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Research Article

Prevalence and Risk Factors of *Entamoeba histolytica* Infection among Children Attending Selected Hospitals in Kaduna North Local Government Area, Kaduna, Nigeria

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ABSTRACT
Amoebiasis, caused by the protozoan parasite *Entamoeba histolytica*, remains a major health challenge in developing countries like Nigeria, particularly among children, where poor sanitation and inadequate hygiene facilitate its transmission. This study investigated the prevalence of *E. histolytica* infection among children between the ages of 0 and 12 years old attending some selected hospitals in Kaduna North Local Government Area, Kaduna State, Nigeria. A cross-sectional descriptive study was conducted in which 138 stool samples were collected from children attending four selected hospitals: General Hospital Kawo (GHK), Ashmed Specialist Hospital (ASH), Garkuwa Specialist Hospital (GSH) and FOMWAN Maternity Hospital (FMH). Stool samples were examined using iodine wet mounted and examined by a light microscope for the presence of *E. histolytica* cysts and trophozoites. Data were analyzed using Chi-square statistics on SPSS version 20. The results revealed an overall prevalence of 48.0% (42/138). The highest occurrence was observed in General Hospital Kawo (18.5%), followed by Garkuwa Specialist Hospital (17.0%), Ashmed Specialist Hospital (7.5%), and FOMWAN Maternity Hospital (5.0%). Male children had a higher infection rate (28.0%) compared with females (20.0%). Age-related prevalence showed that children between the ages of 1–4 years old were the most infected (20.0%), followed by those aged 9–12 years old (13.5%) and then 5–8 years old (8.5%). The high prevalence observed indicates that amoebiasis remains endemic in the study area. Improved sanitation, health education, safe water supply, and routine screening are recommended to reduce infection among children.

Keywords: Amoebiasis; Children; *Entamoeba histolytica*; intestinal protozoa; Kaduna-Nigeria; Prevalence

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INTRODUCTION

Amoebiasis is a parasitic disease caused by the protozoan parasite *Entamoeba histolytica*, which primarily infect the human gastrointestinal tract. The parasite exists in two morphological stages which include the environmentally-resistant infective cyst and the invasive trophozoite responsible for tissue destruction. Transmission occurs through the

ingestion of viable cysts in contaminated food or water, followed by ex-cystation in the small intestine and colonization of trophozoites. However, in the large intestine, they may remain asymptomatic or invade the intestinal mucosa and extra-intestinal organs (Shirley *et al*., 2018; Haque *et al*., 2020). Amoebiasis remains a major global health concern, particularly in low- and middle-income countries that are characterized with poor sanitation infrastructure. Recent estimates indicated that *E. histolytica* infection contributes significantly to the global burden of diarrheal diseases, accounting for tens of thousands of deaths annually and ranking the disease among the leading causes of mortality due to protozoan infections (GBD Diarrheal Diseases Collaborators, 2020; World Health Organization, 2022). The disease burden is disproportionately higher in tropical and subtropical regions, where inadequate access to clean water, poor environmental sanitation, and limited healthcare services facilitates sustained the transmission.

Children specifically are particularly vulnerable to amoebiasis due to their immature immune systems and increased exposure to contaminated environments. In endemic regions, intestinal protozoan infections remain highly prevalent among children and are associated with malnutrition, impaired growth, and increased morbidity (Kotloff *et al*., 2017; Khalil *et al*., 2018). In Nigeria, several studies have reported considerable prevalence rates of *E. histolytica* infection among children, with risk factors including poor personal hygiene, unsafe drinking water, overcrowding, and low socioeconomic status (Inabo *et al*., 2003; Yakubu and Sathiankumar, 2010; Ojurongbe *et al*., 2018). Despite ongoing public health interventions aimed at improving sanitation and controlling parasitic infections, amoebiasis remains endemic in many parts of Nigeria. However, there is a paucity of recent epidemiological data on the prevalence and distribution of *E. histolytica* infection among children in Kaduna North Local Government Area. Updated data are essential for informing targeted intervention strategies and improving disease control programs. Therefore, this study aimed to determine the prevalence of *E. histolytica* infection among children between the age of 0–12 years old attending selected hospitals in Kaduna North Local Government Area of Kaduna State, Nigeria.

