



The Intensity Of Soil Transmitted Helminths Of Selected Public Schools At Karu And Keffi Local Government Areas, Nasarawa State, Nigeria

¹Umukoro, Aghogho; ²Ombugadu, R. J. & ³Yako, A. B.

^{1,2&3}Department of Zoology,
Faculty of Natural and Applied Science,
Nasarawa State University, Keffi, Nigeria

¹umukoroaghogho8@gmail.com

²ruthombugadu@gmail.com/Tel: 08069764934, 09027135379

³andyako66@nsuk.edu.ng/Tel: 08163168704

ABSTRACT

Soil Transmitted Helminths (STH) infections are among the most common global infections, predominantly affecting school-aged children in areas with poor sanitation. This study investigated the prevalence and intensity of STH in soil samples from selected public primary schools in Karu and Keffi Local Government Areas of Nasarawa State, Nigeria. A total of 159 soil samples were collected systematically from the toilet areas, dumpsites, and playgrounds of four selected schools. The isolation and recovery of parasite eggs and larvae were conducted using flotation and centrifugation techniques alongside the modified Baermann sieving and decanting method. Results revealed an overall STH prevalence of 49.69% (79 positive samples). Keffi LGA recorded a higher prevalence of 53.33%, while Karu LGA recorded 44.93%. Kofar Hausa Primary School had the highest prevalence at 67.8%. The toilet areas yielded the highest mean parasite intensity (1.63 ± 0.045), while the lowest was in the playgrounds (1.00 ± 0.20). Three geohelminth species were identified, with Hookworm being the most prevalent (63.55%), followed by *Ascaris lumbricoides* (28.03%) and *Strongyloides stercoralis* (8.41%). The study concludes that school-aged children in these areas are at substantial risk of geohelminthiasis due to poor hygiene and open defecation practices. It is recommended that stakeholders implement standard Water, Sanitation, and Hygiene (WASH) policies, conduct periodic school-based deworming, and construct well-maintained toilet facilities.

Keywords: Soil-Transmitted Helminths, Prevalence, Intensity, Public Schools, Nasarawa State.

1.1 INTRODUCTION

Soil-transmitted helminth (STH) infections are recognized as some of the most prevalent parasitic diseases worldwide and are heavily classified as Neglected Tropical Diseases (NTDs) due to the tremendous disability and chronic illness they inflict on affected populations (Centers for Disease Control and Prevention [CDC], 2011; World Health Organization [WHO], 2012). Globally, an estimated 1.5 billion people, representing approximately 24% of the world's population, are infected with these parasitic worms each year across 112 endemic countries (WHO, 2012, 2023). These infections predominantly afflict the poorest and most deprived communities located in tropical and subtropical regions, particularly where there is poor access to clean water, adequate sanitation, and proper hygiene (WHO, 2012). Geographically, the highest prevalences are reported in sub-Saharan Africa, China, South America, and Asia, with sub-Saharan Africa alone bearing a staggering 40% of the worldwide disease burden (WHO,

2012, 2023). The four principal species responsible for these human infections include the roundworm (*Ascaris lumbricoides*), the whipworm (*Trichuris trichiura*), and the hookworms (*Necator americanus* and *Ancylostoma duodenale*); these species are frequently addressed as a collective group because they share similar transmission routes, require identical diagnostic procedures, and respond to the same anthelmintic medications (Bethony et al., 2006; WHO, 2023).

The transmission of these parasitic worms is deeply entrenched in environmental contamination, occurring primarily when eggs are excreted in the feces of infected individuals and subsequently contaminate the soil in regions lacking adequate sanitation facilities (Bethony et al., 2006). Human infection manifests through several pathways: the ingestion of embryonated eggs attached to poorly washed or uncooked vegetables, the consumption of contaminated water, or via the fecal-oral route when children inadvertently place unwashed, contaminated hands into their mouths after playing (World Health Organization [WHO], 2012). Furthermore, hookworm eggs hatch directly in the soil, releasing larvae that mature and actively penetrate the intact skin of individuals, especially those walking barefoot in contaminated environments. The health consequences of STH infections are profoundly detrimental, severely impairing the nutritional and physical status of the host. Adult worms residing in the human intestines feed on host tissues and blood, precipitating significant losses of iron and protein. Hookworms, in particular, cause chronic intestinal blood loss that frequently results in severe anemia, a condition disproportionately affecting adolescent girls and women of reproductive age. Beyond blood loss, STHs exacerbate the malabsorption of vital nutrients, compete for essential vitamins such as vitamin A, and induce gastrointestinal manifestations including loss of appetite, abdominal pain, diarrhea, and dysentery. For the hundreds of millions of at-risk school-aged children, these morbidities collectively hamper physical growth, impair cognitive development, and lead to poor academic performance, increased school absenteeism, and a heightened vulnerability to other endemic infectious diseases such as malaria and tuberculosis.

