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Demographic, Environmental and Clinical Correlates of Intestinal Parasitic Infections Among Patients Attending Primary Healthcare Centers in Demsa Local Government Area of Adamawa State

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Abstract

Intestinal parasitic infections (IPIs) remain a major public health problem in Nigeria, particularly in rural communities where sanitation and access to clean water are limited. This study investigated the prevalence and correlates of IPIs among patients attending primary healthcare centers (PHCCs) in Demsa Local Government Area (LGA), Adamawa State. A descriptive cross-sectional design was employed, and stool and blood samples were collected from 398 participants using systematic random sampling. Parasitological analysis was conducted using the formol-ether concentration technique, and data were analyzed with descriptive statistics and chi-square tests at a significance level of $p < 0.05$. The overall prevalence of IPIs was 37.4%, with *Ascaris lumbricoides* (14.9%) and hookworm (11.1%) being the most common parasites. Infection prevalence was significantly associated with age ($p = 0.04$), occupation ($p = 0.02$), open defecation ($p = 0.001$), living near stagnant water ($p = 0.005$), and lack of regular deworming ($p < 0.001$), with children aged 11–15 years and

individuals using river water sources being particularly vulnerable. Attendance at health education programs was associated with lower infection rates ($p = 0.006$). The findings emphasize the persistence of IPIs in Demsa LGA, driven by poor sanitation, unsafe water use, and inadequate hygiene practices, and support the need for strengthened community health education, regular deworming, improved sanitation infrastructure, and safe water access to reduce the disease burden and enhance rural health outcomes.

Keywords: Intestinal Parasitic Infections; Sanitation; Hygiene Practices; Demsa Local Government Area; Prevalence

INTRODUCTION

Intestinal parasitic infections (IPIs) remain a critical public health concern in many developing countries, including Nigeria. These infections are primarily caused by intestinal helminths and protozoa, which thrive under conditions of poor sanitation, inadequate water supply, and low socioeconomic status (Yogendra *et al.,* 2019). The burden of IPIs is disproportionately high in tropical and subtropical regions where poverty, overcrowding, and weak health systems persist. The World Health Organization (WHO) estimates that over 1.5 billion people worldwide are infected with soil-transmitted helminths, with the majority of cases concentrated in sub-Saharan Africa (WHO, 2020).

Infections caused by species such as *Ascaris lumbricoides*, Hookworm, *Trichuris trichiura*, *Entamoeba histolytica*, and *Giardia lamblia* are associated with significant morbidity and mortality, particularly among children (Afolabi *et al.,* 2021). Clinical manifestations range from diarrhea, malnutrition, and anemia to impaired cognitive development and stunted growth (Ezeamama *et al.,* 2018). Despite global control efforts, IPIs remain endemic in Nigeria, where prevalence rates range from 20% to 80% depending on geographic and demographic factors (Oluwole *et al.,* 2021).

Demographic characteristics such as age, sex, and educational status play crucial roles in the distribution of these infections. Children and adolescents are often the most affected due to their behaviors and exposure patterns, while limited education contributes to poor hygiene and health-seeking practices (Awoke & Afera, 2019). Environmental factors particularly unsafe water sources, open defecation, and inadequate waste disposal further exacerbate infection risks (Ojurongbe *et al.,* 2014). Clinically, these infections

present with nonspecific symptoms such as abdominal discomfort, diarrhea, and fatigue, complicating diagnosis and treatment in resource-limited settings (Bethony *et al.,* 2006).

Adamawa State, especially Demsa Local Government Area (LGA), presents a unique ecological and socioeconomic environment conducive to intestinal parasite transmission. Despite ongoing control programs, data on how demographic, environmental, and clinical variables interact to influence infection prevalence remain scarce. This study therefore investigates these correlates among patients attending primary healthcare centers (PHCCs) in Demsa LGA, aiming to inform targeted interventions for improved prevention and control.

MATERIALS AND METHODS

Study Area

The study was conducted in Demsa LGA, Adamawa State, Nigeria, located between latitude 9°27'20"N and longitude 12°8'0"E. The area is predominantly rural, with a population of approximately 180,251 (NPC, 2006). Agriculture and fishing are the main occupations, and many residents rely on rivers and open wells for water. Sanitation facilities are limited, with open defecation and improper waste disposal being common practices.

