Research Article

Prevalence and Risk Factors of Soil-transmitted Helminthiasis among Students of Government Day Secondary School Gidan Igwe Area, Sokoto State, Nigeria

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Despite efforts and interventions to control Soil-transmitted Helminths infections, World Health Organization estimated 70.0% school aged children worldwide at risk of infection with at least one Soil-transmitted Helminths species, with 22% occurring in Africa; Soil-transmitted Helminths infections therefore still remain prevalent especially in developing countries. An epidemiological study was conducted to determine the prevalence and associated risk factors of Soil-transmitted helminthiasis among Students of Government Day Secondary School Gidan Igwe Area, Sokoto State, Nigeria. A total of 90 faecal samples were collected and analyzed using wet preparation method to detect the ova of soil-transmitted helminths. Information on risk factors of STHs was obtained from the students through a structured questionnaire. Binary Logistic Regression was used to determine the risk factors of Soil-transmitted Helminthiasis in the study area. Out of the 90 faecal samples examined, 54(60.0%) were found to be infected with at least one species of STHs or the other. Species of STHs encountered during the study in order of occurrence were; Ascaris lumbricoides (35.56%), Trichuris trichiura (16.67%), and Hookworm (7.77%). Results of Binary Logistic Regression indicated being 11-16 years old, farming activity, using well as a source of drinking water, walking barefooted, and not washing hands before and after meals as the major risk factors for the spread of soil-transmitted helminthiasis among the students. Therefore, public health attention is highly needed to control soil-transmitted helminthiasis among the study subjects in the area.

Key words: Epidemiology, Prevalence, geohelminthiasis, Students, Nigeria.

INTRODUCTION

Soil-transmitted helminths (STHs) are parasites that are transmitted by soil contamination of food or drinking water. Infection and transmission of such helminths are propagated by poor hygienic habit such as indiscriminate disposal of human and animal faeces. Three species are the main species responsible for widespread of the diseases in human and these include Ascaris lumbricoides, Trichuris trichiura and Hookworm (Necator americanus and Ancylostoma duodenale) (Ojurongbe, 2013).

Soil-transmitted helminthiasis have been among the major chronic parasitic infections distributed throughout the world. Globally, about 4.5 billion individuals are at risk and more than 2 billion people are infected, of which about 450 million suffer from the infection at school-age (WHO, 2014). The greatest number of soil-transmitted helminths infections occur in sub-Saharan Africa, the Americas and East Asia (WHO, 2019). Soil-transmitted helminthiasis is endemic in all regions of Africa and its public health importance has been described by many researchers in Nigeria (Opara et al., 2012; Auta et al., 2014; Muhammad et al., 2018) and in other parts of the world (Cha et al., 2017; Campbell et al., 2017; Samuel et al., 2017; Ziegelbauer et al., 2012).

Estimate has shown that there are 807 million cases infected with Ascaris lumbricoides (ascariasis), 604 million cases due to Trichuris trichiura (trichuriasis), and 576 million cases with Hookworm infection (Necator americanus duodenale) (WHO, 2014).

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Americanus and Ancylostoma duodenale) (Hotez et al., 2008). These parasitic infections caused about 4.98 million years lives with disability (Pullan et al., 2010). As a result, about 300 million people suffer from severe morbidity attributed to STHs infections, resulting in 10,000-135,000 death annually (WHO, 2014).

