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PREVALENCE OF GEO-HELMINTHS AND PREVENTIVE PRACTICES AMONG FARMERS IN A LOCAL GOVERNMENT AREA OF NORTH CENTRAL ZONE NIGERIA

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ABSTRACT

Background: Geo-helminths are recognized as major public health problems, because they negatively affect the host's nutritional status by affecting the intake, intestinal absorption, metabolism and excretion of nutrient. **Methods**: A descriptive cross sectional study which utilized quantitative and qualitative methods of data collection over a period of one month at various selected communities. A pre-tested semi-structured interviewer-administered questionnaire and soil sample from the communities were used. The data was analyzed using Statistics Package for Social Science (SPSS) Version 20.0. Data were represented in tables and charts. The level of significant was set at $p < 0.05$. **Results**: Most of the respondents were of the younger age group, males, married and with at least secondary education. Almost all the respondents 349 (99.1%) knew hookworm as a type of soil transmitted helminthes 204 (58.0%) correctly mentioned ingestion as a means of transmission and stated that environmental sanitation could prevent helminth infection. Overall, only 172 (42.7%) had good knowledge while 175 (43.4%) had good practice of the prevention and control of soil helminthes. Age, marital status, and level of education were statistically significant associated with practices with respect to Geo-helminthes. Hookworm larva was the most prevalent followed by strongyloids from soil examination. **Conclusion:** Resident of Riyom should improve their hygiene practice by proper faecal handling and hand washing. Further research involving stool samples will be needed to inform policy making.

KEYWORDS: Prevalence, Practice, Transmission, Prevention, Geo-helminthes.

INTRODUCTION

Soil transmitted helminthic infections are among the most widespread and neglected infections globally.[1] They are among the most prevalent afflictions of humans living in areas of poverty in the developing world. Two billion individuals were reported[2] to be parasitized with helminthic worms, majority of them living in resource-poor settings, 80% of these live in sub-Saharan Africa.[3] Prevalence of these intestinal worms varies according to the hygienic conditions and socioeconomic status of the area and occurs in all age groups and sex but is highest among children. In areas where feaces are used as agricultural fertilizer, infection is common in farm workers. It has been estimated that almost two billion people are infected with one or more of these soil-transmitted helminths which account for up to 40% of the universal morbidity.[4] STH infections rarely cause death. Instead, the burden of disease is related less to mortality than to the chronic on the hosts' health and nutritional status.[5] Hookworms have long been recognized as an important cause of intestinal blood loss leading to iron deficiency and protein malnutrition. The iron deficiency anemia that accompanies moderate and heavy hookworm burdens is sometimes referred as hookworm disease.[4]

Ekundayo et al. reported that the prevalence of geo-helminths infections in Nigeria between 1977 and 2006 ranges between 1.5% to 88.5% with Ascaris lumbricoides, hookworms (Necator americanus and Ancylostoma duodenale), and Trichuris trichiuria species as the commonest agents.[6] Prevalence parameters varied for individual parasites and for rural and urban communities. The high prevalence of STH infections has been closely related with illiteracy, poverty, poor environmental hygiene and impoverished health sector.[7–9] Control of geo-helminths infections is based on periodic drug treatment (de-worming), health education and improved sanitation. The WHO recommends periodic drug treatment, without previous

individual diagnosis to all at risk people, especially preschool and school-age children living in endemic areas. The target is to eliminate morbidity due to Geo-helminths in children by 2020. As at 2012, global coverage of de-worming was 32.6%.[2]

Worldwide, more than a billion people are infected with soil-transmitted helminths (STHs), parasitic worms that live in the human intestine (gut).[2] These intestinal worms, including roundworm, hookworm, and whipworm, mainly occur in tropical and subtropical regions and are most common in developing countries, where personal hygiene is poor, there is insufficient access to clean water, and sanitation (disposal of human feces and urine) is inadequate or absent. STHs colonize the human intestine and their eggs are shed in feces and enter the soil. Humans ingest the eggs, either by touching contaminated ground or eating unwashed fruit and vegetables grown in such soil. Hookworm may enter the body by burrowing through the skin, most commonly when bare-footed individuals walk on infected soil. Repeated infection with STHs leads to a heavy parasite infestation of the gut, causing chronic diarrhea, intestinal bleeding, and abdominal pain. In addition the parasites compete with their human host for nutrients, leading to malnutrition, anemia, and, in heavily infected children, stunting of physical growth and slowing of mental development.[2]

