) located in Ibadan Southwest local government.

Table 3 shows that the surface soil was richest in organic matter content. Preliminary observations showed that hookworm larval population count was expectedly higher in the top surface soil samples than in the lower portion of the surface soil profile. Only surface soil samples recorded larval growth, it was however noted that, where subsoil samples organic contents were as high as 4.1%, (the mean value for all the surface soil samples organic matter), there was no support for hookworm larval propagation. Such samples recorded a net zero prevalence.

Assessment of the risk of spread of hookworm infection: Table 4 shows the level of awareness of hookworm infection and sanitation among the hookworm infected food vendors. Eighty percent (80%) of the respondent had no correct perception of hookworm infection while 84% have no correct knowledge of the causes of hookworm infection.

Out of the 100 food vendor trainees, 36 were found positive for hookworm infection, 50% had multiple intestinal worm infestation. The follow-up visits revealed that 75% of the infected food vendor trainees had no household latrine facility in spite of the fact that they all had some level of education; sixty percent had primary education while forty percent had secondary education.

Investigations further showed that 32 out of the 36 hookworm positive respondents claimed to have practiced defecation on communal locations in the bush and had used leaves or other material around the defecation points to clean up.

Discussion

A number of social factors moderate the use of sanitation facilities where they are available. Observation made during this study showed that when people are out of or far from their homes, the facilities commonly available for defecation include bush areas, open public recreational grounds, around school buildings or abandoned and uncompleted buildings and such other solitary places.

Interestingly people saddled with the task of moving around in a bid to enhance their economic power most of the time fall in the economic class that cannot afford decent houses with adequate sanitary and water facilities and only acquire a low level of education, if any at all. Hence food vendors like other such workers constitute a health risk factor especially when public sanitation facilities are lacking. This study has shown that a significant proportion of food vendor trainees have no household latrines coupled with low level of education. The educational status had little or no influence on their perception or awareness of hookworm infection, nor the mode of hookworm transmission.

Oluwande *et al.* (1959), Oduntan (1977) and Oyerinde (1978) working in Lagos and Ibadan among school children, reported high prevalence of hookworm: 93% in Lagos, 90% in Ibadan and 59% in Lagos respectively. It is pertinent to mention that hookworm remains a persistent health problem today. The current status of infection and the associated risk of spread of the infection can be attributed more to the low level of awareness of the disease.

Hookworm infestation is one of the ecologically induced health problems in Ibadan city. The soil samples of all communal defeacation grounds within the urban settlement were found to be heavily polluted with faecal matter from hookworm infested persons. This unsanitary practice favours hookworm larval propagation and subsequent hookworm transmission. The prevalence of hookworm larvae on surface soil is attributed to the air and warmth requirements of hookworms (Chandler, 1961) hence the reduction to net zero occurrences in larval counts in the subsoil layers as encountered during this study. Contrary to several previous reports on the soil requirement of hookworm larval development, the present observation showed that all soil types supported larval propagation thus implicating the significance of human behaviour involvement rather than soil type in the transmission of hookworm infection. A situation where sanitary facilities are lacking and public health education is lacking, is responsible for high level of transmission going on. The frequent indiscriminate contamination of soil and the deleterious effect on health of man within the city can best be curtailed at the state and local government levels considering the individual and community low economic status. A high faecal pollution level is indicated by the high average hookworm larval population count of 11×10^3 per gram of soil sample. The density of hookworm larvae in the five local government areas showed no significant trends, however, the observed significantly high intensities (84×10^3, 83×10^3 and 71×10^3) were restricted to locations with high population density, that is, Gbaremu, Ijokodo areas in Ibadan North LGA and Barracks in Ibadan Northwest LGA.

The need for intensified health education, legislation and its enforcement generally are paramount in view of the importance of the disease and the cost of treatment.

References

Chandler, A.C. 1961. The prevalence of hookworm and other helminthic infections in India. India Journal of Med. Res. 14: 185 – 195.

Cort, W.W.; Augustine, D.L. and Payne, G.C. 1921. Baermann's apparatus and improved technical implementation for field studies on intensity of infection. J. Am. Med. 77, 2023 – 2036.

Gilles, H.M.1996. Soil transmitted helminths (Geohelminths) in: Manson's Tropical Diseases (Ed. Gordon C. Cook), E.L.B.S. and Bailliere Tindall Pub. 1385 – 1390pp.

Lorenzo, S. 1996. World Health Forum. Disease Surveillance. Intern. Journ. of Human Dev. 17 : 211.

Oduntan, S.O. 1977. The health of Nigerian children of school age II: Parasitic and infective conditions, the special senses, physical abnormalities. Ann. Trop. Med. Para. 68: 145 – 156.

Oluwande, P.A. and Okubadejo, A.O. 1959. Intestinal worm infestations in Lagos. Nig. Med. Journ. 8: 919 – 961.

