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PREVALENCE OF INTESTINAL HELMINTHS AMONG SCHOOL AGED CHILDREN IN TAMBO WARD GIREI LOCAL GOVERNMENT AREA, ADAMAWA STATE, NIGERIA

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ABSTRACT
Intestinal parasitic infections remain an important public health concern among school-aged children, particularly in communities where sanitation, hygiene and access to health services are limited. This study assessed the prevalence and distribution of intestinal parasites and selected sociodemographic, health-related and nutritional factors among primary school pupils in Tambo Ward, Girei Local Government Area, Adamawa State, Nigeria. A cross-sectional study was conducted among 350 pupils from Tambo A and Tambo Jumoh primary schools. Stool samples were examined microscopically, and questionnaire data were collected. Data were analyzed using descriptive statistics and chi-square tests at a 5% significance level. Of the 350 pupils examined, 114 were infected, giving an overall prevalence of 32.57%. Prevalence was 33.68% in Tambo A and 31.25% in Tambo Jumoh, with no significant difference between schools ($\chi^2 = 0.24$, $p = .62$). Six parasite taxa were identified; Strongyloides stercoralis was most frequent (36.0%), followed by Ascaris lumbricoides (22.8%), hookworm (14.0%), Taenia spp. (10.5%), Enterobius vermicularis (8.8%) and Giardia lamblia (7.9%). Infection was significantly associated with age, class level, parental education, parental occupation, previous diagnosis, recent symptoms, deworming status and selected nutritional indicators, but not sex ($p = .79$). The findings indicate a substantial burden of intestinal parasitic infection and support integrated school-based health education, sanitation improvement, safe-water provision, appropriate deworming and routine screening.

Keywords. Prevalence; Intestinal Helminths; School Aged Children; Parasites; Sanitation.

Introduction

Intestinal parasitic infections are important public health problems in many low- and middle-income settings. They include infections caused by helminths and intestinal protozoa and are commonly transmitted through contaminated soil, food, water and surfaces. Children are particularly vulnerable because of frequent environmental contact and developing hygiene practices. Infection may be associated with gastrointestinal symptoms and, depending on parasite burden and duration, may contribute to nutritional and health problems (Mbaawuagi & Oladipo, 2019).

In Nigeria, intestinal parasitic infections remain relevant in communities where safe water, sanitation facilities and preventive health services are insufficient. The distribution of infection varies among communities because of differences in environmental conditions, socioeconomic circumstances, hygiene practices, water sources, health-seeking behaviour and access to deworming services. Evidence from Nigerian and other African settings have demonstrated substantial variation in prevalence among school-aged children.
(WHO, 2021).

Girei Local Government Area of Adamawa State contains communities where agriculture is an important livelihood. Environmental exposure to soil and potentially contaminated water or food may increase opportunities for transmission. School-aged children may therefore constitute an important population for surveillance and prevention.

Despite evidence from other parts of Nigeria, locally specific information for Tambo Ward is limited. This study therefore assessed the prevalence and distribution of intestinal parasites among pupils in Tambo A and Tambo Jumoh primary schools and examined selected sociodemographic, health-related and nutritional factors associated with infection (Abubakar & Aliyu, 2021). This study will provide a comprehensive understanding of the scope of IPIs in the region, examine the socio-economic and environmental factors contributing to their prevalence, and explore the consequences of these infections on the health and academic performance of affected children.

Methods and Procedures

1 Study Area

The study was conducted in Girei Local Government Area (LGA) of Adamawa State, Nigeria located between latitudes 9o13’ and 9o 37’ N and longitudes 12º 16’ and 12º 42’E. Girei LGA is located in the northeastern part of Adamawa State, approximately 20 kilometers from the state capital, Yola. It is bordered by other local governments, including Yola South, Song, and Fufore. Girei LGA is characterized by a semi-arid climate, with a significant portion of the population depending on agriculture, particularly farming, as their primary source of income. The region's population is predominantly rural, with a mix of ethnic groups, including the Fulani, Bachama, and other smaller communities (Usman *et al*., 2017). The socio-economic conditions in Girei LGA vary, with a large proportion of the population falling within lower-income brackets. Access to basic services such as clean water, healthcare, and sanitation remains a challenge for many households. Educational facilities in the area are relatively limited, but there are several primary schools, both public and private, spread across the urban and rural areas. These schools offer basic education for children between the ages of 5 and 12 years, the target age group for this study.

