# Prevalence, Spatial Patterns and Predicators of Geohelminths Among Primary School Children in Ussa Lga Taraba State, Nigeria

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**Abstract: Geohelminth infections are widespread globally, disproportionately affecting impoverished communities. They thrive in areas with poor hygiene, overcrowding, limited healthcare, and inadequate sanitation, making them a significant public health concern. This study investigated the prevalence and risk factors of geohelminth infections among primary school pupils in Ussa Local Government Area, Taraba State, Nigeria. A total of 394 pupils participated. Sample containers were used to collect faecal samples and were examined using direct smear and formol-ether concentration methods. Of the 394 stool samples, 170 were positive for geohelminths, giving an overall prevalence of 43.1%. Males had a higher prevalence (26.6%) than females (16.5%). By age, the 10–11years group had the highest prevalence (19.8%). Four major geohelminths were identified: *Ascaris lumbricoides* (25.1%), *Ancylostoma duodenale* (10.7%), *Trichuris trichiura* (4.8%), and *Strongyloides stercoralis* (2.5%). Statistical analysis showed significant differences in prevalence by age (10–11 years: $\chi^2 = 567.43$, $p < 0.001$; 12–13 years: $\chi^2 = 133.73$, $p = 0.001$) and sex (males: $\chi^2 = 57.4$, $p = 0.001$; females: $\chi^2 = 78.70$, $p = 0.001$). No significant variation was found by class ($\chi^2 = 15.45$, $p = 0.287$) or ward ($\chi^2 = 15.45$, $p = 0.1005$). The high prevalence of geohelminth infections in Ussa LGA highlights the need for integrated control programs. Preventive chemotherapy, improved sanitation, and sustained hygiene education are essential to reduce transmission and safeguard child health.**

***Keywords:*** *Geohelminths, Prevalence, School Children,* Ascaris Lumbricoides, *Ussa, Nigeria.*

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## I. INTRODUCTION

According to Isaac *et al*. (2019), geohelminths are intestinal parasites that must pass through soil to enhance the causation of various human ailments. A person can contract a geohelminth infection by eating contaminated or raw food (fruits, vegetables, etc.), touching contaminated soil with unwashed hands, or coming into contact with exposed human skin that has come into contact with contaminated soil (Omotola & Ofoezie, 2019).

Due to poor personal cleanliness, overcrowding, poor sanitation, and limited access to high-quality healthcare, geohelminth infections are common worldwide and primarily affect the impoverished and socially disadvantaged (Isaac *et al*., 2019).

Nigeria has the highest rate of soil-transmitted helminth parasite infections in sub-Saharan Africa, per reports from FMOH (2015). While anyone can contract geohelminths, children in pre-school and school are more susceptible to contracting the disease, especially those who reside in rural sub-Saharan Africa. These children are frequently observed playing unsupervised with dirt and other objects in their environment (Ojurongbe *et al*., 2015; Bethony *et al*., 2016). This study was carried out to investigate the prevalence and risk factors of geohelminth infections among primary school pupils in Ussa Local Government Area, Taraba State, Nigeria

## II. MATERIALS AND METHODS

➢ *Study Area*

Ussa is a local government area in Taraba State, Nigeria. Its headquarters is located in the town of Lissam at latitude 7°11′′N and 10°05′E longitude. The local government borders Takum and the Republic of Cameroon on the north and south, respectively. Its area covers 1,495 km2, and its population was 92,017 by the 2006 census (National Population

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Commission, 2006). The dominant tribe in Ussa is Kuteb; its landforms rocks, hills, and mountains give the area distinctive features. This region is sparsely populated with vast tracts of uncultivated land, starkly contrasting the flood plains. This is broken up occasionally by high, rising hills like the sandstone-based Rufu, Fikyu, and Kpambo hills (Gimba, 2015).

Majority of the inhabitants of Ussa local government area are farmers. As a result, 90% of the people in the region work to produce various crops to satisfy societal demands. Crop rotation, mechanized agriculture, and subsistence farming are the agricultural systems used in the research area. The aforementioned approaches are used by both large- and small-scale farmers; nevertheless, most farmers (85%) are subsistence farmers, with very few engaging in commercial operations Shenpam *et al*. (2019).