Soil transmitted helminths (STH) are intestinal nematodes whose part of their development takes place outside the body of the host. These organisms make soil as their intermediate host before they infect the individual.[10] The three most common STH are the large intestinal roundworm (*Ascaris lumbricoides*), whipworm (*Trichuris trichiura*), and the anthropophilic hookworms (*Necator americanus* and *Ancylostoma duodenale*). The purpose of this study was to quantitatively summarize the relationship between presence of soil helminths at defecation site, refused dump, latrines with Knowledge and practices related to soil-transmitted helminth (STH) infection.

METHODOLOGY

Description of the Study Area: Riyom is one of the 17 Local Government Areas in Plateau State, a North central zone state. It has three districts (Ganawuri, Riyom and Bachi) with two hundred and thirty eight communities. Riyom LGA is predominantly rural with a land mass of 807 km^2 and an estimated population of 131,557. Its major occupation is farming and trading with each community having farmlands located close to their residents. There are few educational institutions, primary and secondary schools; it also has some primary health care centers. Access to some social services is relatively poor.

Study Design

Descriptive cross-sectional study was employed in conducting the study.

Study Population

Land/Soil Farmers (as opposed to poultry or livestock) in selected communities of Riyom local Government area Plateau State. Exclusion criteria: Farmers with chronic illnesses like were excluded from the study.

Sample Size

Using the Leslie Fishers formula at the standard normal deviate of 1.96, 95% confidence interval and a previous prevalence of hookworm from a previous study, 71.1%[11], the minimum sample size was 380 after taking into consideration a non-response rate of 20% but 450 questionnaires was administered for proper representation of the sample population. Multistage sampling was employed in selection of respondents. At Stage 1, simple random technique using balloting was used to select 2 out of the 3 districts in Riyom Local government; at Stage 2, the list of all the enumeration areas/settlements was obtained from the National Population Commission Office (NPC). Twenty enumeration areas per district were selected by simple random sampling technique, giving a total of 40 settlements; at Stage 3, a systematic random sampling of every other house was selected using the existing PHC household numbering system with the first house chosen by simple random method of balloting up to a maximum of 11 houses in each settlement and at Stage 4, one eligible respondent in each of the selected houses were interviewed. Also, 10 soil samples [2 each from streams, latrines, refuse dump/defecation areas, schools compound, and swamping areas in farms] were taken from the communities.

Research Instrument

A pre-tested semi-structured interviewer-administered questionnaire and soil sample from the communities were used. The questionnaire was divided into sections consisting of socio-demographic data, knowledge on Geo Helminths infection and risk practices with respect to Geo Helminths Infections.

For the Soil Sample

Formol Ether concentration method was used. Ten of normal saline was dispensed into a 15ml test tube; 1 gram of the soil sample was added into the 10ml normal saline; It was shaken vigorously; It was sieved to another 15ml test tube, and then the volume was adjusted to the same 10ml.; It was centrifuged at 3,000ϒpm (revolution per minute) for 5minutes; Supernatant was discarded. The deposit was then re-suspended in 7ml of 10% formol saline and 3ml of ether. It was covered with rubber burg. It was shake vigorously then carefully open. It was then centrifuged at the same speed and the same time. The debris was dislodged and the supernatant discarded; the deposit was re-suspended and a drop of the deposit was pipetted and added at the center of a grease free slid and a drop of 10% iodine was added, then covered with cover slip. It was viewed with x10 objective and confirmed using x40 objective and the result recorded.

Data Analysis

The questionnaires were checked for errors after which the data were entered into the computer and then analyzed using the Statistics Package for Social Science (SPSS) Version 20.0. For knowledge score; each correct response is awarded 1 while incorrect or no response scores 0. The total score was computed; respondents with scores above the average score were said to have good knowledge while those below were said to have poor knowledge. The same applies to practice. Data were presented using tables and graphs. Cross-tabulation of variables and other statistical analysis such as chi square were performed to assess statistical association of the variables. The level of significance was set at $p < 0.05$.