MATERIALS AND METHODS

Study Area

This study was conducted in Kaduna North Local Government Area, located in Kaduna State, within the North-West geopolitical zone of Nigeria. Kaduna North is one of the metropolitan Local Government Areas (LGA) forming part of the Kaduna urban axis and serves as a major administrative and healthcare hub in the state. Geographically, Kaduna North LGA lies approximately between latitude 10°31'N and longitude 7°26'E. The area falls within the Northern Guinea Savannah ecological zone and experiences a tropical continental climate characterized by distinct wet and dry seasons. Kaduna North shares boundaries with Igabi LGA to the west, Chikun LGA to the south, Kaduna South LGA to the southwest, and Giwa LGA to the east. The LGA is densely populated and exhibits a mixture of urban and peri-urban settlements with diverse socio-economic and cultural characteristics (Figure 1). A multi-center Hospital-based survey was conducted in four major healthcare facilities within the LGA, namely: General Hospital Kawo (GHK), Ashmed Specialist Hospital (ASH), Garkuwa Specialist Hospital (GSH), and Fomwan Maternity Hospital (FMH) (Table 1). These hospitals were purposively selected based on patient population, accessibility, and their representation of different catchment areas within Kaduna North LGA.

Study Design

A cross-sectional descriptive study design was used to determine the prevalence of *E. histolytica* among children aged 0–12 years attending selected hospitals.

Determination of Sample Size

The sample size was calculated using the formula:
$n = Z^2P(1-p)/\ d2$ as presented in equation 1

$$n = \frac{z^2 p(1-p)}{e^2} \quad \text{\_\_\_\_\_ Equ. 1}$$

Where:
n = sample size
Z = 1.96 (95% confidence interval)
P = estimated prevalence (10%)
d = margin of error (5%)
The calculated sample size was 138 children.

Ethical Consideration

Ethical approval was obtained from the Kaduna State Ministry of Health Ethical Committee. Ethical clearance with reference number (MOH/ADM/744/Vol1/111075) was issued and informed consent/assent was obtained from Ministry of Health Kaduna State. However, verbal consent was obtained from parents or guardians of participating children.

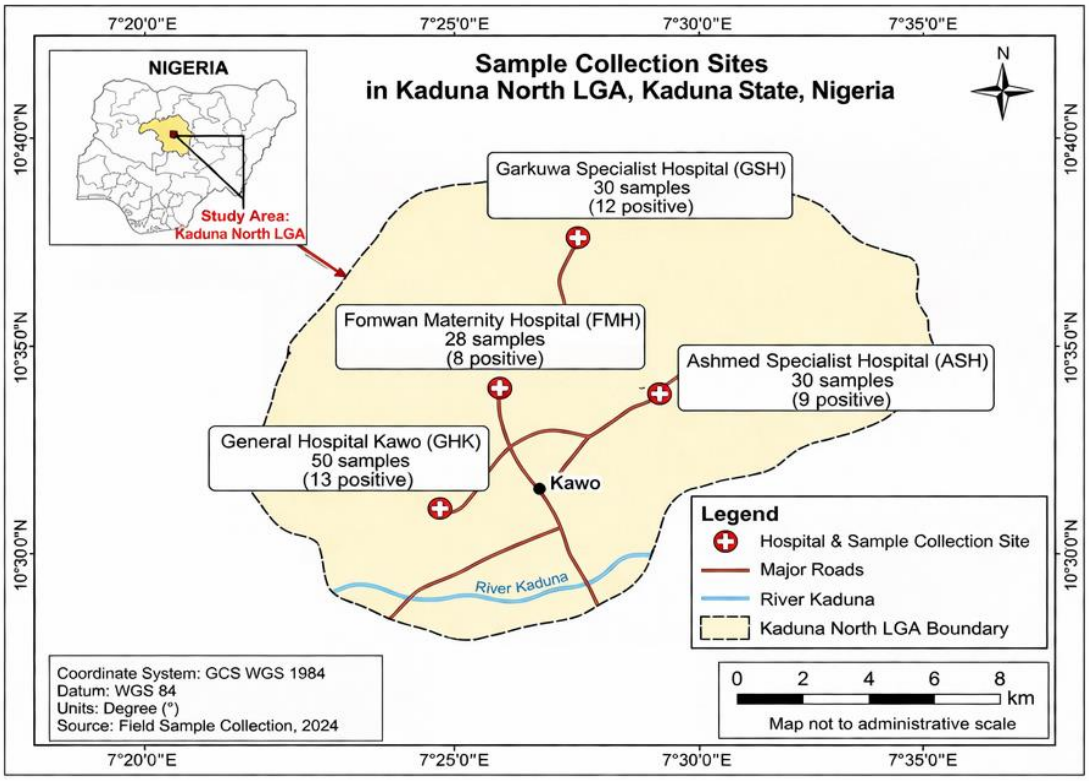

Figure 1. Map of Kaduna North LGA showing hospitals and sample collection sites, Kaduna State, Nigeria

