FUDMA Journal of Sciences (FJS)
ISSN online: 2616-1370
ISSN print: 2645 - 2944
Vol. 10 No. 8, April, 2026, pp 145 – 153
DOI: https://doi.org/10.33003/fjs-2026-1008-5104

PREVALENCE OF ZOONOTIC GASTROINTESTINAL HELMINTHS IN DOGS AND KNOWLEDGE OF RESIDENTS REGARDING GASTROINTESTINAL HELMINTHS IN NORTH BANK, MAKURDI

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ABSTRACT

Zoonotic gastrointestinal helminths (GIH) of dogs remain an important public health concern in developing countries due to poor sanitation, inadequate veterinary care, and increasing stray dog populations. This study assessed the prevalence of GIH among 384 dogs (193 household; 191stray) using saturated sodium chloride flotation and sedimentation techniques. Additionally, 116 dog owners were surveyed using structured questionnaires to evaluate their knowledge and preventive practices related to zoonotic GIH. Data was analyzed using descriptive statistics and Chi-square tests at a significance level of $p < 0.05$. Overall prevalence of GIH was 30.75%, with stray dogs (32.46%) slightly exceeding household dogs (29.02%). Six genera were identified: *Ancylostoma* spp. (13.02%), *Toxocara* spp. (10.94%), *Dipylidium* spp. (3.39%), *Strongyloides* spp. (2.34%), *Echinococcus* spp. (0.52%), and *Trichuris* spp. (0.52%). *Ancylostoma* spp. was more prevalent among strays, whereas *Toxocara* spp. predominated among household dogs. While age, sex and breed showed no significant associations with infection ($p > 0.05$), prevalence was significantly influenced by location and month of sampling; Ujam village ($\chi^2 = 23.46$, p =0.0028) and month of June ($\chi^2 = 35.70$, p = 0.0001) recorded the highest rates. Questionnaire survey findings indicated moderate awareness of zoonoses, yet revealed critical gaps regarding transmission routes and preventive practices. The study demonstrates that dogs in North Bank, Makurdi are important reservoirs of zoonotic GIH, posing substantial public health risks through environmental contamination. To mitigate these risks and protect the community, an integrated approach is recommended; routine deworming, improved environmental sanitation, public health campaigns, and responsible dog ownership.

Keywords: Zoonotic Helminths, Gastrointestinal Helminths, Dogs, Makurdi, Nigeria

INTRODUCTION

Dogs have been associated with humans for over 14,000 years in a cooperative relationship (Morey, 2006). This close association creates opportunities for several health and environmental problems which have been documented globally ranging from biting to faecal contamination of the environment and transmission of zoonotic diseases (Jones *et al*., 2018; Schurer *et al*., 2013; Sambo *et al*., 2013). Dogs act as major reservoirs for a wide range of parasites that are capable of infecting humans and causing severe diseases, among which are gastrointestinal helminths (Gado *et al.*, 2023; Millan *et al*., 2013). This problem is of particular concern in developing countries where the greater population of dogs are free roaming (Morters *et al.*, 2014).

Several zoonotic gastrointestinal helminths such as *Toxocara canis*, *Ancylostoma* spp., *Trichuris vulpis*, *Strongyloides stercoralis*, *Dipylidium caninum* and *Echinococcus spp* that commonly infect dogs also pose serious public health risks to humans (Kamani *et al*., 2021). Human infection occurs through accidental ingestion of infective eggs in water, raw vegetables or soil, larvae penetration through the skin or ingestion of infected intermediate hosts resulting in diseases such as visceral larva migrans, ocular larva migrans, cutaneous larva migrans and hydatidosis (Shahanenko *et al.*, 2024; Morales-Yanez *et al*., 2019). Environmental contamination with faeces plays an important role in maintaining the transmission cycle of these parasites (Traversa *et al*., 2014).