Preschool and school-age children constitute the highest-risk demographic for acquiring these infections, with over 654 million school-age children globally living in areas of intensive transmission (World Health Organization [WHO], 2012). Their heightened vulnerability is primarily driven by behavioral traits, as they frequently engage in play with soil and often walk barefoot within their communities. The school environment itself frequently serves as a critical hotspot for STH transmission. The survival, development, and abundance of parasite eggs and larvae in the environment are heavily dependent on various biotic and abiotic variables, including temperature, moisture, pH, organic matter content, and soil texture (WHO, 2004). In many developing regions, including Nigeria, public school environments are particularly susceptible to severe soil contamination due to socio-cultural practices and significant infrastructural deficits. Factors such as the lack of perimeter fencing, proximity to refuse dumpsites, and the absence of adequate, functioning toilet facilities exacerbate the problem, often leading to open defecation directly on school premises by both pupils and community members. Consequently, these excreted pathogens can survive in the soil for sufficient lengths of time, turning school playgrounds and toilet areas into potential sources for massive outbreaks of gastrointestinal infections among the pupils.

Despite ongoing efforts to map and manage STH infections across various African nations, Nigeria continues to grapple with significant control challenges. There is a pronounced dearth of empirical information regarding the precise extent of parasite contamination in soils across the country. As noted by Nock (2007), the control of these infections in Nigeria remains relatively inadequate largely due to the absence of reliable, localized data concerning the geographical distribution of the disease and the specific populations at risk. Because school children constitute the highest-risk population within these communities, it is highly pertinent to examine the presence of STH eggs and larvae in the soil around school premises and their immediate environments. Therefore, assessing the prevalence and intensity of these geohelminths in selected public schools across Keffi and Karu Local Government Areas of Nasarawa State is essential to generate the evidence-based data required for effective health planning, targeted deworming campaigns, and the improvement of school sanitation infrastructure.

1.2 Statement of the Research Problem

While significant activities regarding STH mapping have been attempted in several African countries, there is a critical dearth of localized information on the extent of parasite contamination in soils across Nigeria at large. This lack of reliable epidemiological data concerning disease distribution and populations at risk renders infection control measures inadequate. School children, who frequently play with soil and walk barefoot, face continuous exposure to STH in school environments, yet the specific contamination levels of these premises are often undocumented. Consequently, this study addresses this gap by investigating the intensity and prevalence of STH in public schools in Karu and Keffi Local Government Areas, speculating that poor sanitary infrastructure contributes to a high prevalence of specific geohelminths in these educational settings.

1.3 Justification of the Study

Pre-school and school age children are in the high-risk category for Soil Transmitted Helminths (STH) infections. This study was designed to investigate soil characteristics and patterns of STH intensity in soil samples obtained from selected primary schools around Nasarawa state. Sub-Saharan Africa is one of the regions with the greatest burden of Soil transmitted helminths. The associated diseases are more prevalent in tropical settings among the rural populations than in other populations in the same region. Available evidence indicates that almost all excreted pathogens can survive in soil for a sufficient length of time and thus pose potential risks to man and animals. There are many abiotic and biotic variables, which may affect parasites in the soil. The survival and development of parasite eggs are dependent on favorable degrees of temperature, moisture, desiccation, pH, soil depth and texture. Most activities with respect to STH mapping have been attempted in some African countries. There is a dearth of information on the extent of parasite contamination in soil around Nigeria at large. The control of infection in Nigeria remains relatively inadequate due to lack of reliable data on the geographical distribution of diseases and the population at risk.