➢ *Study Design and Population:*

A cross-sectional study was carried out between March - August 2024. The study population comprised pupils enrolled in public primary schools across the eight electoral wards of Ussa LGA

- *Study population*

There are 124 public primary schools in Ussa Local Government Area. The study population comprised pupils enrolled in public primary schools in Ussa LGA. 16 School were selected from the 8 electoral wards in Ussa Local Government Area. The Schools include; Uwae ure Primary School, Kwesati, Fikyu Ekan Primary School, Yitsang Primary School, Rufu, Fikyu Central Primary School, Lissam Central Primary School, Lumbu Sarka Primary School, Utaih Primary School, Lissam, Kpambo Puri Primary School, Kpambo Yashe Primary School, Tamiya Primary School, Lissam, Kpambo Yirom Primary School, Kutukok Primary School Kwesati, Kwaibu Primary School, Kpambo, Kunkufxang Primary School, Lissam, Lumbu Rikwerika Primary School and Rufu Primary School.

- *Sample Size and Sampling Technique:*

The minimum sample size was calculated as 394 using the formula for single proportion Naing L *et al*. (2006), assuming a 50% expected prevalence (to maximize sample size), a 5% margin of error, and a 95% confidence level. A stratified random sampling technique was employed. First, 16 schools (2 from each of the 8 electoral wards) were randomly selected. Subsequently, pupils were selected from each school by proportionate sampling

➢ *Data Collection*

A structured, interviewer-administered questionnaire was used to obtain socio-demographic data information.

- *Stool Sample Collection and Examination:*

Each participant received a sterile, leak-proof container and instructed on how to collect a fresh morning stool sample. Samples were transported to the laboratory department of the Taraba State College of Health Technology, Takum within two hours of collection. Each sample was processed and examined microscopically using direct saline smear and formal-ether concentration techniques to identify helminth eggs and larvae.

- *Ethical Considerations:*

Ethical clearance and permission was granted by the Education Secretary of Universal Basic Education Authority of Ussa LGA. Written informed consent was obtained from parents or guardians of all participating children, and assent was obtained from the children themselves.

- *Data Analysis:*

Data were entered into and analyzed using the Statistical Package for the Social Sciences (SPSS) version 16.0. Descriptive statistics (frequencies and percentages) were used to summarize the prevalence and distribution of infections. The Chi-square ($\chi^2$) test was used to determine the association between categorical variables (age, sex, class, ward) and infection status. A p-value of less than 0.05 was considered statistically significant.

## III. RESULTS

➢ *Prevalence of Geohelminth Infections:*

Out of the 394 stool samples examined, 170 were positive for one or more geohelminth species, yielding an overall prevalence of 43.1%.

➢ *Prevalence by School*

The prevalence varied across the 16 schools surveyed (Table 1). Yitsang Primary School, Rufu, had the highest prevalence (16/23, 69.6% of samples from that school, contributing 4.1% to the total positives), while Kpambo Yashe Primary School had the lowest (6/25, 24.0% of school samples, 1.5% of total positives).

Table 1 Prevalence of Geohelminth Infections Among Pupils by School

| Name of School | Samples Collected | Negative Samples | Positive Samples | % Positive |
|---|---|---|---|---|
| Uwae Ure Primary School Kwesati | 24 | 9 | 15 | 3.8 |
| Fikyu Ekan Primary School | 25 | 15 | 10 | 2.5 |
| Yitsang Primary School Rufu | 23 | 7 | 16 | 4.1 |
| Fikyu Central Primary School | 25 | 18 | 7 | 1.8 |
| Central Primary School Lissam | 25 | 10 | 15 | 3.8 |
| Lumbu Sarka Primary School | 25 | 13 | 12 | 3.0 |
| Utaih Primary School Lissam | 25 | 16 | 9 | 2.3 |
| Kpambo Puri Primary School | 25 | 16 | 9 | 2.3 |

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| | | | | |
|---|---|---|---|---|
| Kpambo Yashe Primary School | 25 | 19 | 6 | 1.5 |
| Tamiya Primary School Lissam | 25 | 15 | 10 | 2.5 |
| Kpambo Yirom Primary School | 25 | 16 | 9 | 2.3 |
| Kutukok Primary School, Kwesati | 24 | 11 | 13 | 3.3 |
| Kwaibu Primary School | 25 | 14 | 11 | 2.8 |
| Kunkufxang Primary School, Lissam | 25 | 14 | 11 | 2.8 |
| Lumbu Rikwenrika Primary School | 25 | 16 | 9 | 2.3 |
| Rufu Primary School | 23 | 15 | 8 | 2.0 |
| Total | 394 | 224 | 170 | 43.1 |