Globally, the prevalence of gastrointestinal parasites in dogs ranges from 5% to over 70% depending on the geographic location, environmental conditions and management practices (Nametov *et al*., 2025; Khalif *et al*., 2023; de Waal *et al.*, 2022; Drake *et al* 2022; Akande *et al.*, 2022; Kamani *et al.*, 2021; La Torre *et al.*, 2018). Stray and free roaming owned dogs have a greater frequency of parasites than confined dogs because they reside in lower resource habitat which have more favorable conditions for the growth of parasites (Khan *et al*, 2020; Adimanyi and Omodu, 2016; Katagiri and Oliveira-Sequeir, 2008). In many developing countries including Nigeria, the burden of canine intestinal parasites remains high due to inadequate veterinary care, uncontrolled stray dog populations, poor sanitation and limited awareness of zoonotic risks (Khalifa *et al.*, 2023; Sukupayo and Tamang, 2023; Beiromvand *et al.*, 2013).

Escalating security concerns in Benue State have led to an increase in dog ownership for domestic protection. However, many of these animals are given little or no veterinary care and allowed to roam freely, resulting in indiscriminate defecation in public spaces. Consequently, infected dogs act as both reservoirs and transmitters of various parasites, shedding large quantities of infective stages (oocysts, cysts, eggs and larvae) into the environment (Nametov *et al*., 2025). These pathogens contaminate the environment and serve as a persistent risk to humans (Khan *et al*., 2020; Traversa *et al.*, 2014). Children are particularly vulnerable because of their close physical interactions with animals and they frequently play in open areas with poor hygiene standards (Sukupayo and Tamang, 2023). The knowledge of people regarding the zoonotic potential of these parasites is most times limited which contributes greatly to the persistence of the problem

(Omonijo *et al*., 2024; Lawal, 2023; Awoyomi *et al*., 2022; Ademola *et al*., 2021; Amadi *et al*., 2021; Adimanyi and Omudu, 2016). Despite the public health implications, there is limited epidemiological data concerning these parasites in dogs in many rural and suburban localities in Benue State. In Makurdi, a significant population of stray, semi-domesticated, and owned dogs roam without access to basic veterinary care or deworming protocols (Ishima, 2023). To mitigate these zoonotic hazards, it is essential to understand the local prevalence and distribution of these parasites. Therefore, this study aims to assess the prevalence of zoonotic gastrointestinal parasites in owned and stray dogs and to assess the knowledge and practices of dog owners regarding these infections within the peri-urban areas of North Bank district, Makurdi, Benue State, Nigeria.

MATERIALS AND METHODS

Study Area

This study was conducted in North Bank, a major district in Makurdi, the capital of Benue State, located in North-central Nigeria. Makurdi lies between latitudes 7º40 N and 7º53 N of the equator, and between longitudes 8º22E and 8º35E of the Greenwich Meridian. The city encompasses a 16km radius circle located along the banks of the Benue River and covering an area of 804km^2 lands mass. The town experiences a tropical climate with 7 months of rainfall from April to October and a dry season from November to March characterized by peak temperatures reaching 39.5ºC. Based on the 2006 census, the population of Makurdi was 300,377 persons (Nigeria, 2007) and currently projected at approximately 490,000 people. The town is situated in the lower Benue valley, the relief of which is generally low, with heights ranging between 73 meters and 167 meters above sea level. Makurdi has a very high population of dogs (Ikye-Tor *et al*., 2020). Dogs are mainly kept in the state for security reasons or as companions especially in the urban areas and in some cases for hunting purposes in the rural and peri-urban areas.

Data and samples were collected from diverse residential and open fields in the peri urban zones within North bank comprising Ujam Village, Court Five, Mami area, NASME Barracks and the 72 Division area.

Determination of Sample Size

Sample size was calculated using the formula by Thrusfield (2007) with an assumed prevalence of 50% as follows;

$$n = \frac{Z^2pq}{d^2}$$

Where; *n* = sample size, d= allowable error, P= percentage prevalence, Z= Standard Normal Deviate and q= (1-p)

n =?

p = 50% (0.5)

q = 1-p (1-0.5) = 0.5

Z = 1.96

d= 0.05 using CI = 95%

$$n = \frac{3.841 \times 0.5 \times 0.5}{0.0025} = 384.16$$

This figure was rounded to 384 samples.

Informed consent

For the household survey, each participant got a full explanation of the purpose of study in English. Participation was voluntary with verbal informed consent, and people could withdraw anytime without penalty. All data were coded to remove identifying details, and the report excluded any personal information such as names and addresses.