Ethical consideration

Ethical clearance was obtained from the Primary Health Care, Riyom Local Government Area Plateau State, Nigeria and the District heads of various communities before the commencement of the study. The community members were properly enlightened on the aims, objectives, benefits and protocols of study, and the need for voluntary participation and the right to stop participation at any time. Verbal consent was obtained from each respondent prior to the commencement of the interview. Confidentiality of the respondents was assured.

RESULTS

Out of the 435 questionnaires administered, only 403 were adequate for analysis. This gives a response rate of 92.5%.

Socio-demographic characteristics of respondents

Socio-demographic distribution of the respondents (Table 1) revealed a mean age of 36.2 ± 8.9 years and majority 187 (46.4%) of the respondent was between age group 30-39years. A larger proportion (84.9%) of the respondent was male, with male to female ratio of 5.6:1. Majority of the respondents were farmers only 209 (51.9%) completed secondary school; 197 (48.9%), and married (59.3%).

Respondent knowledge of Geo-helminthes

Table 2 showed that almost all the respondents, 349 (99.1%) knew of hookworm as the type of Geo-helminthes but lower proportion knew other types. Majority, 308 (76.4%) correctly mentioned soil as a potential source of Geo-helminths infection while 204 (58.0%) stated eating or drinking contaminated food/drink as a means of infection transmission. Knowledge of faeces and food crops as sources were mere average. Overall, 172 (42.7%) had good knowledge about geo-helminthes. Figures 1 and 2 showed the respondents main source of water for domestic use and type of toilet facility being used.

Respondent's practice towards prevention and control of Geo-helminthes

The study revealed that most respondents, 355 (88.1%), do not treat their water meant for drinking. Most of them also reported they wash their hands after using the toilet 374(92.8%). Other practices and risk factors are as in Tables 3 and 4. Overall, less than half 175 (43.4%) were assessed to have good practices towards prevention and control of Geo-helminthes infection.

Result of the Soil Analysis

A total of 400 soil samples were taken, 2 samples at different point in each of the streams, latrine, Refuse dump and defecation area, Compound (School/House), Swamping area (Farm) in the selected 40 communities.

From table 5, it can be observed that the younger the age the better their preventive practices of geo-helminthes and the association of age and practice is statistically significant. The same goes for marital status where the singles had a better practice. Similarly, respondents with higher level of education had a better practice towards geo-helminthes. The level of their knowledge of geo-helminthes is also statistically associated with the practices.

Table 6 shows number of different soil samples and the presence of soil transmitted helminthes. Larva of stronglyloids stereoralis was present in soil samples from 4 streams, 10 latrines, 8 refuse dump and defecation areas, 12 compounds (schools/Houses) and 14 swamping areas (farms). Larva of hookworm was present in soil samples from 2 streams, 8 latrines, 12 refuse dump and defecation areas, 12 compounds (schools/Houses) and 24 swamping areas (farms).Ascaris Lumbricoides was present in soil samples from 2 latrines, 2 refuse dump and defecation areas, and 12 compound (schools/Houses). Tapeworm was present in soil samples from 2 refuse dumps.

Table. 1: Socio-demographic characteristics of respondents.

Variables	Frequency(n=403)	Percentage (%)
Age in years		
20 - 29	104	25.8
30 – 39	187	46.4
40 – 49	80	19.9
50 and above	32	7.9
Mean Age ± SD	36.2 ± 8.9	
Sex		
Male	342	84.9
Female	61	15.1

Marital Status		
Single (Never married)	164	40.7
Ever Married	239	59.3
Level of Education		
No formal Education	14	1.4
Primary School	47	11.7
Some Secondary School	51	12.7
Completed Secondary School	197	48.9
Tertiary and post graduate	94	25.3
Occupation		
Farming only	209	51.9
Farming with trading	26	6.9
Farming with Civil Service employment	87	21.1
Farming with schooling	81	20.1

Table. 2: Respondent awareness and knowledge of Geo-helminthes.