Source: Field work, 2024

➢ *Species Distribution of Geohelminths*

Four species of geohelminths were identified. *Ascaris lumbricoides* was the most frequent (99/394, 25.1%), followed by *Ancylostoma duodenale* (42/394, 10.7%), *Trichuris trichiura* (19/394, 4.8%), and *Strongyloides stercoralis* (10/394, 2.5%)

Table 2 Specie Distribution of Geohelminthes Observed in The Population Surveyed

| **Geohelminths** | **Frequency** | **% Frequency** |
|---|---|---|
| Ascaris lumbricodes | 99 | 25.1 |
| Ancylostoma duodenale | 42 | 10.7 |
| Trichiuris trichuria | 19 | 4.8 |
| Strongyloides stercoralis | 10 | 2.5 |
| Total Positve | 170 | 43.1 |

Source: Field work, 2024

➢ *Prevalence by Age*

Infection prevalence varied significantly with age ($\chi^2 = 567.43$, $p < 0.001$). The highest prevalence was found in the 10-11 years' age group (78/180, 43.3% of that group, 19.8% of total population), followed by the 8-9 years' group (56/133, 42.1% of group, 14.2% of total). The lowest prevalence was in the 12-13 years' group (15/47, 31.9% of group, 3.8% of total). The distribution of each species by age group is detailed in Table 3.

Table 3 Prevalence of Geohelminths According to The Age of the Pupils

| **Sex** | **No. Tested** | **No. of Positive** | **No. of Negative** | **Geohelminths Detected** | | | | **Chi-Square** | **df** | **P-Value** |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | **Ascaris Lumbri coides** | **Ancylostoma Duodenale** | **Trichuris Trichiura** | **Strongyloides Stercoralis** | | | |
| 6 - 7 Yrs. | 34 | 21 (5.3) | 13 (3.3) | 16 (4.1) | 3 (0.8) | 1 (0.2) | 1 (0.2) | 121.99 | 3 | 0.0001 |
| 8 - 9 Yrs. | 133 | 56 (14.2) | 77 (19.5) | 30 (7.6) | 15 (3.8) | 7 (1.8) | 4 (1.0) | 415.52 | 3 | 0.0001 |
| 10 - 11 Yrs. | 180 | 78 (19.8) | 102 (25.9) | 44 (11.1) | 21 (5.3) | 8 (2.0) | 5 (1.3) | 567.43 | 3 | <0.0001 |
| 12 - 13 Yrs. | 47 | 15 (3.8) | 32 (8.2) | 9 (2.3) | 3 (0.8) | 3 (0.8) | 0 (0.0) | 133.73 | 3 | 0.0001 |
| Total | 394 | 170 (43.1) | 224 (56.9) | 99 (25.1) | 42 (10.7) | 19 (4.8) | 10 (2.5) | | | |

Source: Field work, 2024

➢ *Prevalence by Sex*

A total of 192 males and 202 females were examined. The prevalence was significantly higher in males (105/192, 54.7% of males, 26.6% of total) compared to females (65/202, 32.2% of females, 16.5% of total) ($\chi^2 = 57.14$, $p = 0.0001$ for males; $\chi^2 = 78.70$, $p = 0.0001$ for females). Males had higher rates of all four helminth species compared to females.

Table 4 Prevalence of Geohelminths According to The Sex of the Pupils

| **Sex** | **No. tested** | **No of Positive** | **No of Negative** | **Geohelminths detected** | | | | **Chi-square** | **df** | **p-value** |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | **Ascaris lumbricoides** | **Ancylostoma duodenale** | **Trichuris trichiura** | **Strongyloides stercoralis** | | | |
| Male | 192 | 105 (26.6) | 87 | 62 (15.7) | 27 (6.9) | 11 (2.8) | 5 (1.25) | 57.14 | 3 | 0.0001 |

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|---|---|---|---|---|---|---|---|---|---|---|
| Female | 202 | 65 (16.5) | 137 | 37 (9.4) | 15 (3.8) | 8 (2.0) | 5 (1.25) | 78.70 | 3 | 0.0001 |
| Total | 394 | 170 | 224 | 99 (25.1) | 42 (10.7) | 19 (4.8) | 10 (2.5) | | | |

Source: Field work, 2024

- *Prevalence by Electoral Ward*

The prevalence of infection across the eight electoral wards of Ussa LGA ranged from 3.8% (Kpambo Puri) to 7.1% (Kwesati). However, statistical analysis showed that the variation in prevalence between different wards was not significant ($\chi^2 = 15.45$, $p = 0.1005$) (Table 5).