Study Population

The study population included both owned (household) and free roaming (stray) dogs. For owned dogs, samples were obtained following the informed consent of the owners. Fecal samples were collected directly from the rectum using a lubricated gloved finger. Stray dogs were actively observed and tracked from a non-threatening positon within public spaces, parks, open fields, refuse dumps and communal areas across the designated study sites. Freshly voided stool samples were carefully scooped from the ground immediately after a specific dog was witnessed defecating and put into clean and properly labelled sample bottles. Samples were stored in a cool box with ice packs and immediately transported to the parasitology laboratory of the Veterinary Teaching Hospital, Joseph Sarwuan Tarka University for analysis. Date, location and animal's zoographic data (age, breed and sex) were noted.

Laboratory Analysis

Floatation Test

Fecal samples were processed using the saturated sodium chloride (NaCl) floatation method as standardized by the World Health Organization (WHO 1999) protocols. A saturated salt solution was prepared by dissolving 400g of NaCl in 1L of distilled water. Fecal aliquots of 2g of each fecal sample was placed in a beaker and homogenized with 12ml of the saturated NaCl solution. The resulting solution was strained through a fine-mesh sieve to remove coarse organic debris. The filtrate was subsequently transferred into a 15ml centrifuge tube and centrifuged at 1500g for 5 minutes. Following centrifugation, the tubes were placed in a vertical rack, and additional floatation solution (approximately 2ml) was carefully added until a convex meniscus formed at the tube's rim. A clean 22 x 22 mm glass coverslip was applied to the meniscus and left undisturbed for 10 minutes to allow for the upward migration and adherence of parasite eggs. Finally, the coverslip was transferred to a microscope slide and examined under a light microscope at 100x and 400x magnification to detect eggs of *Toxocara canis, Ancylostoma caninum* and *Strongyloides stercoralis.*

Sedimentation Test

To ensure the recovery of heavier helminth eggs (e.g. *Trichuris vulpis* and *Echinococcus* spp.) that may not reliably float in saturated NaCl solution, a sedimentation procedure was performed as a diagnostic adjunct (Bayou, 2005). Following the initial floatation process, the supernatant was carefully decanted, and the remaining pellet was processed for sedimentation. A standardized aliquot of the sediment (approximately 50µl) was transferred onto a clean microscope slide using a Pasteur pipette. To improve morphological contrast and facilitate the identification of internal structures, 1% methylene blue was added as a counterstain. The stained preparations were thoroughly homogenized on the slide and covered with a 22 x 22 mm glass coverslip. Each slide was examined systematically using a light microscope under 10x and 40x objective lenses. The presence of characteristic eggs was recorded, with methylene blue providing a dark, contrasting background against which the helminth eggs remained relatively translucent, thereby enhancing visualization.

Survey of Dog Owner's Knowledge

Structured questionnaires were administered to participating dog owners to evaluate their awareness of zoonotic gastrointestinal helminths. They focused on; awareness of common parasites and their clinical signs in dogs, understanding transmission modes to humans and frequency of deworming, hygiene protocols and methods of fecal disposal.

Ethical Clearance

This study was approved by The Animal Ethics and Welfare Committee, College of Veterinary Medicine, Joseph Sarwuan Tarka University, Makurdi with reference: JOSTUM/CVM/ETHICS/2025/15.

Statistical Analysis

The collected data was managed and analyzed using GraphPad Prism 5. Descriptive statistics were used to summarize prevalence. The Chi-square test was employed to determine associations between parasitic infection and independent variables (age, sex and location). A p-value of 0.05 was considered significant.

RESULTS AND DISCUSSION

A total of 384 dogs were sampled for gastrointestinal helminths from North Bank district of Makurdi comprising 193 household dogs and 191 free roaming dogs. From these, 118 dogs were positive for GIHs giving an overall prevalence of 30.75%. The free roaming dogs had a slightly higher prevalence (32.46%) compared to the household dogs (Table 1).