2 Study Design

A cross-sectional study design was adopted for this study which is ideal for assessing the prevalence of intestinal parasitic infections (IPIs) and identifying associated risk factors among

primary school pupils in Girei LGA. This design is efficient for prevalence studies, allowing the researchers to gather relevant data on infection rates, socio-economic factors, and academic performance in a relatively short period. The study involved collection of stool samples from participating children for parasitological examination, along with the administration of structured questionnaires to assess socio-economic, hygiene, and environmental factors that may contribute to the transmission of IPIs.

3 Study Population

The study population includes primary school pupils aged 5 to 12 years in Girei LGA, Adamawa State who are enrolled in both public and private primary schools within the LGA. The inclusion criteria for the study were as follows: the children who were enrolled in primary schools within Girei LGA, aged between 5 and 12 years, and willing to participate in the study, with parental consent for each participating child. Children with any medical conditions that may interfere with the study, such as chronic diseases or those on long-term medications, were excluded. This age group was chosen because it is a critical period for the development of children, and they are at higher risk for contracting IPIs due to poor hygiene and sanitation practices.

4 Sampling Size Determination

The sample size for this study was calculated using a standard formula for prevalence studies Cochran (1977) which is commonly used for determining sample sizes in health-related research. The formula is:

$$N = \frac{Z^2Pq}{L^2}$$

Where:

N= sample size

Z= standard normal distribution at 95% Confidence Interval = 1.96

P= prevalence rate of 30% was used, q= 1 – p= 1- 0.5 = 0.5

L= the allowable error, which was taken as 5% = 0.05

$$N = \frac{1.96^2 \times 0.3 \times 0.7}{0.0025}$$

Based on the above calculation, the sample size was 322 which was rounded up to 350 to account for a 10% non-response or incomplete data rate. A minimum of 350 samples were obtained from 2 different primary schools (Tambo A and Tambo Jumoh), ensuring a comprehensive representation of the pupils within the study area.

5 Data Collection Methods

Data collection methods include three primary methods: parasitological examination, a questionnaire survey, and the review of academic performance records.

1. **Parasitological Examination**: Stool samples were collected from each participating pupil. The samples were preserved and transported to Biological Science Laboratory of Modibbo Adama University, Yola for microscopic examination.
2. **Questionnaire Survey**: A structured questionnaire was administered to the parents/guardians of the pupils, as well as to the pupils themselves (with assistance for younger children).

Laboratory Procedures

The following parasitological methods were employed:

1. **Direct Wet Mount**: A small amount of the stool sample was placed on a glass slide and mixed with a saline solution for the immediate observation of motile protozoa and other parasites.

2. **Formol Ether Concentration Technique:** The formol ether concentration as described by WHO (2023) was employed. With an applicator Stick, 1 gram of fecal sample was emulsified in 10ml of 10% formalin in a tube until a slightly cloudy suspension was formed. A gauze filter was fitted into a funnel and the funnel was placed on top of the centrifuge tube. The fecal suspension was passed through the filter into the centrifuge tube until the 7ml mark was reached. The filter was removed and discarded with the lumpy residue. 4ml of ether was added and mixed well for a minute. The fecal debris was centrifuged at 1000g for a minute. The fecal debris was loosened with an applicator stick and the supernatant poured away by quickly inverting the tube. The tube was replaced in its rack and the fluid on the sides of the tube was replced in its rack and the fluid on the side of the tube was allowed to drain down to the sediment. It was well mixed and drop placed on a slide and then covered with cover slip for examination under a binocular microscope. The eggs and the larvae of soil transmitted helminths were identified using keys described by Chessbrough (2000).

Data Analysis

Data analysis was performed using statistical software SPSS version 16. Descriptive statistics, including frequencies, percentages, and measures of central tendency (mean, median), was used to summarize the prevalence of intestinal parasitic infections and demographic data. Inferential statistics, such as chi-square tests, was used to assess the relationships between risk factors (socio-economic status, sanitation practices, hygiene behaviors) and the prevalence of IPIs. Logistic regression was employed to explore the potential predictors of infection. Statistical significance was set at $p < 0.05$. The results were presented in tables to clearly convey the study's findings.