Table 1: Selected Hospitals and their Geographic Coordinates (WGS 84)

Hospital Code	Hospital Name	Latitude (N)	Longitude (E)
GHK	General Hospital, Kawo	10°30′52″	7°25′15″
ASH	Ashmed Specialist Hospital	10°33′30″	7°28′40″
FMH	Fomwan Maternity Hospital	10°32′18″	7°24′50″
GSH	Garkuwa Specialist Hospital	10°35′40″	7°26′30″

Collection of Samples

Stool samples were collected from children between the age of 0–12 years old using sterile, wide-mouthed specimen containers. Each container was properly labeled with the child's age, gender, and hospital location. Samples were transported immediately to the Microbiology Laboratory at the Department of Applied Biology, Kaduna Polytechnic for analysis.

Laboratory Analysis

The stool samples were preserved in 10% formal ether and examined microscopically using iodine wet mount technique. A small portion of stool was mixed with iodine solution on a glass slide and covered with a cover-slip. The smear was examined using 10x objective for detecting and 40x objective for identification of *E. histolytica* cysts.

Data Analysis

Data obtained were analyzed using the Statistical Package for Social Sciences (SPSS) version 20. Chi-square test was used to determine associations between variables such as gender and age group.

RESULTS

Prevalence of *E. histolytica* Across the Selected Hospitals

The distribution of *Entamoeba histolytica* infection among the children across the selected hospitals is presented in Table 2. Out of the 138 children examined, 42 (30.4%) had *E. histolytica* infection. Hospital-specific prevalence varied across the study sites. The highest prevalence was observed among children that attended Garkuwa Specialist Hospital (40.0%), followed by Ashmed Specialist Hospital (30.0%) and Fomwan Maternity Hospital (28.6%). The lowest prevalence was recorded among the children that attended General Hospital Kawo (26.0%). Despite these observed differences, Chi-square analysis revealed no statistically significant association between hospital attended and the

prevalence of infection (χ^2 = 1.81, df = 3, p = 0.613) (Table 2).

Prevalence of *E. histolytica* according to Gender

The prevalence of *Entamoeba histolytica* infection among children in relation to gender is presented in Table 3. Out of the total 138 children examined, male children accounted for 27 (37.0%) infections, whereas female children accounted for 15 (23.1%) infections. Although a higher prevalence was observed among males compared to females, Chi-square analysis showed no statistically significant association between gender and infection status (χ^2 = 2.52, df = 1, p = 0.112) (Table 3).

Prevalence of *E. histolytica* in accordance to the Age-groups

The age-specific prevalence of *Entamoeba histolytica* infection among the children is shown in Table 4. The highest occurrence was recorded among children between the age of 1–4 years old (30.9%)**,** followed by those of the age between **9**–12 years old (30.0%) and then between 5–8 years old (30.0%)**,** respectively. Despite slight variations across the age groups, Chi-square analysis revealed no statistically significant association between age group and infection prevalence **(**χ^2 = 0.01, df = 2, p = 0.994**)** Table 4**.**

Table 2: Prevalence of *Entamoeba histolytica* infection among children according to hospital attended in Kaduna North LGA

Hospital	Examined (n)	Infected n (%)	Not infected n (%)
General Hospital, Kawo	50	13 (26.0)	37 (74.0)
Ashmed Specialist Hospital	30	9 (30.0)	21 (70.0)
Fomwan Maternity Hospital	28	8 (28.6)	20 (71.4)
Garkuwa Specialist Hospital	30	12 (40.0)	18 (60.0)
Total	138	42 (30.4)	96 (69.6)
Variable	χ^2	df	p-value
Hospital	1.81	3	0.613

Values expressed as number examined and percentage prevalence. Chi-square test showed no statistically significant association between hospital attended and infection prevalence (p > 0.05).

Table 3: Gender distribution of *Entamoeba histolytica* infection among children examined in Kaduna North LGA Hospitals

Gender	Examined (n)	Infected n (%)	Not infected n (%)
Male	73	27 (37.0)	46 (63.0)
Female	65	15 (23.1)	50 (76.9)
Total	138	42 (30.4)	96 (69.6)
Variable	χ^2	df	p-value
Gender	2.52	1	0.112

Chi-square test indicates no statistically significant association between gender and infection (p > 0.05).

Table 4: Age-specific prevalence of *Entamoeba histolytica* among children attending selected hospitals in Kaduna North LGA.

