



AGE AND GENDER STRATIFICATION OF INTESTINAL HELMINTH INFECTIONS AMONG SCHOOL CHILDREN IN ADAMAWA CENTRAL ZONE, ADAMAWA STATE, NIGERIA.



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Abstract

Intestinal helminth infections continue to pose a major public health challenge in rural parts of sub-Saharan Africa, particularly affecting children leading to anemia, malnutrition, growth retardation, and cognitive deficits. While age and gender are known factors influencing susceptibility, few studies in Nigeria have rigorously stratified data to inform targeted deworming interventions. The study aims to fill the gap by analyzing the prevalence and intensity of intestinal helminth infections stratified by age and gender in a rural Nigerian setting. This cross-sectional study was conducted in a rural setting in Adamawa Central Zone, Nigeria. A total of 1,496 children aged 3 to 15 years were examined using multi-stage stratified random sampling. Stool samples were analyzed using formol-ether sedimentation techniques to determine the prevalence of helminth infections. Age- and gender-specific analyses were conducted using chi-square tests. Overall prevalence was 38.64%. Children aged 8–10 years had the highest infection rate (38.8%), followed by those aged 5–7 years (37.3%). Prevalence was lowest in the <5 and >12 age groups. Females had a slightly lower infection rate (30.5%) than males (33.6%). Statistically significant associations were found between age group and infection prevalence ($p < 0.001$), and within-gender stratified analysis also showed significance. Age and gender significantly influence the distribution of intestinal helminth infections in rural Nigerian children. Targeted deworming policies must prioritize high-risk age clusters, particularly 5–10 years, with gender-sensitive health education strategies, and developing hygiene and sanitation education materials that are age-appropriate and responsive to gender roles locally cultured is also recommended.

Keywords:

Helminths, age, gender, deworming, Nigeria, stratification.

Introduction

Intestinal helminths, including *Ascaris lumbricoides*, *Trichuris trichiura*, and hookworms, are among the most prevalent infections in school-aged children in low-income settings (WHO, 2023). Globally, Intestinal helminths affect over 1.5 billion people, contributing to anemia, malnutrition, growth retardation, and cognitive deficits, especially in children (CDC, 2022). Nigeria remains one of the high-burden countries, with environmental, socio-economic, and infrastructural disparities exacerbating intestinal helminths transmission (Yoko *et al.*, 2021).

While mass deworming campaigns have been implemented nationally, the absence of stratified data by age and gender limits the effectiveness of these interventions. Several studies suggest that younger children are more susceptible due to behavioral and immunological factors, and gender differences may influence exposure patterns (Salawu *et al.*, 2020). However, limited empirical data exist on how these variables interact in rural Nigerian contexts.

This study aims to fill that gap by analyzing the prevalence and intensity of intestinal helminth infections stratified by age and gender in a rural Nigerian setting. The findings are intended to inform targeted deworming strategies that reflect local epidemiological realities.

Materials and Methods

The study was conducted in selected rural communities within Adamawa Central Zone, Nigeria. The area experiences a tropical climate with a distinct rainy and dry season. Sanitation infrastructure is limited, with open defecation and unsafe water sources common. The primary economic activities are farming and animal rearing. A community-based cross-sectional study design was adopted. Participants were children aged 3 to 15 years

enrolled in public primary schools. Children with recent deworming (<6 months) or chronic illness were excluded.

Sampling Technique

A multi-stage sampling method was used. First, LGAs were randomly selected, followed by the random selection of schools. Within schools, participants were stratified by age groups (3–5, 6–10, 11–15) and gender. A total of 1,496 children were recruited.

Sample Size Determination

The sample size was determined using Taro Yamane (1967) statistical formula for determination of sample size. Thus,

$$n = \frac{N}{N(e)^2}$$

Where:

n = the sample size

N = the population of the study

e = the margin error in the calculation, 5%

Sample Collection and Laboratory Analysis

Stool samples were collected in labeled containers and preserved in 10% formalin. Laboratory analysis employed formol-ether sedimentation techniques. A sample was observed using 10x microscope to detect Egg/larvae of helminths.

Data Analysis

Data were analyzed using SPSS Version 26. Descriptive statistics were used to calculate prevalence, and chi-square tests assessed associations between infection status and demographic variables. Stratified analysis was conducted by age and gender. Chi-square was used to identify predictors of infection.

Results

Overall Prevalence

Out of 1,496 children examined, 578 tested positives for at least one intestinal helminth, yielding a prevalence of 38.64%. The distribution by species is shown in Table 1.