1.4 Aim of the Study

The study is aimed at determining the Intensity of soil transmitted helminths of selected public schools at Keffi and Karu local Government Areas of Nasarawa State, Nigeria

1.5 Objectives of the study

1. To determine the prevalence of Soil Transmitted Helminths (STH) in selected public schools of Keffi and Karu LGAs.
2. To determine the Soil Transmitted Helminths (STH) intensity of each study location.
3. To identify the specific Soil Transmitted Helminths present in each study site of the selected public schools.

1.6 Hypotheses

1. **H01:** There is no significant prevalence of Soil Transmitted Helminths (STH) in the selected public schools of Keffi and Karu LGAs.
2. **H02:** There is no significant intensity of Soil Transmitted Helminths (STH) across the respective study locations.
3. **H03:** There are no specific Soil Transmitted Helminths present in the selected public schools.

MATERIALS AND METHODS

3.1 Study/Sampling Area

The study was carried out in selected public schools within two Local Government Areas (LGAs) in Nasarawa Metropolis, Nigeria: Karu LGA (specifically LGEA Primary School Maraba Lokotiyé and LEA Primary School Gidan Mangoro) and Keffi LGA (specifically Kofar Hausa Primary School and St. Peters Primary School). Keffi is located at approximately 8.87° North and 7.874° East, while Karu is located at 9.49° North and 7.49° East. Nasarawa State is situated in the North-central part of Nigeria, falling within the Guinea Savannah Vegetation Zone of the country.

3.2 Sampling Design and Soil Sampling

Monthly soil sampling was conducted over a 6-month period, spanning from April to October 2025, across the four selected primary schools in Keffi and Karu LGAs. A total of 159 soil samples were

systematically collected from three specific sites within each school: the playground, the toilet area, and the waste dump site. Sampling was executed between 6:00 and 11:00 hours of the day. At each sampling site, soil was collected from 2 different spots. Approximately 200g of soil was scooped using a hand trowel at a depth of about 3cm to 4cm. These samples were placed into separate, properly labeled, clean, and new polythene bags, and then transported to the Department of Zoology laboratory at Nasarawa State University, Keffi, for analysis.

3.3 Flootation and Centrifugation Technique

For Egg/Larvae Recovery Sodium chloride solution was utilized for the recovery of parasite ova. Exactly 50g of the soil sample was weighed into a plastic sample tube and mixed thoroughly with 200ml of distilled water. This suspension was then strained through a sieve with a 150 µm mesh size to remove large particles. The resulting solution was allowed to sit in a beaker for 2 hours. After decantation, the remaining sediment was re-suspended in 50ml of water and transferred into a centrifuge tube. It was centrifuged at 2500 rpm for 10 minutes; the new sediment was then suspended in 15ml of Sodium Chloride solution and poured into a test tube, filling it to the brim to form a convex meniscus. A clean slide was placed on top of the test tube for 5 minutes to collect any floating eggs, larvae, or adult parasites present in the solution. The slide was carefully observed under a compound microscope using x10 and x40 objective lenses. Parasite identification was conducted using standard morphological keys (CDC, 2014).

3.4 Modified Baermann Sieving and Decanting Method

For this method, 30g of the soil sample was weighed and placed onto a white disposable paper towel. A rubber band was used to tie the towel, forming a pouch. A retort stand was set up with a funnel and rubber tubing. The soil pouch was suspended in the funnel, which was already filled with water. This apparatus was left undisturbed for 48 hours (2 days) to allow any active larvae in the soil to settle to the bottom of the rubber tubing. The lower suspension was then collected into a universal bottle using a Pasteur pipette. Three drops of this suspension were placed on a clean slide and viewed under a compound microscope using x10 and x40 objective lenses to check for nematode larvae. Identification was again confirmed using standard morphological keys (CDC, 2014).

3.5 Determination of the Rate of Soil Sample Contamination

The contamination rate (prevalence) of the soil samples was calculated using the following equation: Prevalence (%) = (Number of contaminated soil samples / Total number of samples collected) x 100.

3.6 Statistical Analysis

All obtained data were computed for analysis using the Statistical Package for Social Sciences (SPSS) version 23 and Microsoft Excel Spread Sheet 2024.

- Correlation analysis was utilized to determine the relationship between transmission indices, soil contamination, and the risk of infection from soil samples across the different sites.
- The Chi-square test was employed to ascertain if there were significant differences between the variables.

