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Species Diversity of Helminth Eggs in Soils of Selected Public and Private Primary Schools in Kaltungo, Gombe State

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Abstract
Globally, billions of people may be at risk of contracting soil-transmitted helminths (STHs), including whipworm (*Trichuris trichiura*), roundworm (*Ascaris lumbricoides*), and hookworms (*Ancylostoma duodenale* and *Necatoramericanus*). This research focused on assessing the variety of helminth eggs found in the soil of chosen public and private primary schools in Kaltungo, Gombe State. A cross-sectional study was conducted, with a total of 280 soil samples were gathered in two phases, March to April 2020 and August to September 2020 repectively. Samples were taken from three locations at each school: near latrines, on playgrounds, and behind classrooms in the schools. To isolate the helminth eggs, floatation and sedimentation methods were utilized. This study identified seven species of helminth eggs: *Ancylostoma duodenale* (285, 26. 71%), *Ascaris lumbricoides* (260, 24. 37%), *Taenia spp* (216, 20. 24%), *Toxocaraspp* (91, 8. 53%), *Strongyloidesstercoralis* (90, 8. 43%), Fasciolaspp (63, 5. 90%), *Schistosoma haematobium* (32, 3. 00%) and *Trichuris trichiura* (30, 2. 81%). There were statistically significant differences in species diversity noticed behind classrooms, near latrines, and at playgrounds, with p-values of (0. 0003), (0. 001) and (0. 000) respectively. The level of species diversity in the playgrounds, around latrines and behind classrooms in the selected public and private schools might be deemed moderate. Furthermore, it is essential to implement actions that enhance environmental conditions and promote hygiene through a thorough community-based health education initiative, along with regular de-worming for pets and students.

Keyword: *Ancylostoma duodenale*, Diversity, Floatation, Helminths, Sedimentation

Introduction

Intestinal parasites known as helminths can lead to diseases in humans when individuals come into contact with parasite eggs or larvae found in warm and moist soil. Helminth-related diseases fall under the Nematoda classification, which includes various types of roundworms such as *Ascaris lumbricoides*, *Trichuris trichiura* (whipworm), and two species of hookworms, *Ancylostoma duodenale* and *Necatoramericanus* (CDC, 2013). Globally, approximately 220 million people are affected, especially in regions of sub-Saharan Africa (Ombugadu et al., 2022). Children of school age are particularly susceptible to soil helminth infections (WHO, 2016) due to their frequent play in soil during school breaks (Joan et al., 2022). The presence of soil-transmitted helminths contributes to malnutrition and cognitive issues, while also reducing the body's ability to combat other infections (Olaniran et al., 2015). In children, a high intensity of *Ascaris lumbricoides* can result in intestinal blockages (Olaniran et al., 2015). In Nigeria, there has not been a nationwide program to control soil-transmitted helminths in schools (Amaechi et al., 2013). Past efforts for de-worming by government officials have been inconsistent and scattered, lacking any reliable baseline data (Ojurongbe et al., 2014). Thus, it is essential to gather accurate and thorough

information regarding the prevalence of parasitic diseases among school children in the area of interest. Various studies have been done on soil helminth diseases in Nigeria Ugbomoiko & Ofoezie (2007); Adefioye et al. (2011); Amaechi et al. (2013); Ojurongbe et al. (2013); Ojurongbe et al. (2014), but many regions remain unexplored, and information on species diversity necessary for developing integrated strategies in most rural settings is limited or absent. Therefore, this study aims to provide foundational baseline data on the species diversity of soil helminth infections in selected public and private primary schools in Kaltungo metropolis.