Variables	Frequency(n=403)	Percentage (%)
Ever heard of STH		
Yes	352	87.3
No	51	12.7
Source of information (n = 352)		
School	173	49.1
Media	119	33.8
Health information chart	29	8.2
Health care personnel	31	8.9
Type of STH known (n = 352)*		
Guinea worm	23	6.5
Whipworm	15	3.7
Tapeworm	56	15.9
Round worm	84	23.9
Hookworm	349	99.1
Potential sources of STH infection (n = 352)*		
Faeces	214	60.8
Soil	308	87.5
Water	239	67.9
Food/vegetable	163	46.3
Others	49	13.9
How people contact STH (n = 352)*		
Eating/drinking infected food/drink	204	58.0
Through the air	38	10.8
Through the skin	89	25.3
STH is dangerous (n = 352)		
Yes	259	73.6
No	93	26.4
How can STH be prevented in the environment (n = 352)		
Environmental sanitation	184	52.3
Wearing protective wears	57	16.2
Public awareness	39	11.1
Water treatment	72	20.4
Knowledge of Geo-Helminthes		
Good	172	42.7
Poor	231	57.3

*Multiple responses.
STH = Soil Transmitted Helminthes.

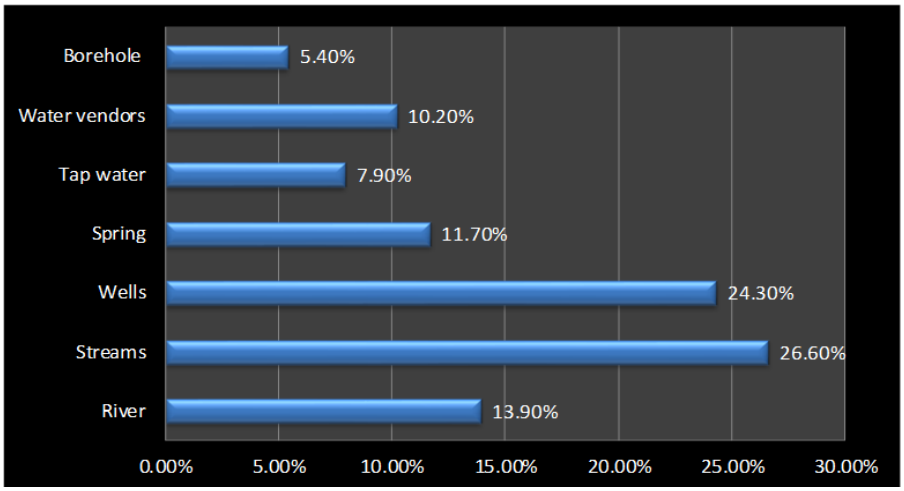

Figure. 1: A bar chart showing respondent's main source of water for domestic use.

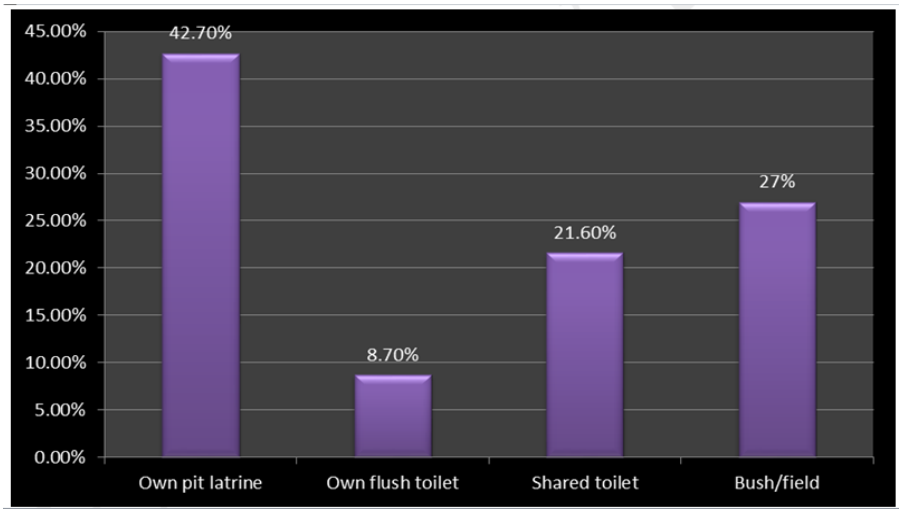

Figure. 2: A bar chart showing type of toilet facilities normally use at home by respondent.