Six genera of GIH were identified namely *Ancylostoma* spp., *Toxocara* spp., *Dipylidium* spp., *Echinococcus* spp., *Trichuris* spp. and *Stryongyloides* spp. (Table 1). Among these, *Ancylostoma* spp. had the highest prevalence (13.02%) followed by *Toxocara* spp. (10.94%) and then *Dipylidium* spp. (3.39%), *Strongyloides* spp. (2.34%), *Echinococcus* spp. (0.52%), and *Trichuris* spp. (0.52%). The prevalence of *Ancylostoma* spp. was higher in stray dogs (16.75%) compared to household dogs (9.33%) while *Toxocara* spp, *Dipylidium* spp. and *Strongyloides* spp. had a higher prevalence in household dogs (12.44%) compared to stray dogs (9.42%). *Echinococcus* spp. was detected only in stray dog with a prevalence of 1.05%.

Table 1: Distribution of Zoonotic Gastrointestinal Helminths in Household and Stray Dogs in North Bank, Makurdi, Benue State, Nigeria

Parasites	Household Dogs n= 193 (%)	Stray Dogs n=191 (%)	Overall Prevalence
Ancylostoma spp	18 (9.33)	32 (16.75)	50 (13.02)
Toxocara spp.	24 (12.44)	18 (9.42)	42 (10.94)
Dipylidium spp.	8 (4.15)	5 (2.62)	13 (3.39)
Echinococcus spp.	0 (0.00)	2 (1.05)	2 (0.52)
Trichuris spp.	1 (0.52)	1 (0.52)	2 (0.52)
Strongyloides spp.	5 (2.60)	4 (2.10)	9 (2.34)
TOTAL	56 (29.04)	62 (32.46)	118 (30.73)

Analysis of demographic variables among household dogs showed no statistically significant association between helminth infection and age, breed or sex (p>0.05), although some categories had higher prevalences (Table 2). Based on age, Adult dogs (> 1 year) had a higher prevalence (30.46%) compared to younger dogs (<1 year) (26.15%). Breed-wise, local breeds had the highest prevalence (31.72%) compared to exotic (19.05%) and cross breeds (22.22%). In terms of sex, infection rate was comparable between males (29.67%) and females (28.43%).

Table 2: Distribution of Zoonotic Gastrointestinal Helminths in Household Dogs Based on Age, Sex and Breed

Variable	Total Sampled	Prevalence (%)	Chi-square	p-value
Age				
Young (<1year)	65	17 (26.15)	0.3897	0.8230
Adult (>1year)	128	39 (30.46)		
Breed				
Local	145	46 (31.72)	2.135	0.7110
Exotic	21	4 (19.05)		
Cross breed	27	6 (22.22)		
Sex				
Male	91	27 (29.67)	0.0358	0.9822
Female	102	29 (28.43)		

Spatial and temporal prevalence showed a significant association between location (χ^2 = 23.46, p =0.0028) and month (χ^2 = 35.70, p = 0.0001) of sampling with prevalence of GIH infection (Table 3). Ujam village had the highest prevalence (48.18%) while Mami area had the lowest (20%). The month of June showed the highest rate of infection (60%) followed by September (32.35%), August (23.75%) and then July (22.50%). There was however, no significant difference in prevalence between stray (32.46%) and household (29.02%) dogs.

Table 3: Prevalence of Zoonotic Gastrointestinal Helminths of Dogs in Relation to Location, Month of Sampling and Dog Type

Variable	Total Sampled	Prevalence (%)	Chi-square	p-value
Location				
Ujam village	110	53 (48.18)	23.46	0.0028
Mami area	50	10 (20)		

Variable	Total Sampled	Prevalence (%)	Chi-square	p-value
Court Five	80	18 (22.5)		
NASME Barracks	87	20 (22.98)		
72 Division Area	57	17 (29.82)		
Month of sampling				
June	70	42 (60)	35.70	0.0001
July	120	27 (22.50)		
August	160	38 (23.75)		
September	34	11 (32.35)		
Dog type				
Household	193	56 (29.02)	0.5353	0.7652
Free roaming	191	62 (32.46)		

One hundred and sixteen dog owners aged 18 years and above participated in the questionnaire survey (Table 4). Those within the age bracket of 26-35 years made up the majority (31.89%) followed by 36-45 years (26.72%), then 18-25 years (25.86%) and those aged 46 years and above were the least (15.51%). Males made up 54.31% of the respondents while females were 45.68%. The respondents were spread across many occupations with students (19.83%) and traders (18.10%) forming the larger groups, followed by animal health workers (13.79%) and health workers (12.10%). About 40.52% of the respondents reported having children.