Oyerinde, J.P.O. 1978. Human Ankylostoma infection in Nigeria. Ann. Trop. Med. and Parasitol. 72: 363 – 367.

Oyerinde, J.P.O. 1982. Education of hookworm as a public health problem in Nigeria urban population. West Afr. Journ. of Med. 2: 23 – 29.

Stoll, N.R. 1962. For hookworm diagnosis, is finding one egg enough? Ann. of New York Acad. of Science 98: 712 – 724.

Symth, J.D. 1996. Phasmid Nematoda: Strongylida. In: Animal parasitology. Low price edition, Cambridge University press. pp 412 – 422.

Ukoli, F.M.A. 1990. Human intestinal nematodes I. In: Introduction to parasitology in Tropical Africa. pp 229 – 244. Textflow Ltd. Ibadan.

UNICEF, 1997. The progress of nations. A statistical profiles. 68p

USDA, 1976. United States Department of Agriculture's laboratory manual for soil analysis.

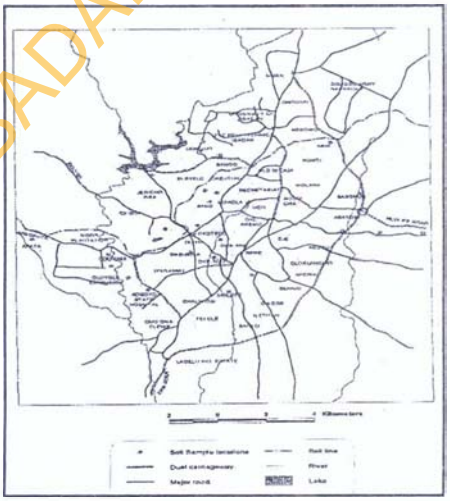

Table 1. Soil texture classification of soil samples from defecation grounds in Ibadan metropolis.

Level (Percent)			Soil texture class	Frequency of occurrence
Sand	Silt	Clay		
85 – 92	2 – 8	4 – 12	Sand	10
52 – 80	5 – 34	8 – 20	Sandy loam	44
80 – 86	4 – 10	7 – 12	Loamy sand	14
52 – 82	6 – 28	12 – 26	Sandy clay loam	7

Table 2. Hookworm larval population count (HLPC) in relation to organic matter content in surface soil samples from communal defecation points.

Local Govt. Area	Location	Organic Matter	Range of Hookworm Larval Population (per gram of soil x 10^3)
	Gbaremu market	7.98	6.1 – 84
	Cheshire High School	4.11	4.1 – 2.4
	Ijokodo	6.95	2.6 – 71
Ibadan North	Jemibewon Road (scrapped land)	3.58	3.1 – 6.3
	Sabo Area (behind recreation club)	6.81	2.4 – 5.1
	Onireke	1.03	1.1– 3.4
	Eleyele	2.79	2.1 – 4.3
Ibadan North West	Sabo	3.18	2.6 – 4.4
	Dugbe	1.39	0.7 – 8.0
	Barracks	6.95	0.7 – 83
	Aleshinloye (scrapped land)	0.52	0.1 – 2.4
	Odo Ona (river bank)	5.07	4.8 – 6.2
Ibadan South West	Odo Ona II	6.31	3.7 – 6.7
	Apata	5.07	4.7 – 14
	Ring Road (refuse dump)	3.27	4.4 – 7.2
	Leaf Road (openland)	2.12	2.1 – 5.6
	Oke Bola (river bank)	7.98	0.2 – 3.9
Ibadan South East	Molete (scrapped river bank)	4.64	1.1 – 7.8
	Oranyan (river bank)	1.98	3.0 – 4.6
	Bashorun	4.47	1.1 – 8.2
	Ashi	4.64	4.4 – 5.9
Ibadan North East	Old Ife Road	4.20	3.6 – 5.8
	Onipepeye	4.64	4.6 – 5.8
	Aba Efun	1.46	2.0 – 5.0
		2.67	4.0 – 6.2

B. Enviromental Microbial Hazards and Risk Analysis

	Range of Organic Matter (%)	Average Value
Soil Surface Layer (0 – 5cm)	0.53 – 7.98	4.18
Middle Sub Soil (15 – 20 cm)	0.43 – 5.68	2.1
Deep Soil	0.36 – 3.74	1.1

Table 4.: Level of awareness in aspects of sanitation and transmission associated with Hookworm spread.

	Number of Yes (%)	Number of No. (%)
Perception and awareness of hookworm disease	7 (20)	29 (80)
Correct knowledge of Hookworm disease	6 (16)	30 (84)
Knowledge of transmission mode	12 (33)	24 (67)
Wrong mode of transmission suspected	27 (75)	9 (25)
Availability of household latrine facility	9 (25)	27 (75)