



Knowledge Assessment and Distribution of Soil-Transmitted Helminths in Ibarapa Area of Oyo State, Nigeria

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Abstract

Over a billion people are infected with soil-transmitted helminths (STHs), a neglected tropical disease that is more prevalent among the poor. Soil contamination with helminth eggs constitutes a major risk factor for STH infections. This cross-sectional study was conducted to determine the prevalence of STHs in soil samples and evaluate the associated determinants in Ibarapa area of Oyo State, Nigeria. Soil samples (n=432) were purposefully collected from cattle markets, cattle kraal, slaughter slabs and around different water bodies. Laboratory examination of the samples for STHs was carried out using centrifugal floatation method. Semi-structured questionnaire was administered to 393 consenting participants to obtain information on the knowledge related to presence and prevention of STH infections. Data were analyzed using descriptive statistics and multivariate logistic regression at $p \leq 0.05$ level of significance. An overall STH prevalence of 11.3% (49/432) was recorded and three STHs were identified: *Strongyloides* spp. (7.6%, n=33), *Ascaris lumbricoides* (3.7%, n=16) and *Trichuris* spp (2.3%, n=10). Soil samples from the slaughter slab (29.6%, 32/108) were the most contaminated. A two-third (71.5%) of respondents do not know that transmission can occur via contact with contaminated soil. The prevalence of STHs in this study is a proof of its public health importance. Further, the disposition of respondents to preventive measures against STHs is poor. Hence, there is a need for increased public health enlightenment campaigns on STHs, in combination with preventive chemotherapy in Ibarapa area of Oyo State.

Keywords: Cattle; Prevalence; Soil-transmitted helminths

Introduction

One of the main causes of health issues worldwide is soil-transmitted helminths, particularly in the most impoverished and underprivileged areas where it is challenging to apply preventative measures (Mascarini-Serra, 2011; Hotez *et al.*, 2009). Approximately 1.5 billion people are estimated to be infected with soil-transmitted helminths (STHs) globally with significant morbidity and mortality (WHO, 2020). Soil-transmitted helminths infection, also known to cause intestinal helminths infection, belong to the group of neglected tropical diseases caused primarily by four major helminth species of the Class Nematoda, namely: *Ascaris lumbricoides*, *Trichuris trichiura*, *Ancylostoma duodenale* and *Necator americanus* (Karagiannis-Voules *et al.*, 2015). Anaemia, stunted growth, and delayed cognitive development can all be caused by STH infections (Ostan *et al.*, 2007) and are regarded as one of the main causes of disability-adjusted life years (De Silva *et al.*, 1999). Their transmission is intimately

associated with poverty, poor sanitation and lack of access to healthcare (WHO, 2020).

A huge percentage of infected people are resident in the tropical and sub-tropical regions like Nigeria where poverty results in poor unsanitary condition (Stolk *et al.*, 2016). Majority of rural and urban communities in the country do not have adequate and proper disposal system for human waste, and many inhabitants defecate indiscriminately in different places including directly on the soil, rocks and in water bodies (Adegoke, 2000). Further escalating the contamination of soil is the faeces from stray and/or grazing animals which are particularly dangerous and can equally serve as potential source of public health problems due to possible zoonotic transmission (Ukoli, 2000). People contract infection mainly by walking barefoot on soil contaminated with infective larvae or by ingestion of infective ova (Alie, 2017; Montresor *et al.*, 2008). These worms can survive for several years in the gastrointestinal tract of their hosts (Zaiss and Harris 2016). The main



source of contamination with parasites is represented by infected humans and animal faeces that were poorly disposed (Traversa *et al.*, 2014).

There is strong evidence that children are the most vulnerable category (Brooker *et al.*, 2006; Galvani, 2005) where infections are contracted by playing in filthy dirt and engaging in pica behaviours (Despommier, 2003; Fisher, 2003). Although the prevalence of *Ascaris lumbricoides*, *Trichuris trichiura* and the hookworms (*A. duodenale* and *Necator americanus*) has decreased globally, in the Americas and Asia, the situation in sub-Saharan Africa remains unchanging (Pullan *et al.*, 2014). The helminths contamination of the soil as a result of human and animal activities has not been comprehensively investigated in the study location. Most studies on STHs carried out in Oyo State were faecal examination based while relatively few soil examination based studies were carried out mostly around school premises. Hence, this study was conducted to assess the distribution of helminths that are of public health importance in soil of Ibarapa area, Oyo State. Further, there is need to investigate the level of knowledge as it relates to prevention of intestinal parasitic infections among residents of the area.