Soil-transmitted helminth infections are a major health problem of children from rural areas of developing countries and it is an important cause of morbidity in school-age children, especially primary school pupils (4-15 years) who were reported to be the highest prevalent and parasitized (Aboya et al., 2011). Over 270 million preschool-aged and over 600 million school-aged children live in areas where these parasites are actively transmitted. The total lost years of schooling due to worm associated absenteeism amount to over 200 million years and average Intelligent Quotient (IQ) loss per worm infection is 3.75 points amount to Intelligent Quotient loss of 633 million points in low and middle income countries where toilet facilities and portable drinking water are lacking (WHO, 2014). More so, inadequate water supply, overcrowding, lack of sanitation, unavailability and high cost of anthelmintic drugs are important determinants for the transmission of soil-transmitted helminths infections (Bethony et al., 2006). Mere observation of the school premises will reveal that the source of drinking water for everyday need in the school is an open water reservoir where students had to use buckets from toilet for fetching water directly from the reservoir. Most of the students can be seen playing football in the school premises barefooted and use their soiled hands to eat without washing. Because of the aforementioned, there is need to determine the risk factors of STHs in the study area.

Therefore, this study was designed to investigate the prevalence and risk factors of soil-transmitted helminthiasis among Students of Government Day Secondary School Gidan Igwe Area in Sokoto State, Nigeria, and to proffer possible solutions and recommendations on their prevention and control. The research also will serve as baseline data for future research as there was on research conducted on soil-transmitted helminthiasis in the study area.

MATERIALS AND METHODS

Study Area

The study was carried out from April to September, 2018 at Government Day Secondary School Gidan Igwe, located in Sokoto North Local Government, Girabshi road, Sokoto State, Nigeria. Sokoto State has an elevation of 450m (1,476 ft) and is located in dry Sahel with an annual average rainfall of 629 mm and annual average temperature of 28.3°C. Over Eighty percent of the inhabitants of the state are farmers practicing one form of farming or the other. The school is located at latitude 13.615240° North and longitude 5.2073086° East. The school was established in 2006 and currently having a total of 1,046 students (Junior Secondary School (JSS) and Senior Secondary School (SSS) included). The predominant tribe attending the school are Hausa-Fulani with other tribes like Yoruba, Igbo, and other minority tribes that live within the area. The main occupation of the people where the school is located includes farming, fishing, trading, as well as few civil servants.

Study Population and Sample Size Determination

The study was conducted to determine the prevalence and risk factors of soil-transmitted helminth infection among Students of Government Day Secondary School Gidan Igwe Area, Sokoto State, Nigeria. A total of 90 students were selected, fifteen from each arm (JSS1 to SS3). The sample size was calculated using the single proportion formula: \( n = \frac{Z^2 \hat{p} \hat{q}}{d^2} \) at 95% confidence interval, \( p \) = prevalence from a previous study conducted by Campbell et al. (2013), where they recorded a prevalence of 6.3%.

Ethical Consideration

The research was approved by Ministry of Health Sokoto State and the School Management of Government Day Secondary School Gidan Igwe, Sokoto State, Nigeria. Principal of the school obtained informed consent from parents/guardians of the students. Also, consent was obtained from the students selected for the study after explaining the purpose, procedure, possible risk and inconveniences of the study. The participating students were guided on how to fill the questionnaire with the help from their teachers. Students were not forced to participate in the study, rather they can drop at any stage of the study.

Sample Collection

A total of 90 faecal samples were collected from the Students of GDSS Gidan Igwe, Sokoto State. Fifteen (15) samples were collected from each arm (JSS1 to SS3). The students were selected randomly and each was given a clean, dry, sterile universal container to provide their stool sample. The stool samples were labelled to correspond with the student’s number on the questionnaire. The samples were preserved using 10% formalin and were immediately transported to Parasitology Laboratory Usmanu Danfodiyo University Sokoto for analysis.

Questionnaire Administration

Questionnaire was administered to each participating student from whom sample was collected. The questionnaire was aimed at obtaining information such as student’s age, parental occupation, type facility used, walking barefooted, hand washing before and after meal, and source of drinking water. All these were done with the permission of the Principal of the school.
Parasitological Analysis of Stool Samples

The stool samples were analyzed using direct saline/iodine wet preparation method (WPM) as described by (Alli et al., 2011). The preparation was observed under microscope using ×10 and ×40 objectives respectively. The adult worm or ova of soil-transmitted helminths parasites was identified based on standard chart provided by (WHO, 2004).