DATA PRESENTATION AND ANALYSIS

The Prevalence Assessment of Soil Transmitted Helminths (STH) in Samples in the Selected Public Schools

Table 1 shows the result of the Prevalence Percentage of Soil Transmitted Helminths (STH) of four Schools in Keffi and Karu Local Government Area of Nasarawa State. Out of the one hundred and fifty- nine (159) soil samples from the four (4) schools, 79 (49.69%) were positive for the presence of parasite *Larvae*, *Ova* and *Adult* with the highest number of infected samples from the schools in Keffi Local Government with a total number of 48(53.3%) infected samples and the lowest recorded in Karu Local Government Area with 31(44.93%) infected samples. Running a chi-square test(χ^2): ($c^2 = 0.556$ P = 0.456). There was a significant difference in number of infected samples of the schools in the two (2) local government area recorded during the experiment with P < 0.05

Prevalence and Intensity rate assessment in relation to sampled Sites

±Toilet area had the highest mean parasite intensity of 1.63 ± 0.045 with the lowest mean intensity record of 1.00 ± 0.20 in the playground. The highest mean intensity was recorded in the Toilet area at Kofar Hausa Primary School Keffi while the lowest mean intensity was recorded in the playground at LGEA Primary School Lokotiyе Karu (Table 4 -7)

Intensity/ Parasitic Count in relation to sampled locations

The highest parasite intensity was found in KHPSK 40 (67.8%), followed by LGEALK 20 (45.5%), LEAGMK 11 (39.3%), and the least count was recorded for SPPSK 8 (22.9%) (Table 7). Out of the one hundred and fifty- nine (159) soil samples from the four (4) schools, Seventy -nine (49.69%) were positive for the presence of parasites *larvae* and *ova*. Three (3) different geohelminths species were identified: Hookworm, *Strongyloides stercoralis* and *Ascaris lumbricoides* of all the species recovered, only. One hundred and seven (107) parasites were recovered in total. *Ascaris* showed the highest occurrence with 68 (63.5%), while *Strongyloides stercoralis* the least present with 9 (8.4%) (Table 8).

Prevalence (%) Assessment

Table 1 shows the prevalence (%) percentage of Soil Transmitted Helminths in the 2 LGAs. Out of the 159 soil samples collected in the selected Public schools in both LGAs (Keffi and Karu). There was an overall prevalence of 79(49.69%). Keffi had the highest prevalence of 48(53.33) while Karu had a prevalence of 31(44.93%).

Table 1.1: Statistical Characteristics of the Study Areas of Keffi and Karu LGAs

LGAS	No Examined	NO Infected	Prevalence (%)
Keffi LGAS	90	48	53.33
Karu	69	31	44.93
Total	159	79	49.69

(Where N = 159) Running a chi square test ($\chi^2 = 0.556$ P = 0.456).

Table 2 shows the prevalence of STH infections in the selected schools in Keffi.

The overall prevalence of the infection was 48(45.33%). KHPSK -Kofar Hausa Primary School Keffi had the highest prevalence of STH infection 40(67.8%), while SPPSK – St Peter Primary School Keffi had a prevalence of 8 (22.86%). There was a significant difference in the prevalence of STH infection between the two schools. ($\chi^2=20.55$, P=0.0001 Df=1)

Table 2.2: Prevalence statistics of Soil Transmitted Helminths (STH) of the selected schools in Keffi LGA

Schools	No Examined	No Infected	Prevalence
KHPSK	57	40	67.8
SPPSK	33	8	22.86
Total	90	48	45.33

KEY;

KHPSK: Kofar Hausa Primary School Keffi

SPPSK: St Peter Primary School Keffi

Table 3. shows the prevalence of STH infections in the selected schools in Karu local Government area.

The overall prevalence of the infection was 31 (42.374%). LGEAPSK had the highest prevalence of STH infection 20 (45.45%), while LEAPSK prevalence of 11 (39.29%). There was no significant difference in the prevalence of STH infection between the two schools. ($\chi^2=0.058$, P=0.81).