Table 4: Demographic Information of Respondents Regarding Gastrointestinal Helminths in North Bank, Makurdi

Variable	Category	Respondents n= 116 (%)
Age	18 - 25	30 (25.86)
	26 -35	37 (31.89)
	36 – 45	31 (26.72)
	46 and above	18 (15.51)
Gender	Male	63 (54.31)
	Female	53 (45.68)
Occupation	Health worker	14 (12.1)
	Trader	21 (18.1)
	Civil servant	13 (11.21)
	Animal health worker	16 (13.79)
	Student	23 (19.83)
	Artisan	8 (6.89)
	Military Personnel	5 (4.31)
Do you have children	Yes	47 (40.52)
	No	69 (59.48)

Regarding respondents' knowledge, 91.38% indicated they were aware of disease transmission from dogs to humans. Assessment of respondents' knowledge of mode of transmission, 28.45% indicated contaminated food, water or soil while 23.28% indicated dog faeces. Other routes mentioned were bites (21.55% and direct contact (18.97%) with 7.76% not knowing any route of transmission. A good proportion (90.52%) considered safety protocols to be very important and all the respondents expressed interest in receiving preventive information. None of the respondents indicated that either them or their family member had ever been diagnosed of zoonotic helminth infection although 31.03% were uncertain of their status. This information is contained in Table 5.

Table 5: Knowledge of Respondents Regarding Gastrointestinal Helminths in North Bank, Makurdi

Variable (Knowledge of)	Category	Respondents n=116 (%)
Zoonoses	Yes	78 (67.24)
	No	38 (32.79)
Dog-to-human diseases	Yes	106 (91.38)
	No	10 (8.62)
Mode of transmission	Bite	10 (8.62)
	Dog faeces	27 (23.28)
	Direct contact	22 (18.97)
	Contaminated food/water/soil	33 (28.45
	Don't know	9 (7.76)
Dog faecal borne disease	Yes	76 (65.52)
	No	28 (24.14)
	Not sure	12 (10.34)
Importance of safety protocols	Very important	105 (90.52)
	Neutral	11 (9.48)

Variable (Knowledge of)	Category	Respondents n=116 (%)
Interested in preventive Info?	Yes	116 (100)
	No	0 (0.00)
Personal/Family diagnosis	Yes	0 (0.00)
	No	80 (68.97)
	Not sure	36 (31.03)

Discussion

This study found an overall prevalence of 30.73% gastrointestinal helminths in dogs in the peri urban areas of North Bank, Makurdi indicating a high burden of infection. Previous hospital-based studies from the same location recorded a similar prevalence of 32.99% (Per *et al*., 2019). A lot of studies across different regions and low-income countries suggest that at least 50% of sampled dogs carry gastrointestinal helminths (Adhikari *et al*., 2025; Miambo *et al*., 2025; Adesoye *et al*., 2024; Sukupayo and Tamang, 2023; Lawal, 2023; Jajere *et al*., 2022; Abulude, 2019; Chidumayo, 2018; Amissah-Reynolds *et al*., 2016). Compared to these studies, this figure is low, nonetheless, a 30.73% prevalence still underscores a significant public health risk and the persistent challenge these parasites cause in the environment. Other studies in Nigeria have also recorded lower prevalence (Kamani *et al*, 2021; Ayinmode *et al*, 2016).

The prevalence in stray dogs was slightly higher (32.46%) compared to household dogs (29.04%) however this difference was not significant. In most studies across different regions, stray dogs show a consistently higher prevalence of GIH than household dogs (Adesoye *et al*., 2024; Sukupayo and Tamang, 2023; Calvopina *et al*., 2023; Bourgoin *et al*., 2022; Abulude, 2019; Satyal *et al*., 2013). The marginal difference in the prevalence between stray and household dogs in this study suggests that household dogs in this area may be free roaming and may not receive the required veterinary attention as stipulated by law. The prevalence of GIH in an area also reflects on poor environmental sanitation, high ambient temperatures and humidity (Kim *et al*., 2012).