Statistical Data Analysis

Prevalence was calculated using the formula: (Number infected/ Number Examined) ×100. Chi square ($\chi^2$) statistical analysis was used corrected with Fisher exact test to determine the association of occurrence of soil-transmitted helminth infection with class, age, parental occupation, source of drinking water, type of toilet used, wearing of shoe, and hand washing before and after meal. P-values less 0.05 were considered significant. Data collected were summarized into tables. Data were analyzed using Epi Info Software version 7.2.2.6

RESULTS

The results of the global prevalence of soil-transmitted helminths parasites among students of Government Day Secondary School Gidan Igwe Area of Sokoto State shows that out of 90 stool samples examined, 54 (60.00%) were found to be infected. The parasites encountered during the study in order of occurrence were Ascaris lumbricoides (32/90; 35.56%), Trichuris trichiura (15/90; 16.67%) and Ancylostomids (Ankylostoma duodenale/Necator americanus (7/90; 7.7%)

It can be seen from table 2, that the prevalence of Soil-transmitted helminthiasis was highest among JSS1 Students (80.0%), followed by JSS 3 students (66.67%), while SS 3 students recorded the least prevalence (33.3%). Chi square analysis indicated no significant association between occurrence of soil-transmitted helminthiasis and student’s class ($\chi^2$ cal = 9.3, df = 5; $\chi^2$ tab = 11.07; P > 0.05). Table 2.

There was an increase in prevalence of soil-transmitted helminths infection with increasing age. Students aged 11-13 years had the highest prevalence (74.29%), followed by those aged 14-16 years (70.0%) while those aged 17-19 years had the lowest prevalence (28.0%). There is significant association in the occurrence of soil-transmitted helminthiasis with age of the students ($\chi^2$ cal = 14.94, df = 2; $\chi^2$ tab = 5.99; P < 0.05) Table 3. It could be seen from table 4 that students whose parent engage in farming activities recorded the highest prevalence (87.50%), followed by those whose parents were businessmen (43.33%), children of fishermen (40.0%), while children of civil servants recorded the least prevalence (26.66%). Occurrence of soil-transmitted helminthiasis significantly associate with parental occupation ($\chi^2$ cal = 15.58, df = 3; $\chi^2$ tab = 7.82; P < 0.05) Table 4.

The results of this study indicated significant association of soil-transmitted helminthiasis with source of drinking water ($\chi^2$ cal = 8.70, df = 3; $\chi^2$ tab = 7.82; P < 0.05). (Table 5).

It could be seen from table 6 that students who use open space to defecate had the highest prevalence (65.4%), followed by those who use pit latrine (53.3%), while those that used water closet had the least prevalence (40.0%). Chi square analysis indicated lack of significant associate between occurrence of soil-transmitted helminthiasis and type of toilet used ($\chi^2$ cal = 2.06, df = 2; $\chi^2$ tab = 5.99; P > 0.05). The occurrence of soil-transmitted helminths parasites significantly associates with wearing of shoe. Students that wear shoe sometime had the highest prevalence (79.2%), followed by those who always wear shoe (32.4%), but no prevalence was reported for students who do not wear shoe at all ($\chi^2$ cal = 9.88, df = 2; $\chi^2$ tab = 5.99; P < 0.05) Table 7. Chi square statistical analysis revealed no significant association in the occurrence of soil-transmitted helminth infection with hand washing before eating, although students who wash their hands before eating had higher prevalence (76.19%) than those who do not wash their hands before eating (55.07%) ($\chi^2$ cal = 3.15, df = 1; $\chi^2$ tab = 3.84; P > 0.05) Table 7. It could be seen from table 7 that students who do not wash their hands after meal had higher prevalence (88.23%) than those who wash their hands after meal (53.4%), statistical analysis indicated significant association between occurrence of soil-transmitted helminthiasis with respect to hand washing after meal ($\chi^2$ cal = 7.21, df = 1; $\chi^2$ tab = 3.84; P < 0.05).