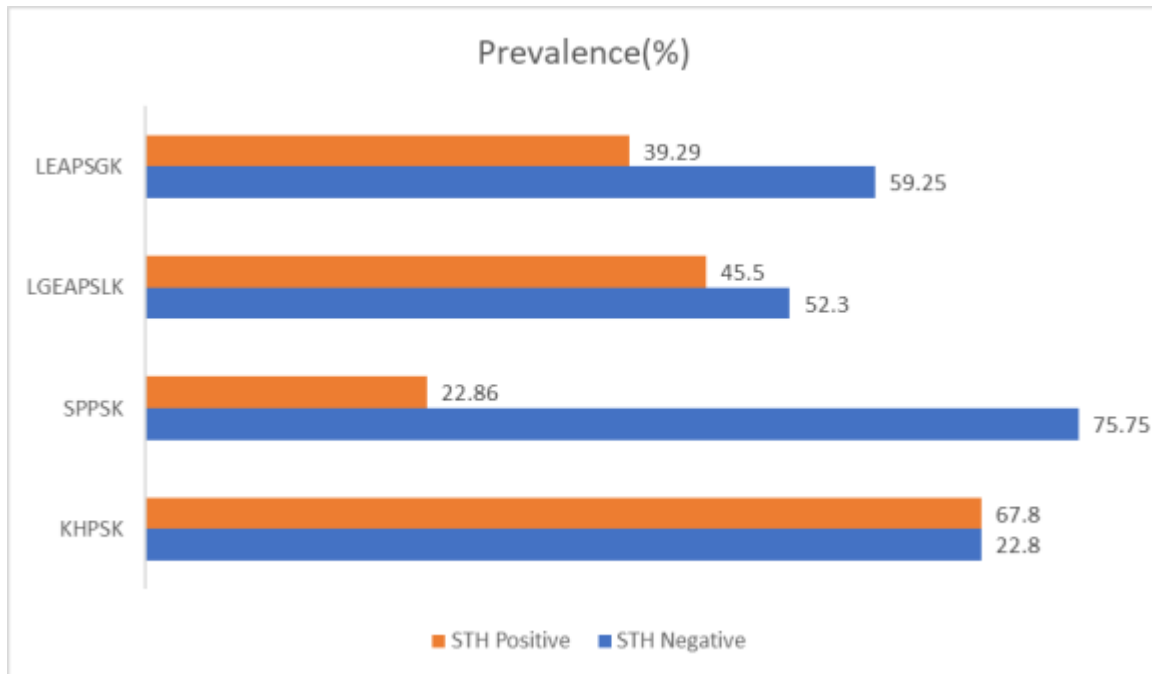
Table 4.3: Statistical representation of the Prevalence of Soil Transmitted Helminths (STH) in the Selected Public Schools of Karu LGA

Schools	No Examined	No infected	Prevalence
LGEAPSK	42	20	45.45
LEAPSK	27	11	39.29
Total	69	31	42.37

KEYS

LGEAPSLK: Local Government Education Authority Primary School Lokotiyе Karu

LEAPSGK: Local Education Authority Primary School Gidan-Mangoro Karu



FIG

4.1: Chart Showing the prevalence percentage of infected samples in the selected public schools in both Karu and Keffi LGAs of Nasarawa State.

Keys;

KHPSK -Kofar Hausa Primary School Keffi

SPPSK -St Peters Primary School Keffi

LGEAPSLK -Local Government Education Authority Primary School Lokotiyе Karu

LEAPSGK -Local Education Authority Primary School Gidan-mangoro Karu

Prevalence and the intensity rate assessment in relation to sampled Sites

Table 4. shows the Prevalence and mean intensity rate of parasitic infection of samples collected in KHPSK (Kofar Hausa Primary School Keffi).

At $\alpha = 0.05$, 19 samples examined the P-value (0.108) is greater than 0.05, the observed prevalence is significantly different from 50% at the Toilet area having the highest mean intensity of 1.63 ± 0.045 .

The playground had a lower intensity on average of 0.27 ± 0.001 . At $\alpha = 0.05$, the P-value (0.491) is lesser than 0.05, so the observed prevalence is not significantly different from 50%. The Dumpsite had a mean intensity of 0.85 ± 0.002 and a P-value of 0.108 therefore not significant.

Table 4.4: The intensity of Soil Transmitted Helminthes (STH) in the selected sites of Kofar Hausa Primary School (KHPSK) Keffi LGA.

Study Area	NO Examined	NO Infected	Prevalence(%)	Parasite Count	Parasite Intensity(Mean)	χ^2	P-Value
Dumpsite	19	13	68.42	11	0.85 ± 0.002	2.578	0.108
Toilet Area	19	16	84.21	26	1.63 ± 0.045	2.579	0.0291
Playground	19	11	57.89	3	0.27 ± 0.001	0.473	0.491
Total	57	40	70.17	40			

Table 5 shows the mean intensity of parasitic infection of samples collected in St Peters Primary School Keffi.