Table. 3: Respondent practice towards prevention and control of Geo-helminthes.

Variables	Frequency(n=403)	Percentage (%)
Treatment for drinking water		
Boiling	31	7.4
Filtration	12	3.0
Use of water guard/chemicals	5	1.5
Nothing	355	88.1
Availability of water for washing hands in the toilet facility		
Yes	68	16.9
No	335	83.1
Wash hands*		
Before eating	239	59.3
After eating	198	49.1
After toilet	374	92.8
How easy it is to have soap for washing hands in the toilet facility		
Very easy	46	11.4
Easy	102	25.3
Difficult	193	47.9
Very difficult	62	15.4

*Multiple responses.

Table. 4: Respondent respondents practice towards prevention and control of Geo-helminthes continued.

Variables	Frequency(n=403)	Percentage (%)
Material for house walls		
Poles and mud	89	22.1
Sun dried bricks	103	25.6
Baked bricks	112	27.8
Timber	23	5.7
Cement bricks	76	24.5
Material of toilet floor		
Earth	205	50.9
Cement	161	40.0
Tiles	37	9.1
Frequency of putting on footwear outside the house		
Always	137	34.0
Occasionally	192	47.6
Rarely	74	18.4
Frequency of putting footwear when going to toilet		
Always	37	9.2
Occasionally	192	47.6
Rarely	174	43.2
Wear foot wear while farming		
Always	109	27.0
Occasionally	204	50.6
Rarely	90	22.4
Practice towards prevention and control of Geo-helminthes infection		
Good	175	43.4
Poor	228	56.6

Table. 5: Distribution of Respondents' Socio-demographic Characteristics and knowledge of Geo-helminthes with Preventive Practices.

	Preventive Practices of Geo-helminthes				
Socio-demographic	**Good n(%) 175**	**Poor n(%) 228**	**Pearson Chi-Square(x^2)**	**df**	**P-value (P)**
Age in years					
20 – 29 30 – 39 40 – 49 50 and above	58(55.8) 78(41.7) 24(30.0) 15(46.9)	46(44.2) 109(58.3) 56(70.0) 17(53.1)	12.698	3	0.0053
Sex					
Male Female	151(44.2) 24(39.3)	191(55.8) 37(60.7)	0.487	1	0.4852
Marital Status					
Never married Ever married	82(50.0) 93(38.9)	82(50.0) 146(61.1)	4.867	1	**0.**0274
Level of Education					
No Formal Education Primary School Secondary School or less Tertiary & Post-Graduate	5 (35.7) 26 (26.5) 71(36.0) 68(77.7)	4(64.3) 72 (73.5) 126 (64.0) 26(22.3)	64.940	4	<0.0001
Knowledge of Geo-helminthes					
Good **Poor**	129 (75.0) 46 (19.9)	43 (25.0) 185 (80.1)	121.777	1	<0.0001

* Statistically significant df = degree of freedom

Table 6: Distribution of Geo-helminthes in Soil and water

Soil Transmitted Helminthes	Streams	Latrines	Refuse dump and defecation areas	Compound (Schools/ Houses)	Swamping areas (farms)
Larva of Stronglyloids Stereoralis	4	10	8	12	14
Larva of hookworm	2	8	12	12	24
Ascaris Lumbricoides	0	2	2	2	0
Tapeworm	0	0	2	0	0

DISCUSSION

Geo-helminths are recognized as major public health problems, because among other things, they negatively affect the host's nutritional status by affecting the intake, intestinal absorption, metabolism and excretion of nutrients. Studies by Stephenson et al and Chukumwa, et al[5,12] in Nigeria showed that 53.6% soil and 87.7% stool samples were positive for geo-helminthes. Clearly, Geo- helminth infections remain an enormous public health problem in the 21st century. More than two-thirds of the adults involved in this study were males and this is not unusual for the study population being farmers. This is similar to the findings of Ogunlela[13] but differs from the study conducted in Nigeria which found that the 60-68% of farmers are males B.[14]