Materials and Methods

The research took place in the KAltungo Local Government Area of Gombe State. Situated in the southern region of Gombe State, Kaltungo serves as the local government's headquarters. It is found westward in the area along the A345 highway, precisely at a latitude of 9° 48'51N and a longitude of 11^0 18'32E. This locality spans an area of 881 square kilometers and had a population of 149,805 according to the (2006 census). Kaltungo experiences two main seasons: the rainy season from May to October and the dry season from November to April.A cross-sectional approach was utilized for the study. The Kaltungo Local Education Authority provided a list of schools, from which schools were chosen randomly.In total, 280 soil samples were gathered during two distinct time frames, March to April 2020 (dry season) and again August to September 2020 (rainy season). During these two seasons, samples were taken from three locations in each selected school: near latrines, in playgrounds, and at the back of classrooms. The public schools involved included Umar Memorial Primary School (9. 81472; 11. 31527), Kalaring Primary School (9. 812318; 11. 309094), Nasarawa Primary School (9. 825779; 11. 315616), Termana Primary School (9. 814536; 11. 301333), and L.E.A Primary School (9. 820539; 11. 311701). The private schools included Kings Academy (9. 817750; 11. 308982), Randatul Qur'an International Primary School (9. 814353; 11. 313629), Nifak Academy (9. 818321; 11. 328552), Mai Lamai Academy (9. 825094; 11. 311383), and Walter Gowan Primary School (9. 828947; 11. 302734). The collected samples were taken to the Department of Biochemistry at Gombe State University for parasitological analysis.In the laboratory, eggs were extracted using the formal-ether sedimentation method to concentrate trematode eggs, alongside Zinc Sulfate Sucrose flotation for nematode and cestode eggs, following guidelines established in 2000. The identification of helminth ova or eggs was performed based on their characteristics and morphologies, as described by Souls in 1982, with assistance from an online parasite atlas.The information was analyzed using one-way ANOVA, with a significance level of P value < 0.05 indicating notable differences.

Results

Species of Helmiths Eggs Recovered in Soils Behind Class Roomsthe selected Public and Private Schools

Figure (1), shows the helminth eggs observed behind class rooms of both public and private primary schools. The total number of helminth eggs observed from all schools was 350(100%), 194(55.43%) in public schools and 156(44.57%) in private schools. The highest species of helminth eggs collected was *Ascaris lumbricoides and Ancylostomaduodenale*egg srepresenting 93(26.57%) respectively in all schools, *Ascrislumbricoides*eggs, 27(13.92%) in public schools and 66(42.31%) in private school respectively while *Ancylostomaduodenale*eggs, 47(24.23%) in public schools and 46(29.49%) in private school respectively .The least helminth egg was *Schistosome haematobium*eggs representing 8(2.29%) from all schools, 7(3.61%) from public schools and 1(0.64%). However, there was statistically significant difference (p=0.05) in species of helminth eggs recovered behind class rooms of the selected public and private primary schools.