Study Design

A descriptive cross-sectional design was adopted to determine the prevalence and correlates of intestinal parasitic infections among patients attending selected PHCCs. Both stool and blood samples were collected for parasitological analysis.

Study Population and Sampling

Participants included male and female patients of all ages presenting at the PHCCs. Using the Yamane formula (Yamane, 1967) with a population size of 180,256 and a precision level of 0.05, a minimum sample size of 399 was determined. A systematic random sampling technique was employed, enrolling every nth patient until the desired sample size was reached. Informed consent was obtained from all participants, and parental consent was secured for minors.

Inclusion and Exclusion Criteria

Patients who consented and had not taken antiparasitic or antimalarial medication in the two weeks preceding the study were included. Those currently on treatment for parasitic infections or who declined participation were excluded.

Data Collection

A structured questionnaire was used to collect demographic, environmental, and clinical information, including age, sex, education, occupation, water source, sanitation practices, and health history. Stool and blood samples were collected under sterile conditions.

Laboratory Analysis

Stool samples were examined using the formol-ether concentration technique for the identification of helminth eggs and protozoan cysts (Cheesbrough, 2009). Microscopy was conducted under 10× and 40× objectives for parasite identification using standard morphological criteria

Data Analysis

Data were analyzed using SPSS version 26. Descriptive statistics summarized the data, and associations between variables were tested using the chi-square test at a 5% significance level ($p < 0.05$).

Ethical Considerations

Approval for the study was obtained from the Head of primary health care center Demsa local Government Area of Adamawa State, and ethical guidelines were strictly followed. Participants' anonymity and confidentiality were maintained throughout the research.

RESULTS

The overall prevalence of intestinal parasitic infections among 398 examined patients was 37.4%. The most frequently identified parasites were *Ascaris lumbricoides* (14.9%), hookworm species (11.1%), *Giardia lamblia* (6.0%), *Entamoeba histolytica* (4.8%), and Taenia solium (2.4%). Prevalence varied by primary healthcare center (PHC), demographic

characteristics, environmental risk factors, and clinical history as shown in the following tables.

Table 3. 1. Prevalence of Intestinal Parasites across All Primary Healthcare Centers

PHC	Number Examined	Number Infected	Prevalence (%)
Loh	41	13	31.7
Borrong	42	13	31.0
Gwamba	43	15	34.9
Dilli	42	17	40.5
New Demsa	40	20	50.0
Tassala	43	22	51.2
Demsa	42	19	45.2
Tahau	48	15	31.3
Kpasham	45	14	31.1

Table 3.2. Infection Prevalence by Demographic Characteristics

Variable	Number Examined	Number Infected	Prevalence (%)	p-value
Male	159	70	44.0	0.12
Female	237	90	38.0	0.12
0–5 years	52	18	34.6	0.04
6–10 years	40	14	35.0	0.04
11–15 years	108	40	37.0	0.04
Above 15 years	196	88	44.9	0.25

Demographically, infection was more prevalent among children aged 11–15 years (44.9%) compared to younger or older groups ($p = 0.04$). Gender differences were not statistically significant ($p = 0.12$). Occupation showed significant association, with farmers and students recording higher prevalence (46.8% and 40.0%, respectively; $p = 0.02$).

Table 3.3. Infection Prevalence by Environmental Risk Factors

Risk Factor	Total Examined	Number Infected	Prevalence (%)	p-value
River/Stream water source	200	90	45.0	0.23
Open Defecation	340	160	47.1	0.001
Pit Latrine	29	10	34.5	0.001
Flush Toilet	27	5	18.5	0.001
Living near stagnant water	250	115	46.0	0.005

Environmental risk factors strongly influenced infection rates. Individuals relying on river or stream water exhibited higher infection prevalence (45%) compared to those using boreholes or piped water (p = 0.23). Open defecation was significantly associated with infection (47.1%; p = 0.001), while poor waste disposal and barefoot walking also increased risks. Living near stagnant water correlated positively with infection (p = 0.005).