Age group (years)	Examined (n)	Infected n (%)	Not infected n (%)
1–4	68	21 (30.9)	47 (69.1)
5–8	30	9 (30.0)	21 (70.0)
9–12	40	12 (30.0)	28 (70.0)
Total	138	42 (30.4)	96 (69.6)
Variable	χ^2	df	p-value
Age group	0.01	2	0.994

No statistically significant difference in infection prevalence among age groups (p > 0.05)

DISCUSSION

This study investigated the prevalence and associated factors of *Entamoeba histolytica* infection among children attending selected hospitals in Kaduna North, Nigeria. The overall prevalence of 30.4% observed in this study indicates that amoebiasis remains a significant public health concern in the study area. This prevalence is comparable to reports from other parts of sub-Saharan Africa, where intestinal protozoan infections continue to be endemic due to poor sanitation and limited access to safe drinking water (Ojurongbe *et al*., 2018; World

Health Organization, 2022). However, it is higher than values reported in some recent global estimates, which suggest a declining burden of amoebiasis in regions with improved water, sanitation, and hygiene (WASH) interventions (GBD Diarrheal Diseases Collaborators, 2020). The hospital-based distribution of infection showed variability, with the highest prevalence recorded at Garkuwa Specialist Hospital (40.0%) and the lowest at General Hospital Kawo (26.0%). Despite these differences, the absence of a statistically significant association between hospital attended and infection prevalence suggests that the burden of infection is relatively uniform across healthcare facilities. However, from the Chi-square analysis it could also indicates that the variation in infection rates across the hospitals may be due to random variation rather than true differences in exposure or risk. This finding aligns with studies indicating that amoebiasis transmission is primarily driven by community-level environmental factors, rather than healthcare facility–specific variables (Shirley *et al.,* 2018). Similar observations have been reported in other endemic regions, where exposure to contaminated water and poor hygiene practices are widespread across communities (Haque *et al*., 2020).

Gender-related analysis in this study revealed a higher prevalence among male children compared to females, although the difference was not statistically significant. This pattern is consistent with findings from several studies in Africa and Asia, where males often show slightly higher infection rates, possibly due to increased outdoor activities and greater exposure to contaminated environments (Khalil *et al*., 2018; Feleke *et al*., 2019). However, the absence of statistical significance indicates that sex does not play a meaningful role in infection risk. Instead, transmission appears to be driven primarily by environmental exposure and behavioral factors rather than inherent biological differences. The slight variation observed between male and female children is therefore likely due to random variation rather than a true epidemiological pattern, confirming that gender was not a significant predictor of *E. histolytica* infection in this population.

Age-specific analysis showed a relatively uniform distribution of infection across all age groups, with children between the age 1–4 years old exhibiting the highest prevalence. Although younger children are generally considered more vulnerable due to immature immune systems and poor hygiene practices, the absence of a significant association between age and infection in this study suggests that exposure to *E. histolytica* is widespread across all pediatric age groups. This finding contrasts with some global studies that reported higher infection rates among younger children (Kotloff *et al*., 2017), but agrees with others reported that demonstrate similar exposure risks across childhood in endemic settings (Khalil *et al*., 2018a). The relatively high prevalence observed in this study may be attributed to persistent challenges in sanitation, including inadequate access to clean water, improper waste disposal, and poor personal hygiene practices. These factors have been consistently identified as key drivers of amoebiasis transmission in developing countries (WHO, 2022). In addition, statistical analysis indicates that infection was evenly distributed across all age categories, with no particular age group demonstrating increased susceptibility. The relatively uniform prevalence across age groups suggests that exposure to infection sources is widespread within the community, affecting children irrespective of age. Furthermore, the findings highlighted the need for integrated control strategies that combine health education, improved sanitation infrastructure**,** and routine screening, particularly among vulnerable populations such as children. This study generally emphasized that *E. histolytica* infection remains endemic in Kaduna North LGA of Kaduna State, with no significant variation across hospitals, gender, or age groups. The uniform distribution of infection suggests that interventions should focus on community-wide preventive measures rather than targeting specific subgroups.

CONCLUSION

This study revealed a high prevalence of *Entamoeba histolytica* infection among children in Kaduna North Local Government Area of Kaduna State. The findings highlight the need for improved sanitation, access to clean water, health education, and regular screening programs to reduce the burden of amoebiasis among children.

Future research should employ molecular diagnostic methods and larger population-based samples to generate more accurate estimates of amoebiasis burden and transmission patterns in the region, while also strengthening public health efforts through hygiene education for parents and children, prioritization of safe drinking water provision, routine parasitic screening among children, and integration of protozoan infection control into existing deworming programs.

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DECLARATION OF CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest regarding the publication of this manuscript. The study was conducted independently, and no financial, personal, or professional relationships influenced the design, execution, analysis, or reporting of the work.

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