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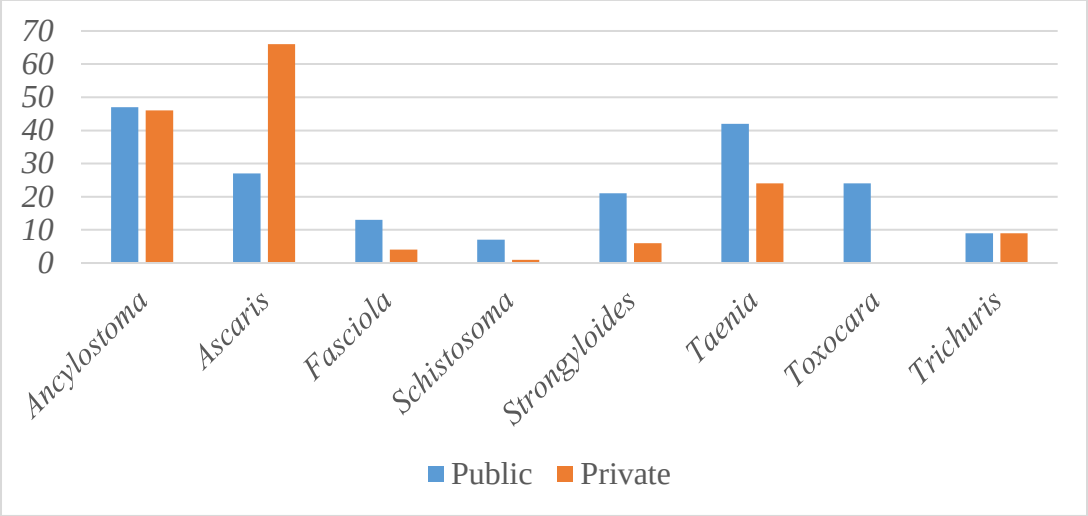
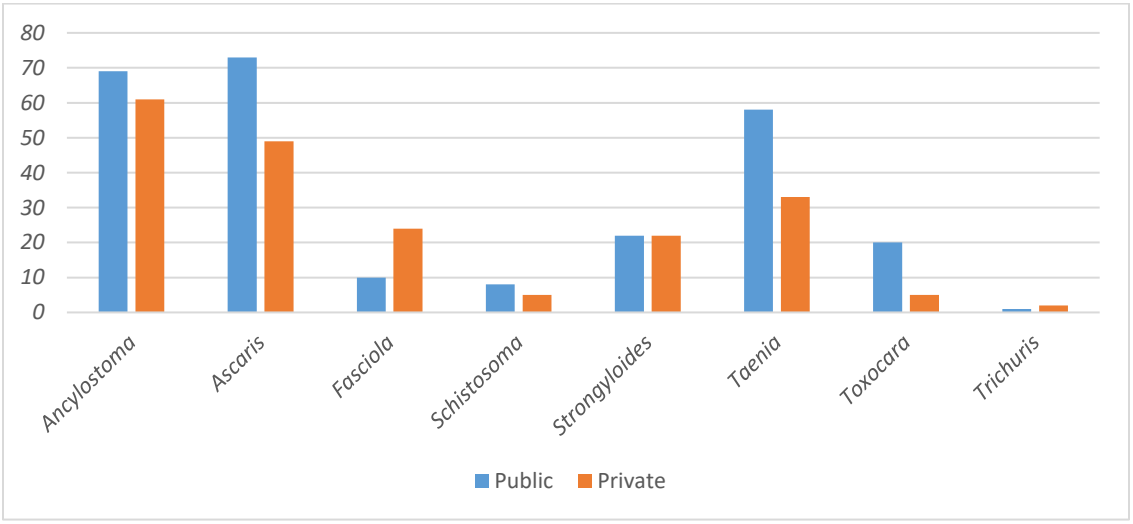


p = 0.0003

Figure 1: species of Parasite Eggs Behind Class Rooms of Public and Private Schools

Species of Helmiths Eggs Recovered in Soils Around latrines of the selected Public and Private Schools

Figure (2), shows the helminth eggs observed around latrine of both public and private primary schools. The total number of helminth eggs recovered around latrine from all schools was 464(100%), 256(55.17%) in public schools and 208(44.83%) in private schools. The highest helminth egg collected was *Ancylostoma duodenale* eggs representing 130(28.03%), in all schools, 69(26.95%) in public schools and 61(29.33%) in private school respectively. the least helminth eggs recovered was *Trichuris trichuira*eggs represent 13(2.8%) from all schools, 8(3.13%) from public schools and 5(2.4%). However, there was statistically significant difference ($p < 0.05$) in prevalence of helminth eggs recovered around latrines of the selected public and private primary schools.



p= 0.001

Figure 2: Prevalence of Helminth Eggs around latrines of the selected Public and Private Schools