Table 5 Prevalence of Geohelminths by Electoral Wards

| **Wards** | **Number of samples collected** | **Number of Positive samples** | **Number of Negative samples** | **Prevalence (%)** |
|---|---|---|---|---|
| Lissam 1 | 50 | 24 | 26 | 6.1 |
| Lissam 2 | 50 | 21 | 29 | 5.3 |
| Kpambo | 50 | 20 | 30 | 5.1 |
| Fikyu | 50 | 17 | 33 | 4.3 |
| Kpambo Puri | 50 | 15 | 35 | 3.8 |
| Lumbu | 50 | 21 | 29 | 5.3 |
| Kwesati | 48 | 28 | 20 | 7.1 |
| Rufu | 46 | 24 | 22 | 6.1 |
| **Total** | **394** | **170** | **224** | 43.1 |

p-value: 0.1005

## IV. DISCUSSION

This research revealed that geohelminth infection is endemic in the Ussa Local Government Area of Taraba State, with an overall prevalence of 43.1%. This prevalence is in agreement with the findings of Elkanah *et al.* (2017) and Gbebi *et al*. (2018), who reported a prevalence of 41.90% in the Zing Local Government Area and 42.8% in the Kurmi Local Government Area of Taraba State, respectively. The increase in prevalence from 2017 to 2024 may be as a result of constant exposure to the origin and carriers of these geohelminths.

The 43.1% prevalence reported in this study far exceeds the yearly WHO threshold prevalence (≥ 10%) (WHO, 2020) for treating communities' endemic to intestinal and soil helminths. A lower prevalence of 5.7% was reported by Ay *et al.* (2023), who undertook their study in the Fufore Local Government Area of Adamawa State. Therefore, their findings regarding the prevalence of geohelminth infection are inconsistent with this study.

From the sixteen (16) schools where this study was conducted, it was noted that all the schools recruited for this research had geohelminth infection, with a prevalence ranging from 1.5% to 4.1%. This finding also agrees with Elkanah *et al.* (2017), who reported helminth infection in all three schools used for their research, and Abe *et al.* (2019), who reported geohelminths in all five schools recruited for their study.

In this study, four geohelminths were identified; namely, *Ascaris lumbricodes* was the most prevalent geohelminth with 25.1%, followed by *Ancylostoma duodenale* with a prevalence rate of 10.7% and *Trichiuris trichuria* with a prevalence rate of 4.8%, while *Strongyloides stercoralis* was the least prevalent with 2.5%. These findings of geohelminths identified in this research were similar to those of Eneanya and Njom, (2023), who carried out their study on the prevalence of gastrointestinal helminth infections among school-aged children in Nsukka Local Government Area, Enugu State, Nigeria, However, this does not agree with the findings of Chukuma *et al.* (2019), David *et al.* (2020), and Ay *et al.* (2023). The three (3) different authors identified only three geohelminths instead of the four reported in this study.

With regards to the prevalence of each geohelminth, the prevalence for *Ascaris lumbricodes* was higher than the previous studies undertaken by Elkanah *et al.* (2017), who reported a prevalence of 5.71% in Zing, Taraba State; Gbebi *et al*. (2018) reported 9.3% in Kurmi, Taraba State; De Silva *et al.* (2023) reported 13% in Spain; and Ay *et al.* (2023) reported 11.5% in Fufore, Adamawa State.

Ancylostoma duodenale in this study was observed to have a prevalence of 10.7%, which is similar to Hassan *et al.* (2017), who reported 10.8%, while Abe *et al.* (2019) reported a slightly lower prevalence of 8.0%. A higher prevalence of 94.2% of *Ancylostoma duodenale* was reported by Odinaka *et al.* (2015) among school-aged children in Imo State. While a similar study undertaken by Chukwuma *et al.* (2019) in the Orlu Local Government Area of Imo State did not identify *Ancylostoma duodenale,* its presence can be attributed to the study being conducted during the rainy season. This was also supported by the study by Nwosu *et al.* (2015), who reported that the transmission of *Ancylostoma duodenale* increases during the rainy season.