The identified species were *Ancylostoma* spp., *Toxocara* spp., *Dipylidium* spp., *Echinococcus* spp., *Trichuris* spp. and *Stryongyloides* spp. This finding is consistent with studies across Nigeria (Kamani *et al*., 2021; Esonu *et al*., 2019; Per *et al*., 2019; Idika *et al*., 2017; Ayinmode *et al*., 2016) demonstrating that these parasites are widespread in the country as they thrive on warm moist environments. This is particularly worrisome as these species are zoonotic and have been demonstrated to persist in the environment, yet no concerted efforts are made to address the issue. Among the GIH parasites identified, *Ancylostoma* was the most prevalent which aligns with previous reports (Jajere *et al*., 2022) that in Northern Nigeria, *Ancylostoma* is the most prevalent GIH of dogs. This parasite is the primary agent responsible for cutaneous larva migrans in humans. The higher prevalence of *Ancylostoma* spp. in stray dogs suggests that these animals serve as major reservoirs, continuously shedding infective stages into the environment especially in public places. *Toxocara* spp., the second most prevalent parasite detected, is associated with visceral and ocular larva migrans in humans (Morales-Yanez *et al*., 2019). The relatively higher prevalence of this parasite among domestic dogs highlights the potential risk of transmission within households, especially to children who are most vulnerable to these parasites and are more likely to play with contaminated soil. The low prevalence of *Echinococcus* spp. and *Trichuris* spp. documented suggests that they may be rare in the study area or the detection method was not sensitive enough, nonetheless, their presence highlights a potential public health risk. Other authors (Sukupayo and Tamang, 2023; Tadesse *et al*., 2020; Satyal *et al*., 2013; Paulos *et al*., 2012) also found low prevalence of infection in *Echinococcus* spp. and *Trichuris* spp.

The relationship between intrinsic host factors (age, sex and breed) and the prevalence of GIH infections observed in this study deviated from established epidemiological trends. Age is considered a risk factor for GIH infection as younger dogs (puppies and juveniles) consistently show higher prevalence than older dogs (Calvopiña *et al*., 2023; Sukupayo and Tamang, 2023; Bourgoin *et al*., 2022; Per *et al*., 2019; Satyal, *et al*., 2013). Younger animals lack a fully developed immune system, making them highly susceptible to infections when they ingest infective ova or larva from a contaminated environment (Taylor *et al*., 2016). Furthermore, the life cycles of *Toxocara canis* and *Ancylostoma caninum* help to maintain this epidemiological pattern by vertical transmission through the placenta and colostrum (Burke and Roberson, 1985; Schnieder *et al*., 2011). In contrast, our findings revealed slightly higher infection rates in adult dogs compared to younger ones, which may be due to cumulative exposure over time. In many African settings free roaming dogs are common and veterinary care is irregular, so adult dogs experience ongoing, repeated exposure to contaminated soil, public waste and paratenic hosts (Mukaratirwa *et al*., 2018). In well managed kennels, older dogs develop age acquired immunity because of controlled conditions (Sowemimo, 2009), whereas the adult dogs in this study seem to face frequent reinfection that exceeds their immune systems ability to cope.

Similarly, a marginally higher prevalence was observed in local breeds than exotic breeds though this also did not reach statistical significance. This subtle difference may be due to human behavior and socioeconomic management practices rather than biological or genetic resistance. In Makurdi, exotic and crossbred dogs are usually seen as high value investments for security and breeding; consequently, owners are more inclined to manage them more intensively through confinement, commercial feed and regular deworming (Tion *et al*., 2016). Conversely, local breeds are often kept under extensive or semi intensive management systems. These dogs are regularly allowed to scavenge, which puts them in direct contact with environmental sources of helminth eggs and other infections. Our findings align with findings of Edo-Taiwo and Akpan-Augustine (2024) who investigated GIH profiles in various breeds of dogs in Nigeria but could not link risk of infection to any breed. Overall, these findings indicate that even though local and exotic dog ownership in Makurdi involves different management practices, environmental contamination is widespread enough to expose and cross-contaminate all breeds.