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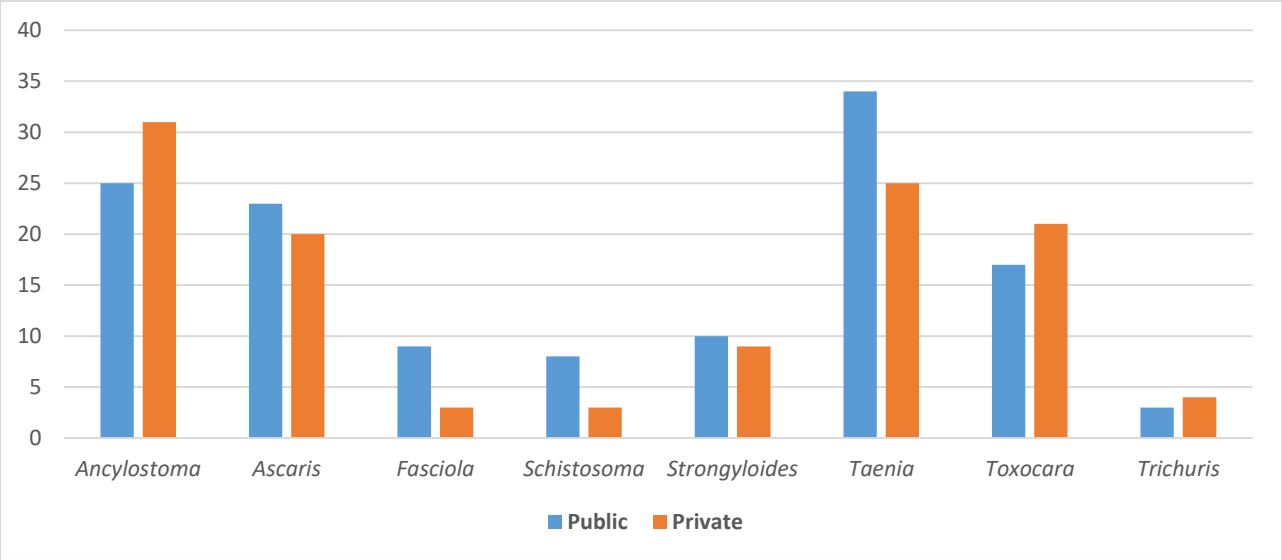
Species of Helmiths Eggs Recovered in Soils at Playground of the selected Public and Private Schools

Figure 3, shows the helminth eggs observed at playground of both public and private primary schools. The total number of helminth eggs recovered from all schools was 253(100%), 137(54.15%) in public schools and Figure 116(45.85%) in private schools. The highest helminth egg collected was *Ancylostoma duodenale* eggs representing 62(24.51%), in all schools, 31(22.63%) in public schools and 31(26.72%) in private school respectively. while the least helminth eggs recovered was *Trichuris trichuira*eggs represent 11(4.35%) from all schools, 8(5.84%) from public schools and 3(2.59%). However, there was statistically significant difference ($p < 0.05$) in species specific of helminth eggs recovered at playground of the selected public and private primary schools.



p = 0.000

Figure 3: Species of Helminth Eggs at playground of the selected Public and Private Schools

Species specific prevalence of helmiths eggs in soils of selected public and private school

Species specific prevalence revealed that highest number of eggs of *Ancylostoma duodenale* 285(26.71%) with mean of 146.5± 69.25 were recovered, while *Trichuris trichiura*had the least egg comes of 30 (2.81 %) and mean of 19.0 ± 5.5 (Table 1).

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Table 1: species specific prevalence of helminthes eggs in soils of selected primary schools in Kaltungo

Type of egg	No. Of eggs recovered (n)	Percentage (%)	Mean ± S.E.M
Ascaris lumbricoides	260	24.37	134.0 ±63.0
Schistosome haematobium	32	3.00	20.0±6.0
Ancylostoma duodenale	285	26.71	146.5±69.25
Strongyloidestercoralis	90	8.43	49.0 ±20.5
Trichuris trichiura	30	2.81	19.0 ±5.5
*Fasciola*spp	63	5.90	35. 5 ±13.75
Taenia spp	216	20.24	112.0±52.0
*Toxocara*spp	91	8.53	49.5 ±20.75
Total	**1067**	**100**	**537.5 ± 264.75**

Species specific prevalence of helminth eggs in soils of selected public primary schools

Out of 587 (55.01 %) helminth eggs and a mean of 73.38 ± 10.66 was recovered from the soils of public schools. The highest prevalence was eggs of *Ancylostoma duodenale* 147 (25.04 %) with mean of 18.38 ± 2.59and the least was *Trichuris trichiura*eggs 15 (2.56%) with mean of 1.88 ± 1.53 (Table 2).