In this study, *Trichiuris trichuria* had a prevalent of 4.8%, similar to the study of Gbebi *et al.* (2018), who also reported 4.3% among school-aged children in Kurmi Local Government Area. A slightly lower prevalence of 3.57% was reported by Elkanah *et al.* (2017) in the Zing Local

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Government Area, while a higher prevalence of 7.5% was reported by Abe *et al*. (2019) reported a 7.5% higher prevalence, While Ay *et al*. (2023) reported a very low prevalence of 1.5%,

Strongyloides stercoralis, which was also identified, was found to have a prevalence of 2.5% in the study area. This is similar to the study of Abe *et al*. (2019), who also reported 2.5% among school-aged children in Lafia, Nasarawa State. A higher prevalence of 9.04% and 6.5% of *Strongyloides stercoralis* was reported by Elkanah *et al*. (2017) and Ezeagwuna *et al*. (2019) in Kurmi Local Government Area and Uyo Local Government Area in Akwa Ibom State, respectively.

The age group of 10–11 years had the highest prevalence of 19.8%, followed by the age group of 8–9 years with a prevalence of 14.2%, while the least was seen among the age group of 12–13 years with a prevalence of 3.8%. This finding is not in agreement with the reports of Elkanah *et al*. (2017) in Zing Local Government Area of Taraba State, Abe *et al*. (2019) in Lafia, Nasarawa State, and Ay *et al*. (2023) in Fufore Local Government Area of Adamawa State, who reported the highest prevalence of geohelminths among the age groups of 0–5 years and 5–7 years. The high prevalence of geohelminths within the age group of 10–11 years could be linked to the fact that pupils within this age group always play with their fellow mates, both in soil and water bodies, and sometimes they tend to eat vegetables without washing them. Nevertheless, the findings of Odu *et al*. (2015) reported that the prevalence of geohelminths is not age-dependent.

Regarding the pupils' sex, it was observed that the male had the highest prevalence of 26.6%, while the female had 16.5%. This agrees with the findings of Elkanah *et al*. (2017), who reported 43.0% in male subjects and 40.85% in female subjects. Also, Abe *et al*. (2019) reported a higher rate of geohelminths in male subjects than females in Taraba State's Zing Local Government Area. Abe *et al*. (2019) and Ay *et al*. (2023) also reported a higher prevalence of geohelminths among male subjects than female subjects. Therefore, this does not agree with the study of Na'cha *et al*. (2017), who reported a higher prevalence in female subjects than male subjects. The high prevalence reported in this study could be linked to the fact that male subjects are always outside, playing on soil or in water bodies without their parent's knowledge, unlike female subjects, who are always at home with their mothers. A significant relationship exists between the prevalence rate and the pupils' gender.

This study observed a substantial prevalence of geohelminth infections across the various wards, with an overall infection rate of 43.1%. Kwesati recorded the highest prevalence at 7.1%, while Kpambo Puri had the lowest at 3.8%, suggesting potential variations in environmental factors, hygiene practices, or sanitation infrastructure across the wards. Notably, Lissam 1 and Rufu both exhibited a prevalence rate of 6.1%, highlighting a need for targeted interventions in these areas. Despite these variations, the p-value of 0.1005 suggests that the differences in prevalence rates among wards are insignificant, implying a widespread burden of geohelminth infections across the study area.

The limitations of this study include its cross-sectional design, which provides a snapshot of prevalence and cannot establish causality. Furthermore, the use of questionnaires for behavioral factors is subject to recall and social desirability bias.

## V. CONCLUSION

The study's results indicated that the prevalence rate of geohelminth infection in the Ussa Local Government Area of Taraba was 43.1%. Data analysis revealed that geohelminth infections were more prevalent among male respondents than females. Furthermore, within the age groups of the pupils surveyed, those aged 10–11 exhibited the highest infection rates. The study successfully identified four species of geohelminths: *Ascaris lumbricoides*, *Ancylostoma duodenale*, *Trichuris trichiura*, and *Strongyloides stercoralis*. Among these, *Ascaris lumbricoides* was found to be the most prevalent species. These findings underscore the need for targeted public health interventions to improve hygiene practices and reduce exposure to infection among school-aged children in this region.

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