Materials and Methods

Study Area

The study was carried out in Ibarapa area of Oyo State, Nigeria, which falls within latitudes 70.15'N and 70.55'N, and longitudes 30.0'E and 30.3'E (Rasaki *et al.*, 2020). The Ibarapa area is divided into three LGAs by the Federal Government of Nigeria in 1996 with an estimated human population of about 322,295 by the National Population Census of 2006. It is located approximately 100 kilometres north of the coast of Lagos and about 95 kilometres west of Oyo State capital and neighbouring city, Ibadan (Duze, 1984).

Study Design and Sample Size

A cross-sectional study was conducted between May and November, 2019. Total of 432 soil samples were examined and purposive sampling method was used. The sampling sites were distributed across the three (3) LGA in Ibarapa area. The sampling sites were cattle markets (3: 1 per LGA), cattle kraal (18; 6 per LGA), 5-20m around slaughter slabs (6: 2 per LGA) and different streams (18 ; 6 per LGA) (used by both humans and animals). A total of

108 soil sample was collected per site, which is 36 samples/LGA. Soil samples of approximately 200-250 g from a depth of about 2 cm in an area not exposed to direct sun light were collected.

Laboratory Analysis

The helminth eggs were detected by modified centrifugal flotation method (Dryden *et al.*, 2005). Eggs/oocysts were checked under the microscope at x10 and x40 magnification. Identification of specific STHs was carried out using bench aids for the diagnosis of intestinal parasites (WHO, 1994).

Questionnaire Administration

A total of 393 questionnaire administered comprised of both close and open-ended questions, which was designed in order to collect data on socio-demographic characteristics and knowledge related to prevention of helminth infections.

Ethical Approval

This research was approved by the Oyo State Ministry of Health (AD13/479/304) before the commencement of the study.

Data Analysis

Data were analyzed using IBM SPSS software package version 23 and Epi-Info version 3.5.1. Descriptive statistics such as frequencies and percentages were determined. Association between variables was assessed by calculating the odds ratios. Multivariable logistic regression model (MVLM) was used to determine predictors of infection and confidence interval was set at 95% with level of significance at 5%.

Results

Of the 432 soil samples collected across Ibarapa area, 49 (11.3%) were positive for ova of STHs (Table 1). *Strongyloides* spp. was the most frequently encountered STH, with an overall prevalence of (7.6%, n=33) while *Trichuris* spp had the least prevalence of (2.3%, n=10). The study showed the true parasitic profile of contamination of soil in different sampling sites. The examined soil samples from each site showed slaughter slab 27 (6.3%) as the most contaminated while the samples from soil surrounding different stream water had the least, a prevalence of 3 (2.8%) each. Findings from this study also revealed that seven (1.6%) out of the 432 samples collected had the presence of multiple (>1)



STHs while the remaining positive samples 42 (9.7%) had single STHs presence.

All participants had heard of helminth infections. However, only 28.5% knew transmission of helminths could occur via contact with contaminated soil. Only the education status was associated with the knowledge of prevention of helminth infections (Table 2). The respondents without formal education were about seven times less likely to be knowledgeable about prevention of helminth infections than those with post-secondary education (OR = 0.14, 95%CI: 0.05-0.37).

Discussion

The presence of parasitic helminth eggs in soil is of great epidemiological significance and a serious public health concern. The prevalence of soil contamination recorded in this study vary from previously reported studies. In Nigeria, Oyebamiji *et al.* (2018) reported a prevalence of 54.9%. In India, 4.75% (Sudhakar *et al.*, 2013), 7.9% in Poland (Bojar and Kłapeć, 2012), 24% in Italy (Habluetzel *et al.*, 2003), 31% in the Philippines (Paller and de Chavez, 2014), 63.3% in Portugal (Otero *et al.*, 2014) and 22.4% was reported in Brazil, (Marchioro *et al.*, 2013). The differences between this study and earlier documented studies may be attributed to a wide range of factors, such as climatic conditions, soil type, number and volume of samples tested, the season in which sampling was performed, the mode of storage of samples and the method of analysis used (Santarém *et al.*, 2009).