3.0 Results

Results

1 Prevalence of Intestinal Parasite Infection

Of the 350 pupils examined, 114 were infected, giving an overall prevalence of 32.57%. Tambo A recorded 64 infected pupils (33.68%), whereas Tambo Jumoh recorded 50 (31.25%). The difference was not statistically significant ($\chi^2(1, N = 350) = 0.24$, $p = .62$).

School	Examined	Infected	(%) Prevalence
Tambo A	190	64	33.68
Tambo Jumoh	160	50	31.25
Total	350	114	32.57

$\chi^2(1, N = 350) = 0.24$, $p = .62$.

2 Distribution of Intestinal Parasites

Six parasite taxa were identified. *Strongyloides stercoralis* was the most frequently recorded (41; 36.0%), followed by *Ascaris lumbricoides* (26; 22.8%), *hookworm* (16; 14.0%), *Taenia spp*. (12; 10.5%), *Enterobius vermicularis* (10; 8.8%) and *Giardia lamblia* (9; 7.9%). The distribution differed significantly ($\chi^2(5, N = 114) = 39.21$, $p < .001$).

Parasite	Frequency	Percentage
Ascaris lumbricoides	26	22.8
Hookworm	16	14.0
Enterobius vermicularis	10	8.8
Strongyloides stercoralis	41	36.0
Taenia spp.	12	10.5
Giardia lamblia	9	7.9
Total	114	100.0

3 Socio-Demographic Factors Associated with Infection

Sex was not significantly associated with infection (p = .79). Age, class level, parental education and parental occupation were significantly associated with infection at the reported significance levels.

Factor	Category	Examined	Infected (%)	Pvalue
Sex	Male	180	60 (17.14)	0.79
	Female	170	54 (15.43)	
Age	5–7 years	120	48 (13.71)	0.045
	8–10 years	130	40 (11.43)	
	11–13 years	100	26 (7.43)	
Class	Primary 1–3	185	68 (19.43)	0.038
	Primary 4–6	165	46 (13.14)	
Parent/guardian education	No formal education	65	45 (12.86)	<0.001
	Primary	70	36 (10.29)	
	Secondary	117	20 (5.71)	
	Tertiary	98	13 (3.71)	
Parent/guardian occupation	Farming	180	60 (17.14)	0.001
	Trading	60	30 (8.57)	
	Civil service	90	10 (2.86)	
	Other	20	14 (4.00)	

4 Health-Related Factors

Previous diagnosis, recent symptoms and deworming status showed significant associations with current infection in the reported analyses. Frequency of previous infection during the preceding year was not significantly associated with current infection ($\chi^2 = 0.36$, p = .83).

Factor	Category	Examined	Infected (%)	Pvalue
Previous diagnosis	Yes	201	45 (12.86)	<0.001
	No	149	69 (19.71)	
Previous infections in last year	Once	80	20 (5.71)	0.83
	Twice	70	15 (4.43)	
	More than twice	51	10 (2.86)	
Recent symptoms	Diarrhoea	120	60 (17.14)	<0.001
	Abdominal pain	115	40 (11.43)	
	Weight loss	40	3 (0.86)	
	Vomiting	60	10 (2.86)	
	Loss of appetite	15	1 (0.29)	
Dewormed in last 6 months	Yes	130	15 (4.43)	<0.001
	No	220	99 (28.29)	

5 Nutritional Factors

Meal frequency, appetite-related responses, hunger complaints, reported anemia history and nutritional supplement use were significantly associated with infection in the reported analyses.

Factor	Category	Examined	Infected (%)	Pvalue
At least three meals daily	Yes	170	34 (9.71)	<0.001
	No	180	80 (22.86)	
Poor appetite	Strongly agree	40	2 (0.57)	<0.001
	Agree	80	12 (3.43)	
	Disagree	180	89 (25.43)	
	Strongly disagree	50	11 (3.14)	
Hunger after eating	Strongly agree	50	4 (1.14)	<0.001
	Agree	70	10 (2.86)	
	Disagree	190	90 (25.71)	
	Strongly disagree	40	10 (2.86)	
Health worker reported anaemia	Yes	20	15 (4.29)	<0.001
	No	330	99 (28.29)	
Vitamin/nutritional supplements	Regularly	15	1 (0.29)	<0.001
	Occasionally	260	51 (14.57)	
	Never	75	62 (17.17)	

Discussion of Results

1 Prevalence of intestinal helminths

The overall prevalence of 32.57% indicates that intestinal parasitic infection was common among the pupils examined. The prevalence obtained from the present study agrees with the findings from Ibadan, where (Auta, Bello & Gyang, 2022) reported a prevalence of 29.4% among primary school pupils. Similarly, studies conducted in Ibadan and Kano reported prevalence rates ranging from 28% to 41% among school children (Auta, Bello & Gyang, 2022) and a study in Ethiopia reported a prevalence of 34.2% (Tadesse, Alemu & Mekonnen, 2022). Another study conducted in Kano by (Ibrahim, Yusuf & Abdullahi, 2023) documented a prevalence of 31.8%, which closely aligns with the present findings.