In contrast to host intrinsic factors, environmental factors (location and month of sampling) showed significant associations with helminth prevalence highlighting the critical role that microenvironments and climatic variables play in parasitic transmission dynamics. Ujam village recorded a higher prevalence (48.18%) compared to the more urbanized NASME barracks and Court 5 showing a clear rural-urban gradient in canine parasitism. This geographic difference is largely due to variations in man-made infrastructure and dog management. Ujam village due to its rural setting suffers from poor sanitation, poor drainage systems, and a higher density of free roaming dogs. These deficiencies create conditions where free roaming dogs spread environmental contamination continuously. In contrast, the lower prevalence observed in the semi urbanized areas (NASME barracks and Court 5) can be attributed to better infrastructural sanitation and improved veterinary services. This finding aligns with the findings of Mukaratirwa *et al.*, (2018) and Uwalaka *et al.*, (2011), who observed that rural canine populations in sub-Saharan Africa consistently present with heavier helminth burdens due to extensive management systems and high soil contamination levels.

The peak prevalence recorded in June (60%) coincides with the steady onset of the rainy season in this region ushering in high moisture and humidity which provides optimal conditions for embryonation of helminth eggs and larvae in the soil (Kim *et al.*, 2012). The rains also facilitate the dissemination of helminth eggs and larvae in the environment. These findings strongly mirror the longitudinal observations of Dawet *et al.*, (2020) in Plateau State and Sowemimo (2009) in Ile-Ife, both of whom documented significant increases in canine helminth infection during the peak rainy months.

The questionnaire survey revealed moderate levels of awareness among dog owners regarding zoonoses (67.24%) and a high knowledge of dog-to-human disease transmission (91.38%). Studies across many states in Nigeria (Omonijo *et al*., 2024; Lawal, 2023; Awoyomi *et al*., 2022; Ademola *et al.*, 2021; Amadi *et al.*, 2021; Adimanyi and Omudu, 2016) show that awareness of zoonotic GIH is generally low. Increased knowledge of dog to human diseases transmission however is usually attributed to rabies rather than GIH (Omonijo *et al*, 2024; Awoyomi *et al*., 2022; Ademola *et al*., 2021; Odeniran *et al.*, 2019). This is because GIH are primarily transmitted through environmental contamination making the link between dog and disease less obvious. On the other hand, due to the emphasis of public health campaigns on rabies, knowledge of dog-to-human disease transmission is high. Many respondents could not correctly identify critical transmission routes such as direct contact with dogs or dog faeces, therefore, despite a moderate awareness of disease, gaps still remain in specific knowledge of transmission routes of zoonotic diseases of dogs.

None of the households surveyed reported any personal or family history of zoonotic GIH infection, which is a striking contrast to the 30% active infection rate found in local dogs. This mismatch reflects a common pattern with neglected tropical diseases; human cases of infections like toxocariasis and ancylostomiasis often go undiagnosed, misdiagnosed or remain asymptomatic. This is because these conditions often show vague symptoms like mild stomach pain, persistent cough or fatigue, frontline health workers usually misattribute the symptoms to other more common illnesses like malaria or amoebiasis. This diagnostic gap feeds a “cycle of neglect” in public health. When patient records don’t reflect the real burden of human zoonotic helminths, policymakers and local authorities see the parasites as low priority, which delays funding for integrated control efforts. This public health gap is worsened by the mismatch between what people say and what they actually do. Most respondents said they wanted preventive information showing they are open to learning, but that willingness did not translate into active risk-mitigation behaviors. Such a gap demonstrates that mere passive awareness of a disease is insufficient to change ingrained habits such as allowing dogs to roam freely or neglecting regular deworming. This finding agrees with reports of Amin-Acheampong *et al*., (2016) and Sambo *et al*., (2014) who argued that rural and semi-urban communities often possess high baseline anxiety regarding zoonotic diseases but lack the economic capacity or behavioral infrastructure to execute sustainable preventive measures.

CONCLUSION

The findings of this study reveal a high burden of zoonotic GIHs in both domestic and stray dogs in North Bank, Makurdi. The coexistence of moderate infection in dogs and gaps in community knowledge creates a conducive environment for transmission. Integrated control strategies involving veterinary services, public health education, and environmental management are therefore essential to reduce the burden of these infections and mitigate their zoonotic impact.

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