Table 3.4. Infection Prevalence by Clinical/Medical History and Symptoms

Variable	Total Examined	Number Infected	Prevalence (%)	p-value
Previous Parasitic Diagnosis	254	115	45.3	0.009
Past Treatment for Parasitic Infection	73	28	38.4	0.06
Regular Deworming (Yes)	87	20	23.0	<0.001
Regular Deworming (No)	309	150	48.5	<0.001
Attended Health Education	91	30	33.0	0.006
No Health Education	305	140	45.9	0.006

Clinically, individuals with prior parasitic diagnoses had higher infection rates (45.3%; p = 0.009). Those not engaged in regular deworming were significantly more infected (48.5%; p < 0.001). Attendance at health education programs was inversely associated with infection prevalence (33.0% among attendees vs. 45.9% among non-attendees; p = 0.006). Awareness of prevention methods remained low (23.5%).

DISCUSSION

The observed prevalence (37.4%) stress the persistent burden of IPIs in rural northern Nigeria. Similar prevalence levels have been reported in studies conducted in Mubi North (30.3%) and Yola (24.3%) (Pukuma *et al.,* 2023; Abdulhamid *et al.,* 2021). The slight variation may be attributed to environmental conditions, sanitation practices, and differences in community health education. The predominance of *Ascaris lumbricoides* and hookworm infections is consistent with patterns found across tropical Africa, where poor sanitation and open defecation facilitate soil contamination and parasite transmission (Ezekiel *et al.,* 2024; Mogaji *et al.,* 2020).

The higher infection rate among school-aged children (11–15 years) supports previous findings that this group is particularly vulnerable due to frequent exposure to

contaminated environments and inadequate hygiene practices (Qadeer & Osemeahon, 2023). The lack of significant gender differences aligns with evidence suggesting that in rural populations, exposure risk is largely determined by household and environmental conditions rather than sex (Pukuma *et al.,* 2023).

Environmental factors such as the use of untreated water and open defecation were key determinants, reinforcing earlier reports from southwestern and central Nigeria where these factors accounted for over half of detected cases (Ojurongbe *et al.,* 2017; Aku *et al.,* 2016). The association between infection and living near stagnant water highlights how geography and seasonal flooding promote parasitic persistence in endemic areas (Getnet *et al.,* 2022).

Behavioral determinants including irregular handwashing, lack of soap use, and barefoot walking were significant contributors to infection. These findings echo those of Ayanwale et al. (2024), who noted that poor personal hygiene practices are central to IPI transmission in low-income communities. Furthermore, the study revealed low participation in regular deworming (22.0%) and limited health education coverage (23.0%), reflecting systemic gaps in community outreach programs.

Clinically, the coexistence of infections and symptoms such as diarrhea and weight loss corresponds with the pathophysiological effects of helminthic infestations, which impair nutrient absorption and immune response (Bethony *et al.,* 2006). The positive correlation between previous infection history and current parasitic detection suggests inadequate treatment follow-up or reinfection, emphasizing the need for sustainable deworming campaigns.

Overall, these findings emphasize that IPIs in Demsa LGA are driven by an interplay of demographic vulnerability, environmental exposure, and behavioral practices. The persistence of such infections highlights the necessity for integrated interventions combining public health education, improved sanitation, and mass drug administration to mitigate disease burden

Policy Implications

The results of this study provide actionable evidence for strengthening Nigeria's National Deworming Programme and Water, Sanitation, and Hygiene (WASH) strategies at the local level. Integrating deworming activities with community-based WASH interventions such as the construction of sanitary latrines, promotion of safe water supply

systems, and continuous hygiene education can significantly reduce reinfection rates. Local implementation through the Adamawa State Primary Health Care Development Agency and collaboration with community leaders would enhance program ownership and sustainability. Moreover, aligning these interventions with the National Strategic Plan of Action for Neglected Tropical Diseases (2023–2030) will support national and global targets for the elimination of intestinal parasitic infections as a public health concern.

CONCLUSION

This study demonstrates that intestinal parasitic infections remain a significant health challenge in Demsa LGA, with prevalence influenced by demographic, environmental, and clinical factors. The results reveal that poor sanitation, unsafe water sources, inadequate hygiene practices, and low awareness are the primary drivers of infection. Children and agricultural workers represent particularly vulnerable groups.

Recommendations

1. Health Education: Implement sustained health education campaigns to promote hygiene, sanitation, and safe water practices.

2. Deworming Programs: Reinforce periodic deworming through community-based and school-centered initiatives.

3. Water and Sanitation: Expand access to treated water and construct public latrines to reduce open defecation.

4. Surveillance: Strengthen parasitic disease surveillance at PHCCs for early detection and response.

5. Policy Support: Encourage local government participation in vector control, community sensitization, and infrastructure improvement.

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