However, the prevalence observed in this study disagree with 41.6% reported in Makurdi (Odey, Terlumun & Umeh, 2022) and 44.2% in Calabar (Ekpo, Odoemene & Mafiana, 2021). So also, the prevalence recorded in this study disagree with the reports from rural communities in Cameroon (45.8%) and Kenya (49.0%) (Ntonifor, Green & Bopda, 2021; Mwangi, Kamau, & Otieno, 2022). The relatively moderate prevalence in Tambo may be attributed to periodic deworming programs and improved awareness of hygiene practices.

Conversely, the prevalence in this study is higher than the 18.5% reported in Lagos (Adekunle, Ojo, & Lawal, 2023), likely due to better urban sanitation systems and improved access to healthcare services in metropolitan areas. The absence of a statistically significant difference in infection between the two schools suggests that environmental and sanitation conditions are similar in both locations, which agrees with findings by (Adeyemi, Ibrahim, & Salisu, 2023), who

reported uniform distribution of infections among schools sharing similar ecological characteristics.

There is no significant difference between the two schools (p = 0.62) The prevalence was similar between Tambo A and Tambo Jumoh, and the difference was not statistically significant. Variation between studies can arise from differences in sanitation, water supply, environmental exposure, diagnostic methods, population characteristics and deworming coverage. Similar findings were reported in Ilorin, where no significant inter-school variation was observed (Salami, Olanrewaju, & Ibrahim, 2022).

2 Distribution of Helminths Parasite Species

The predominance of *Strongyloides stercoralis* (36.0%) in this study contrasts with many Nigerian studies where *Ascaris lumbricoides* is typically the most prevalent parasite. The high prevalence of soil-transmitted helminths in this study supports global observations by the World Health Organization (2023), which identified school-aged children as the most vulnerable group due to frequent soil contact and inadequate hand hygiene. For example, research conducted in Port Harcourt found Ascaris lumbricoides as the dominant parasite (35.7%) (Nwosu, Amadi & Ibe, 2023). Similarly, studies in Jos reported Ascaris as the leading infection (Olorunfemi, Dung & Gyang, 2022; WHO, 2023; Opara, Udoidung & Opara, 2022). However, similar findings were reported in parts of southern Nigeria where warm, moist soil conditions favor the development of *Strongyloides* larvae (Eze *et al*., 2023).

The higher prevalence of *Strongyloides stercoralis* in Tambo may be linked to increased soil contact and barefoot walking, as the parasite's transmission is closely associated with skin penetration by infective larvae. This pattern aligns with findings from rural communities in Enugu, where Strongyloides prevalence was significantly high due to farming activities (Eze *et al*., 2023).

Hookworm prevalence (14.0%) in this study is consistent with findings in Abeokuta, where 13.2% prevalence was recorded (Ogunrinade, Akinmoladun & Nwankwo, 2022). The presence of protozoan parasites such as Giardia lamblia (7.9%) aligns with reports from Kaduna, where water contamination was implicated as a risk factor (Bello, Musa & Adamu, 2023).

The relatively lower prevalence of *Giardia lamblia* (7.9%) is consistent with findings in semi-urban communities where treated water sources are partially available (Ogunrinade, Akinmoladun & Nwankwo, 2022). Differences in parasite distribution across regions may be explained by variations in sanitation infrastructure, climate, and public health interventions.

3. Socio-Demographic Factors

Sex was not significantly associated with infection (p = 0.79), which agrees with findings from Abuja, where no gender disparity was observed (Danladi, Okeke & Hassan, 2022) and also agrees with the findings of studies in Ghana and Nigeria where no gender disparity was observed (Mensah, Osei & Boateng, 2022; Ibrahim, Yusuf & Abdullahi, 2023). However, this contrasts with a study in Sokoto that reported higher infection rates among males due to increased outdoor exposure (Bello, Musa & Adamu, 2023).