A little above half of the respondents are farmers who did not have other jobs while others were engaged with other income earning ventures. Farming in Nigeria especially in rural areas are subsistence[13] and so farmers usually find other ways to earn additional income. In the same vein, private and public employees also took to farming either as alternative source of income, hobby or means of household feeding provision.[15] This practice has become more popular in recent times in Nigeria owing to the dwindling economy. In most rural areas, education has not been given much priority by inhabitants, despite continuous government efforts for Universal Basic Education, so young people usually drop out of school to take to farming and other manual and menial jobs.[16]

This study revealed a good knowledge of Geo-helminths by less than half of respondents. Though, their awareness of the common type of helminthes, hookworm, was high, their knowledge of transmission and prevention was poor to average. This is different from the report in Kenya by Tarimo[14] among primary school children who reported high level of knowledge regarding STHs where 72.4% of them knew at least one of its transmission mode. Another study in Kenya and a Nigerian qualitative study in Enugu state also reported good knowledge of causes, transmission, prevention and health seeking behaviours.[18,19] However, it is noted that this study was among poor rural farmers while the above studies were among school children or adults in urban metropolis.

In Nigeria, a considerable amount of human and animal wastes are discharged into the soil daily leading to the contamination of the soil with STH eggs and larvae.[20] The presence of general poor practice exposes them to Geo- helminthes infection. Majority of the respondents get water for domestic use from unclean/unprotected sources with only 10 % treating it. This put them at high risk of helminthic infection.[21] Almost three quarters of the respondents do not put on a foot wear while working on their farms which are mainly on swampy rice farm which are rich sources of ova of helminths. Studies[21,22] have shown that wearing shoes alone can effectively control hookworm infestation. Habits of not wearing shoes and not washing hands before eating have been severally stated to be associated with increased odds of STH infection.[19-22] Hookworm infection occurs due to penetration of the skin by the larvae of the parasite. As a result, children walking barefoot on the soil contaminated with fecal matter will be exposed to the infective larval stages of the parasite. The same goes for the poor of defeacating and hand washing practices which not only put them at risk but also help to spread the infection to contacts.[21,22] Similarly, children playing in contaminated soil might also get exposed to infective stages (embryonated eggs) of A. lumbricoides. A study also reported a wide and unrestricted spread of the infection was attributed to failure to wear footwear in school, lack of functioning toilet facilities, geophagia and preference of the pupils to defecate in the bush leading to indiscriminate defecation in and around the school yard.[12]

This study shows that level of education is statistically significantly related to practice of prevention and control of geo-helminthes as well as age and marital status but not sex as also found in other studies.[23] Though not always the case, the knowledge of geo-helminthes among the respondents was statistically significantly associated with their practice of prevention and control of soil transmitted helminthes ($p<0.001$).

The findings from the soil samples were similar to previous studies. The higher number of stonglyloids stereoralis and hook-worm is also supported by Simon-Oke.[24] The prevalences of Ascaris lumbricoides, Strongyloides stercoralis and Hookworm seen in this study can be attributed to the unsanitary habits especially in handling of foods and drinks. Multiple infection varied with A.lumbricoides and Hookworm; A. lumbricoides and S. stercoralis, and Hookworm and S.stercoralis. The helminths are found majorly around samps water logged, moist soil, defeacation area.

Environmental factors such as water supply for domestic and personal hygiene, sanitation and housing conditions;

and other factors such as socioeconomic, demographic and health related behavior are known to influence Geo-helminths infection among farmers. The prevalence of hookworm is high particularly in adults.[15]

CONCLUSION AND RECOMMENDATION

Geo-helminthes are pervasive in the study area. The knowledge of the farmers are below average and their preventive and control practices are poor. There is a need for more education to prevent the hazard especially with respect to food and faecal handling, hand washing and shoe wearing. Further studies to investigate stool samples among children and adult are also recommended.

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