Dumpsite area had the highest parasite intensity of 1.40 ± 0.10 , because the P-value 0.763 is much greater than the standard significance level of 0.05. there is no statistical significance. Toilet area had a lower intensity on average of 1.33 ± 0.53 with a P value of 0.132 therefore indicating no significant difference.

Table 5.5: The intensity of Soil Transmitted Helminthes (STH) in the selected sites of St Peters Primary School (SPPSK)Keffi LGA.

Study Area	NO Examined	NO Infected	Prevalence(%)	Parasite Count	Parasite Intensity(Mean)	X ²	P-Value
Dumpsite	11	5	45.5	11	1.40 ± 0.10	0.091	0.763
Toilet Area	11	3	27.7	26	1.33 ± 0.53	2.270	0.132
Playground	11	0	0	0	0	0	0
Total	57	40	70.17	40			

Table.6 shows the prevalence and parasitic infections were accessed across three sampling sites in LGEAPSLK (Local Government Education Authority Primary School Lokotiye Karu).

At the dumpsite 6 out of 14 samples were infected resulting in a prevalence of 6(42.86%) and a mean parasite intensity of 1.00 ± 0.30 per infected sample with a P-value of 0.033 it was not significant. Similarly, the toilet site showed the highest prevalence 11(78.57 %),P-value 0.033 there was statical significance with a corresponding mean intensity of 1.00 ± 0.25 . The playground had the lowest prevalence 3(21.43%) yet the mean intensity remained 1.00 ± 0.20 ,P-vale of 0.101 there was no significance. indicating uniform parasite burden of soil samples across all sites.

Table 6.6: The intensity of Soil Transmitted Helminthes (STH) in the selected sites of Local Government Authority Primary School Lokotiye (LGEAPSLK)Karu LGA.

Study Area	NO Examined	NO Infected	Prevalence(%)	Parasite Count	Parasite Intensity(Mean)	X ²	P-Value
Dumpsite	14	6	42.86	6	1.00 ± 0.30	4.570	0.033
Toilet Area	14	10	78.57	11	1.10 ± 0.25	4.570	0.033
Playground	14	4	21.43	3	1.00 ± 0.20	0.286	0.101
Total	57	40	70.17	40			

Table .7 shows the prevalence and parasitic infections were accessed across three sampling sites of LEAPSGK(Local Education Authority Primary School Lokotiye Karu).

At the prevalence 5(55.56 %) with a corresponding mean intensity 1.20 ± 0.45 . The playground had a prevalence 5(44.44%) yet the mean intensity remained 1.25 ± 0.50 with a P-value of 0.739 indicating uniform parasite burden of soil samples across all sites and no significance.

Table 7.7: The intensity of Soil Transmitted Helminthes (STH) in the selected sites of Local Education Authority Primary School Gidan-mangoro (LEAPSGK)Karu LGA.

Study Area	NO Examined	NO Infected	Prevalence(%)	Parasite Count	Parasite Intensity(Mean)	X ²	P-Value
Dumpsite	9	2	22.22	3	1.00 ± 0.00	2.718	0.096
Toilet Area	9	5	55.56	20	1.20 ± 0.45	0.111	0.739
Playground	9	4	44.44	5	1.25 ± 0.50	0.111	0.739
Total	27	11	40.74	28			

Intensity/ Parasitic Count in relation to sampled locations

Shows Parasite types and frequency of occurrence: Out of the 159 soil samples, 70.8% contained parasites. The types and species-specific intensity of parasites encountered are: Ova of *Ascaris* 30 (28.03%), larvae and adult Whipworm 9 (8.4%) and larvae of hookworm 68 (63.6%). Hookworm occurred most followed by *Ascaris* and Strongyloides. Similar trend was found in each of sampling locations.