Age showed a significant association (p = 0.045), with children aged 5–7 years having the highest infection rate. Similar age-related vulnerability was reported in Benin City (Okonkwo, Ibeh & Aniebo, 2022), where younger children exhibited poorer hygiene behaviors, similar findings were also reported in Ethiopia, where younger children were more susceptible due to poor hygiene practices and immature immunity (Tadesse, Alemu & Mekonnen, 2022). This supports the assertion by the UNICEF (2023) that younger school children are at increased risk of parasitic infections in low-resource settings.

The significant association between class level and infection supports findings from Uyo, where pupils in lower classes were more infected due to limited hygiene awareness (Udoh, Ekpo & Ekanem, 2021). This aligns with studies conducted in Kenya and Nigeria (Mwangi, Kamau & Otieno, 2022; Adekunle, Ojo & Lawal, 2023), which highlighted low socio-economic status as a major predictor of intestinal parasite infections. Parental education showed a highly significant association ($p < 0.001$), consistent with findings in Minna (Yakubu, Musa & Abdullahi, 2023), where children of less-educated parents were more likely to be infected. This underscores the role of parental awareness in preventive practices. Similarly, children of farmers had significantly higher infection rates, aligning with findings from Bauchi, where agricultural exposure was a major risk factor (Abdullahi, Usman & Bala, 2022).

4. Health-Related Factors

The strong association between lack of deworming and infection ($p < 0.001$) corroborates findings from Ibadan, where children who had not been dewormed in the previous six months were significantly more infected (Auta, Bello & Gyang, 2022). This finding is also consistent with recommendations by the WHO (2023), which emphasizes regular mass deworming in endemic communities. Symptoms such as diarrhea and abdominal pain were significantly associated with infection, similar to reports from Uganda (Kato, Nsubuga & Ocen, 2022). These symptoms are typical clinical manifestations of helminth and protozoan infections and it was consistent with reports from Zaria (Sani, Lawal & Ibrahim, 2023). These findings reinforce the clinical burden of intestinal parasites among school-aged children.

5. Nutritional Factors

The significant association between meal frequency and infection supports findings in Nsukka (Ezeh *et al*., 2019), where malnourished children were more susceptible to parasitic infections. The relationship between anemia history and infection aligns with reports from Owerri (Ntonifor, Green & Bopda, 2021), where helminth infections were strongly linked to iron-deficiency anemia. Furthermore, the significant association between supplement intake and reduced infection prevalence suggests that improved nutritional status enhances immune resistance. Similar conclusions were drawn in a study conducted in Ilorin (Salami, Olanrewaju & Ibrahim, 2022). The inverse relationship between supplement intake and infection suggests that improved nutritional status enhances immunity. This is consistent with findings from the WHO (2023), which links poverty, poor diet, and parasitic infection in developing countries.

Overall, the findings of this study corroborate global evidence that intestinal parasitic infections remain closely linked to poverty, poor sanitation, and inadequate nutrition.

Conclusion

Intestinal parasitic infection was detected in 32.57% of the 350 pupils examined in Tambo Ward. The prevalence was similar in Tambo A and Tambo Jumoh. *Strongyloides stercoralis* was the most frequently reported parasite. Infection was significantly associated with several sociodemographic, health-related and nutritional variables, while sex was not significantly associated. The findings indicate a continuing public health burden requiring coordinated prevention and control measures. These findings confirm that intestinal parasitic infections continue to pose a significant public health challenge in the study area and are strongly influenced by socio-economic conditions, hygiene practices, and nutritional status.

Recommendations

Based on the findings of this study, the following recommendations are proposed:

i. Mass deworming campaigns should be conducted at least twice yearly to reduce infection prevalence.

ii. Schools should strengthen health education programs emphasizing handwashing, use of footwear, safe food handling, and environmental sanitation.
iii. Provision of clean water and functional toilet facilities in schools and communities should be prioritized.
iv. Community outreach programs should target parents, especially those with low educational backgrounds, to improve preventive practices.
v. School feeding programs and micronutrient supplementation initiatives should be strengthened to enhance immunity and reduce susceptibility to infection.
vi. Routine screening of school children for intestinal parasites should be implemented to ensure early detection and treatment.

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Conflict of Interest

The author declares no conflict of interest.

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