Table 2: species specific prevalence of helminth eggs in soils of selected public primary schools

Type of eggs	No. of eggs recovered (n)	Percentage (%)	Mean ± S.E.M
Ascaris lumbricoides	118	20.10	14.75 ± 1.69
Schistosome haematobium	23	3.92	2.88 ± 1.28
Ancylostoma duodenale	147	25.04	18.38 ± 2.59
Strongyloidestercoralis	53	9.03	6.63 ± 0.34
Trichuris trichiura	15	2.56	1.88 ± 1.53
*Fasciola*spp	32	5.45	4.00 ± 1.0
Taenia spp	134	22.83	16.75 ± 2.19
*Toxocara*spp	65	11.07	8.13 ± 0.03
Total	**587**	**100**	**73.38 ± 10.66**

Species specific prevalence of helminth eggs in soils of selected private primary school

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Musa, A.M., Rabiu, I., Abubakar, B., Umar, A.B., Patrick, D.B., Danjuma, H.J., Johnny, J., Eli, E.I., Muhammad, S.U., Abdullahi, A.B., & Simeon, D.O. (2025).Species diversity of helminth eggs in soils of selected public and private primary schools in Kaltungo, Gombe State. *FNAS Journal of Basic and Environmental Research*,*2*(2), 32-38.

Out of 480(44.99 %) helminth eggs observed in private school with mean of 62.02 ± 11.62, The highest species specific prevalence in the soils of selected private schools was eggs of *Ascaris lumbricoides 142* (29.58 %) with mean 17.75 ± 2.44and the least was *Schistosomehaematobium*9 (1.88 %) with mean of 1.13 ± 1.72 (Table 3).

Table 3: species specific prevalence of helminth eggs in soils of selected private primary school

Type of eggs	No. of eggs recovered (n)	Percentage (%)	Mean ± S.E.M
Ascaris lumbricoides	142	29.58	17.75 ± 2.44
Schistosome haematobium	9	1.88	1.13 ± 1.72
Ancylostoma duodenale	138	28.75	17.25 ± 2.31
Strongyloidestercoralis	37	7.71	6.63 ± 0.84
Trichuris trichiura	15	3.13	1.88 ± 1.53
*Fasciola*spp	31	6.46	3.88 ± 1.03
Taenia spp	82	17.08	10.25 ± 0.56
*Toxocara*spp	26	5.42	3.25 ± 1.19
Total	480	100	62.02 ± 11.62

Discussion

The analysis of species-specific prevalence indicated that eggs from *Ancylostoma duodenale* were the most commonly found in soil samples taken from primary schools, both public and private. This finding surpassed the prevalence noted by Aschalew et al. in 2022 (16. 5%) and was somewhat similar to the 26. 7% indicated by Chigozie in 2014. The notably high occurrence of *Ancylostoma duodenale* in this research might be attributed to poor waste disposal practices on school grounds, open defecation, and inadequate personal and environmental hygiene (Aschalew et al., 2022). The species with the lowest occurrence of helminth in this investigation was *Trichuris trichiura*, which was consistent with the results from Mobolanle & Oluwasejun (2021), who reported an incidence of 0. 7%. This rate was lower than the findings of Okwa et al. (2023), who noted a prevalence of 2. 56%. The reduced amount of *Trichuris* eggs could be explained by the unfavorable ecological conditions for their survival. *Trichuris* eggs are more sensitive to slightly lower temperatures (between 52 ℃ and 54 °C) and can die more quickly compared to *Ascaris lumbricoides* eggs (Mohammed, 2010).

Conclusion

The study identified seven helminth species: *Ancylostomaduodenale*, *Ascaris lumbricoides*, *Taenia*spp, *Toxocara*spp, *Strongyloidesstercoralis*, *Fasciolaspp*, *Schistosoma haematobium*, and *Trichuris trichiura*. These species pose significant public health risks in the chosen public and private primary schools in Kaltungo metropolis, Gombe state. Therefore, it is recommended that school officials and parents encourage hygienic practices, such as washing hands with soap following defecation, ensuring access to clean drinking water, properly disposing of waste and sewage, and raising awareness about public health in their communities.

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