Table 8 shows the parasite intensity in the sampling locations with a parasitic count and also the species found. The highest parasite intensity was found in KHPSK, followed by LGEAPSLK, LEAPSGK, and the least count was recorded for SPPSK (Table 7

Table 8.8: Intensity in relation to sampling locations

Study Location	Parasite Species	Count	Total Count (Freq of occurrence)	
<i>Parasite Prevalence</i>	<i>Ascaris</i>	Strongyloides	Hookworm	
KHPSK	10	4	33	47
SPPSK	6	0	12	18
LGEAPSLK	10	2	14	26
LEAPSGK	4	3	9	16
Total	30(28.03%)	9(8.41%)	68(63.55%)	107

Key ;

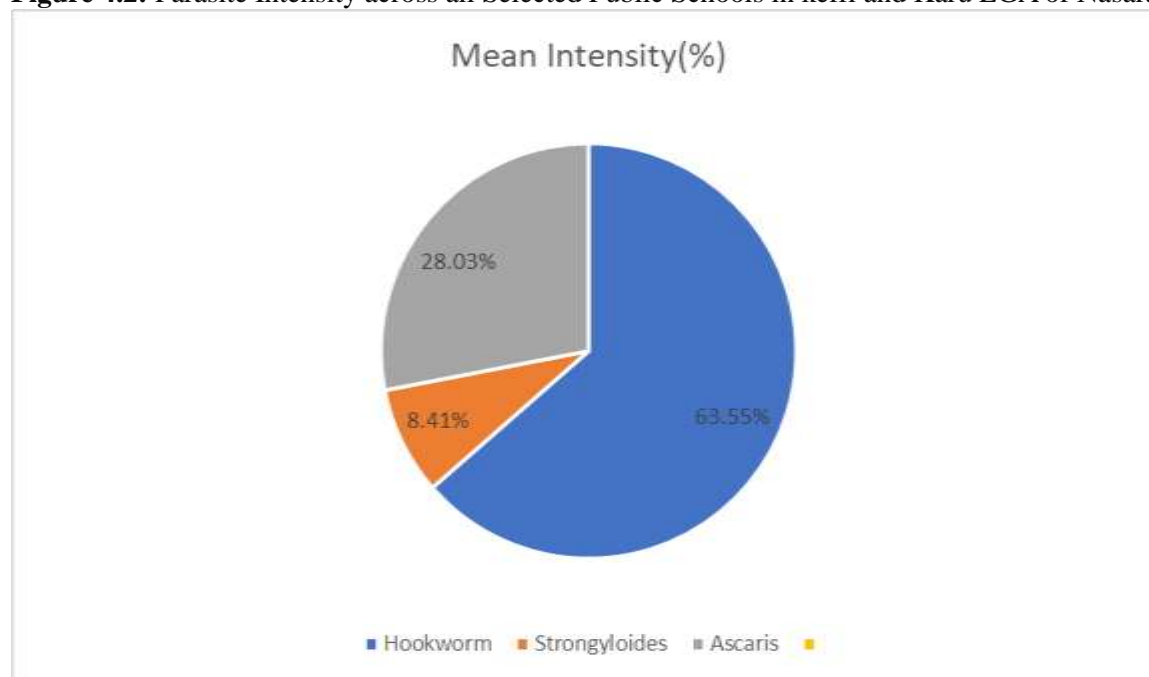
KHPSK -Kofar Hausa Primary School Keffi

SPPSK -St Peters Primary School Keffi

LGEAPSLK -Local Government Education Authority Primary School Lokotiyе Karu

LEAPSGK -Local Education Authority Primary School Gidan-mangoro Karu

Figure 4.2: Parasite Intensity across all Selected Public Schools in keffi and Karu LGA of Nasarawa State



Parasites Ecountered During The Study



Plate A: *Strongyloides* adult



Plate B. *Ascaris* egg



Plate D. Hook-worm egg



Plate C. *T. trichiura* egg



Plate E. *Strongyloides* larvae



Plate F. Hookworm larvae

DISCUSSION

As of 2018, it was estimated that 33.9 million school-aged children were infected with one or more soil-transmitted parasites in Africa (Sartorius *et al*,2021). Studies have demonstrated that children may acquire parasitic infections early in life which causes initial organ damage that can remain subclinical for years and manifest overtly only later in adulthood (Hassan *et al* 2018). Over 260 million preschool-age children, 654 million school-age children, 108 million adolescent girls and 138.8 million pregnant and lactating women live in areas where these parasites are intensively transmitted, and are in need of treatment and preventive interventions (Yap *et al* 2012). School children are mostly the high-risk population in the communities because they often play with soil and walk around bare-footed, traits also peculiar to pre-school children, it is therefore pertinent to examine the presence of eggs or larvae of STH in soil samples around the school premises and the immediate environments which are subject to STH.