Strongyloides spp and *Ascaris* spp that were both reported in this study have been reported as common soil helminths in other part of Oyo State (Oniya, 2019; Oyebamiji *et al.*, 2018; Hassan *et al.*, 2017). The presence of *Ascaris* spp in soil might possibly be due to human defecation and could also be attributed to the fact that the adult female worms are highly fecund (producing about 200,000 eggs daily) and the eggs are highly resistant; due to the presence of thick external layers to environmental stress and can survive for many years in the soil (Zibaei *et al.*, 2010). The presence of zoonotic nematodes, like *Trichuris* eggs, may likely be linked to sampled sites being exposed to scavenging stray and grazing animals that defecate about.

There is a risk of contracting infection from any of the sampled sites because both humans and

animals frequent the sites sampled. Also, STH contaminated soil serves as a continuous source of infection according to Ogbolu *et al.* (2011). There is a risk of contracting infection from any of the sampled sites since both humans and animals frequently visit these sites. Also, STHs-contaminated soil serves as a continuous source of infection (Ogbolu *et al.*, 2011). The high rate of poor knowledge that transmission of helminths could occur via direct contact with contaminated soil is disturbing, considering the vulnerability and exposure risks associated, importantly, children (Welch *et al.*, 2016). Further, the association of education with knowledge of prevention of helminths infection further gives credence to the power of information. This suggests the need for more enlightenment campaigns regarding prevention of helminth infections among members of the community.

Conclusion and Recommendation

The presence of helminths contamination of soil observed in the present study poses a high risk of STHs transmission in the study area. Therefore, there is a need for proper education on helminths transmission in the area.

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Conflict of Interest Statements

The authors declare no conflict of interests.

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Table 1: Prevalence of STHs in Soil Samples from various sites in Ibarapa area

Sites	No. of sample	No. of positive		<i>Ascaris</i> spp (%)	<i>Trichuris trichuria</i> (%)	<i>Strongyloides</i> spp (%)
		Samples	with STHs (%)			
Cattle markets	108	4	(3.7)	2 (12.5)	1 (10)	1 (3.0)
Cattle kraals	108	20	(18.5)	2 (12.5)	4 (40)	14 (42.4)
Slaughter slabs	108	32	(29.6)	10 (62.5)	5 (50)	17 (51.5)
Soil around water sources	108	3	(2.8)	2 (12.5)	-	1 (3.0)
Total	432	49		16	10	33

Table 2: Factors Influencing Levels of Knowledge about Intestinal Parasitic Infection Prevention Amongst Respondents in Ibarapa, Oyo State (N = 393).

Variable	Category	Poor Knowledge of Worms n (%)	Good Knowledge of Worms n (%)	OR, 95%CI, P value
Age (in years)	18-29	25 (21.7)	90 (78.3)	0.50, 0.20-1.26, 0.142
	30-39	30 (27.8)	78 (72.2)	0.60, 0.28-1.28, 0.184
	40-49	19 (11.2)	151 (88.8)	1.00 (reference)
Gender	Male	46 (17.2)	221 (82.8)	0.84, 0.44-1.60, 0.603
	Female	28 (22.2)	98 (77.8)	1.00 (reference)
Education status	None	17 (36.2)	30 (63.8)	0.14, 0.05-0.37, 0.000
	Primary	21 (32.3)	44 (67.7)	0.11, 0.04-0.29, 0.000
	Secondary	21 (15.1)	118 (84.9)	0.50, 0.21-1.26, 0.125
	Post-secondary	15 (10.6)	127 (89.4)	1.00 (reference)
Occupation	Unemployed	112 (15.0)	68 (85.0)	1.92, 0.53-6.94, 0.319
	Entrepreneurs	51 (30.4)	117 (69.6)	1.49, 0.48-4.68, 0.493
	Farmers	3 (3.6)	81 (96.4)	24.14, 4.73-123.30, 0.000
	Pastoralists	1 (4.8)	20 (95.2)	9.27, 0.92-93.71, 0.059
	Civil servant	7 (17.5)	33 (82.5)	1.00 (reference)
Marital status	Married	60 (19.9)	241 (80.1)	1.92, 0.35-10.60, 0.457
	Single	11 (13.9)	68 (86.1)	3.77, 0.52-27.38, 0.189
	Divorced	0 (0.0)	5 (100)	1.00 (reference)
	Separated	3 (37.5)	5 (62.5)	0.5, 0.09-2.89, 0.5