Table 1: Distribution of Helminth Species among Infected Children

Parasite	Frequency	Percentage (%)
<i>Ascaris lumbricoides</i>	271	46.9
Hookworm	126	21.8
<i>Trichuris trichiura</i>	109	18.9
Mixed Infections	72	12.5

Age-Stratified Prevalence

Infection prevalence was highest among children aged 8–10 years (38.8%) followed by those aged 5–7 years (37.3%). The lowest prevalence was observed in children younger than 5 years (25.8%) and older than 12 years (25.4%). Chi-square analysis indicated a significant association between age group and infection ($\chi^2(4) = 15.625$; $p < 0.001$). See Table 2.

Table 2: Age-wise Distribution of Infection

Age Group	Examined	Infected	Prevalence (%)
<5	194	50	25.8
5–7	300	112	37.3
8–10	340	132	38.8
11–12	276	90	32.6
>12	386	98	25.4

Gender-Stratified Prevalence

Among males, 235 of 699 were infected (33.6%), while 243 of 797 females tested positive (30.5%). Gender-stratified chi-square tests showed significant associations within both groups: Male ($\chi^2(4) = 10.543$; $p = 0.001$), Female ($\chi^2(4) = 12.437$; $p = 0.002$). See Table 3.

Table 3: Gender-wise Distribution of Infection by Age Group

Male Examined	Male Infected	Female Examined	Female Infected
101	29	93	21
143	51	157	61
161	59	179	73
123	41	153	49
171	55	215	43

Age-Gender Interaction

A cross-tabulation of age and gender showed that boys aged 8–10 years and 5–7 years had the highest prevalence rates (36.6% and 35.7%, respectively). Among girls, the

highest rates were in the 8–10 and 5–7 age groups (40.8% and 38.9%). These trends highlight a critical need for age-gender tailored deworming interventions.

Discussion

This study provides important insights into the age and gender dynamics of intestinal helminth infections in a rural Nigerian context. The overall prevalence of 38.64% underscores the continued endemicity of intestinal helminths, despite ongoing deworming initiatives. The dominance of *Ascaris lumbricoides* aligns with findings from other Nigerian studies (Salawu *et al.*, 2020; Afolabi *et al.*, 2022) and reflects its greater environmental resilience and egg viability.

Children aged 5–10 years showed significantly higher infection rates than other age groups, a trend well documented in helminthology literature (WHO, 2023; Osazuwa *et al.*, 2019). This heightened susceptibility is attributed to age-specific behaviors such as outdoor play, geophagia, and inconsistent hygiene. The younger children (<5 years) and adolescents (>12 years) had comparatively lower rates, likely due to closer supervision or greater personal hygiene.

Gender-stratified analyses revealed subtle differences in infection burden. Although males had slightly higher overall prevalence, females aged 8–10 years showed the highest specific infection rates. This nuance suggests possible socio-cultural dimensions influencing exposure, such as gendered household roles like caregiving or water-fetching, which may increase contact with contaminated environments (Yoko *et al.*, 2021).

These findings are consistent with results from similar studies in Ethiopia (Eyamo *et al.*, 2019), Kenya (Wekesa *et al.*, 2020), and northern Nigeria (Rabia *et al.*, 2024), which all identified school-aged children as the most vulnerable group. The implications are clear: blanket deworming strategies may be insufficient. Policies must integrate epidemiologically informed targeting to reduce reinfection rates and maximize resource efficiency.

Conclusion

The findings from this study confirm that intestinal helminth infections remain a moderate to high burden among school-aged children in rural Adamawa. The marked differences in prevalence across age and gender categories highlight the need for stratified intervention approaches. Children aged 5–10 years, particularly females in that cohort, emerge as the most vulnerable subpopulation. These results provide empirical justification for tailoring deworming and health education programs to specific demographic groups.

Recommendations

- Implement Age-Targeted Deworming: Focus biannual school-based deworming efforts on children aged 5–10 years to break transmission cycles.
- Gender-Sensitive Health Education: Develop hygiene and sanitation education materials that are age-appropriate and responsive to gender roles in the local culture.
- WASH Infrastructure Improvements: Provide clean water, handwashing stations, and gender-separated latrines in schools and communities to reduce exposure risks.

- iv. Community Engagement: Encourage local participation in helminth control to ensure sustained behavioral and environmental change.
- v. Regular Monitoring and Evaluation: Establish age- and gender-disaggregated infection surveillance to guide iterative program improvements.

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Conflict of Interest

The authors declare no conflict of interest.

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