Table 1: Prevalence of Soil-transmitted helminth parasites among Students of GDSS Gidan Igwe

<table>
<thead>
<tr>
<th>Parasite</th>
<th>Frequency</th>
<th>Prevalence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ascaris lumbricoides</td>
<td>32</td>
<td>35.56</td>
</tr>
<tr>
<td>Trichuris trichiura</td>
<td>15</td>
<td>16.67</td>
</tr>
<tr>
<td>Hookworm</td>
<td>7</td>
<td>7.77</td>
</tr>
<tr>
<td>Total</td>
<td>54</td>
<td>54(60.00)</td>
</tr>
</tbody>
</table>

Table 2: Prevalence of Soil-transmitted Helminthiasis among Students of GDSS Gidan Igwe in relation to their Classes

<table>
<thead>
<tr>
<th>Classes</th>
<th>No. Examined</th>
<th>No. Infected</th>
<th>Prevalence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>JSS 1</td>
<td>15</td>
<td>12</td>
<td>80</td>
</tr>
<tr>
<td>JSS 2</td>
<td>15</td>
<td>10</td>
<td>66.67</td>
</tr>
<tr>
<td>JSS 3</td>
<td>15</td>
<td>11</td>
<td>73.33</td>
</tr>
<tr>
<td>SS 1</td>
<td>15</td>
<td>8</td>
<td>53.33</td>
</tr>
<tr>
<td>SS 2</td>
<td>15</td>
<td>8</td>
<td>53.33</td>
</tr>
<tr>
<td>SS 3</td>
<td>15</td>
<td>5</td>
<td>33.33</td>
</tr>
<tr>
<td>Total</td>
<td>90</td>
<td>54</td>
<td>60</td>
</tr>
</tbody>
</table>

$\chi^2$ cal = 9.3, df = 5; $\chi^2$ tab = 11.07; P > 0.05
Table 3: Prevalence of Soil-transmitted Helminths Parasites among Students of GDSS Gidan Igwe with respect to Age

<table>
<thead>
<tr>
<th>Age</th>
<th>No. Examined</th>
<th>Lumbri-coides (%)</th>
<th>T. trichiura (%)</th>
<th>Hook worm (%)</th>
<th>Total (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>11-13</td>
<td>55 (61.11)</td>
<td>15 (28.57)</td>
<td>7 (20.00)</td>
<td>4 (11.43)</td>
<td>26 (47.27)</td>
</tr>
<tr>
<td>14-16</td>
<td>30 (33.33)</td>
<td>12 (40.00)</td>
<td>6 (20.00)</td>
<td>3 (10.00)</td>
<td>21 (70.00)</td>
</tr>
<tr>
<td>17-19</td>
<td>25 (27.78)</td>
<td>5 (20.00)</td>
<td>2 (8.00)</td>
<td>0 (0.00)</td>
<td>7 (28.00)</td>
</tr>
<tr>
<td>Total</td>
<td>90</td>
<td>32 (35.56)</td>
<td>15 (16.67)</td>
<td>7 (7.77)</td>
<td>54 (60.00)</td>
</tr>
</tbody>
</table>