The result of the study showed that Hookworm was the highest occurring parasite in the examined soil samples. This is similar to previous reports in other parts of Nigeria (Hassan,2018: Oniya,2019). *Strongyloides* had the least occurrence in the soil, the low rate observed may be due to minimal dispersion of their *ova* into the environment, another contributing factor is its rapid developmental and limited lifespan.as its free living stage and infective larvae have a limited lifespan(typically less than 3 weeks in optimal conditions) and die rapidly in unfavorable conditions,so they are not a permanent fixture in the soil environment(Olsen *et al* 2009). The lack of perimeter fences in public schools could also have contributed to the high contamination rate as children and even adults around the school environment had access to the school compound after school hours to engage in various activities and possibly defaecate on the soil thereby contaminating the school environment with parasitic stages. However, the substantial trend of the parasite distribution observed in the schools showed that school-aged pupils in these schools are at risk of soil-transmitted infections, as contamination may have more to do with behavioural and ecological factors rather than socio-economic status. In regard to collection sites, higher contamination rate was observed around the toilet area as compared with playgrounds and dumpsite. The presence of soil parasites around the playground is a potential source for massive outbreak of gastrointestinal infections among school-aged children.

From personal observation during my visits to the schools suggests that socio-cultural practices like poor hygiene and sanitation influenced the abundance of soil-transmitted parasites in the soil. Intestinal helminth parasites in soil around refuse dumpsites have also been reported previously

(Simon, 2020). This could also explain the high contamination rate as a good number of the school toilets were situated very close to a dumpsite. There was visible evidence of faecal contamination of soil in most schools, suggesting that school pupils still engage in open defaecation around school premises. This is due fact that most of the primary schools lack functioning toilets. Open defaecation increases the rate of parasites dispersion into the environment.

CONCLUSION

The soil contamination rate observed in this study has revealed that school-aged children are at potential risk of geohelminthiasis irrespective of their socio-economic status. It can also be inferred that some socio-cultural factors played a significant role in the occurrence and abundance of geohelminths in the study area. Therefore, control should be greatly encouraged to hamper the futher contamination of Soil Transmitted Helminthes in school-aged children.

RECOMMENDATION

- I. The primary health care system of each Keffi and Karu LGAs should strongly consider periodic school-based deworming programs.
- II. Implementation of standard Water, Sanitation and Hygiene (WASH) policy by school heads across public schools in both Keffi and Karu LGAs
- III. Sensitization campaigns in publics schools to raise awareness aga inst continuous open defecation and the risk it imposes on the environment including safe practices the children can engage in.
- IV. The government should engage more into building suitable infrastructures ranging from adequate toilets, dumpsites and parameter fencing in these schools.

REFERENCES

- Bethony, J., Brooker, S., Albonico, M., Geiger, S.M. and Loukas, A. 2006. Soil-transmitted helminth infections: ascariasis, trichuriasis, and hookworm. *Lancet*, 367:1521-1532.
- Centers for Disease Control and Prevention (CDC). DPDx – Laboratory identification of parasites of public health concern 2014.
- Centers for Disease Control and Prevention (CDC). DPDx – The Targeted neglected tropical diseases 2011.
- Hassan AA, Oyebamiji DA. Intensity of soil transmitted helminths in relation to soil profile in selected public schools in Ibadan metropolis. *Biom Biostat Int J* 2018; 7: 413-417.
- Nock IH, Duniya D, Galadima M. Geohelminth eggs in the soil and stool of pupils of some primary schools in Samaru, Zaria, Nigeria. *Nig J Parasitol*. 2007;24:115–122.
- Sartorius B, Cano J, Simpson H, Tusting LS, Marczak LB, Miller-Petrie MK, Kinvi B, Zoure H, Mwinzi P, Hay SI, Rebollo M, Pullan RL. Prevalence and intensity of soil-transmitted helminth infections of children in sub-Saharan Africa, 2000–2018: a geospatial analysis. *Lancet Glob Health* 2021; 9: 52-60.
- WHO. Prevention and control of schistosomiasis and soil transmitted helminthiasis. *Parasitol Int*. 2004;53(2):103–113.