$\chi^2_{cal} = 14.94$, df = 2; $\chi^2_{tab} = 5.99$; P < 0.05

DISCUSSION

The results of this study demonstrated the presence of soil-transmitted helminthiasis among Students of Government Secondary School Gidan Igwe with a prevalence of 60.00%. The prevalence of 60.0% obtained in this study seems to be higher than 1.40% reported by Isyaku et al. (2015) and 33.50% reported by Muhammad et al. (2018) all in Sokoto State, Nigeria and 6.30% by Campbell et al. (2017) in Cameroon. However, the prevalence is lower than 74.0% reported by Singh and Idris (2014) among boarding school children in Sokoto State, Nigeria. The prevalence could be attributed to engaging in farming activities, using well as a source of drinking water, and walking barefooted during which they may get infected with the infective stages of soil-transmitted helminths.
parasites. The high prevalence of *Ascaris lumbricoides* (35.56%) in this study might be due to walking barefooted by the students and the ability of the parasites to produce numerous eggs which can remain viable for a long period of time. This is in accordance with findings in Sokoto State (Singh and Idris 2014; Adeyaba 2011) and in other part of Nigeria (Banji et al., 2012) in which this helminthic worm was reported to have high prevalence followed by *Strongyloides stercoralis*, *Trichuris trichiura* and Hookworm.

*Ascaris lumbricoides*, *Trichuris trichiura* and Hookworm (*Ancylostoma duodenale/Necator americanus*) were the most prevalent parasites encountered during the study with *Ascaris lumbricoides* having the highest prevalence. The variability in prevalence could be as a result of the students engaging in farming activities, using well as a source of drinking water, and walking barefooted. The results of this study is in agreement with the one documented previously by Chigozie et al., (2007) in Eastern part of Nigeria where they attributed the high prevalence of *Ascaris lumbricoides* among school pupils to their exposure to contaminated soil which often contain the infective eggs of the parasites, thereby enhancing transmission from hand to mouth.

In the present study, occurrence of soil-transmitted helminth infection was significantly associated with farming. This may be due to the fact that the students accompany and assist their parents in farming activities where night soil may be used as fertilizer and in turn, they get exposed to faecally contaminated soil, thus, getting infected with infective stages of soil-transmitted helminths parasites.

The significant association of soil-transmitted helminthiasis with age in the present study is in conformity with the report of (Simon-Oke et al., (2014) in Ondo State, and Chinenyen et al., (2007) in River State, where they observed increase in prevalence with increasing age. However, (Muhammad et al., (2018) in Sokoto State, reported lack of significant association of soil-transmitted helminthiasis with age.

Occurrence of soil-transmitted helminthiasis significantly associate with well water. This may be due to the fact that well water are not usually covered, and contaminants being introduced into the wells as the same containers used in the toilet are being used in drawing the water and or direct dumping of dirt into the wells, hence, are susceptible to contamination with human and animal faeces containing infective stages which might expose the students to helminthic infection. Contamination of well water with diseases-causing agents had been documented in some parts of Nigeria (Adebote et al., (2004). This is in accordance with the report of (Isyaku et al., (2015) and Adeyaba et al., (2004), where they reported significant association of soil-transmitted helminthiasis with well water.

The lack of significant association of soil-transmitted helminthiasis with type of toilet used indicated that regardless of the place of defecation all students are equally expose to helminthic infection. This agrees with the report of Isyaku et al., (2015) and Muhammad et al., (2018), who also noted similar lack of significant association of helminthic infection with type of toilet used. However, Olusegun et al., (2011) in Osun State report significant association of helminthic infection with type of toilet used.

Ogbaini et al., (2014) reported that poor environmental and personal hygiene with respect to hand washing before and after eating are the driving forces of soil-transmitted helminths infections. However, in the present study, there was lack of significant association in the occurrence of helminthic infection with respect to this factor. This agrees with the findings of Isyaku et al., (2015) where they reported lack of significant association of intestinal helminths infection with hand washing habit.

**CONCLUSION AND RECOMMENDATION**

The 60.0% prevalence of intestinal helminthiasis among students of Government Day Secondary School Gidan Igwe Sokoto is high. This may be attributed to being 11-16 years, engaging in farming activity, walking barefooted, and using well as source of drinking water. While the farmers in the study area should avoid using night soil as fertilizer, government on the other hand, should intensify effort intensify efforts to provide portable drinking water, health education to the students on the dangers of soil-transmitted helminthiasis, and make drugs available to the school authority for mass chemotherapy.

**REFERENCES**


