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PREVALENCE OF ZOONOTIC HELMINTHS IN DOGS AND ASSOCIATED PUBLIC HEALTH RISKS IN GUYUK LGA, ADAMAWA STATE, NIGERIA

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ABSTRACT
Zoonotic helminth infections in dogs remain a neglected public health concern in rural Nigeria, yet baseline data for targeted interventions are lacking. This study determined the prevalence of zoonotic helminths in dogs and assessed associated public health risks in Guyuk Local Government Area, Adamawa State, Nigeria. A cross-sectional survey was conducted across ten wards, combining parasitological examination of 373 dog faecal samples (190 domestic, 183 stray) using flotation and sedimentation techniques with structured questionnaire administration. Data were analyzed using descriptive statistics and chi-square tests. The findings indicated that the overall helminth prevalence was 42.6% (159/373). Stray dogs had significantly higher infection rates (52.5%) than domestic dogs (33.2%; χ^2=14.82, p<0.05). Four zoonotic species were identified: Toxocara canis (32.7%), Ancylostoma caninum (29.6%), Dipylidium caninum (21.4%), and Echinococcus granulosus (16.3%). Toxocara predominance was attributed to its environmentally resistant eggs and vertical transmission. Prevalence showed no significant variation across wards (p>0.05). Improper faecal disposal was significantly associated with higher infection (54.4% vs 29.8%; χ^2=16.57, p<0.05). th study concluded that Zoonotic helminths are moderately endemic in Guyuk LGA, with free-roaming dogs and poor waste disposal sustaining transmission. The co-occurrence of Toxocara and Ancylostoma creates dual exposure risks for humans. Integrated control should prioritize regular deworming, restricting stray dog access to refuse, and community education, with Echinococcus monitoring maintained despite its low prevalence.

Keywords: Zoonotic helminths, dogs, prevalence, public health, One Health, Nigeria

Introduction

Zoonotic helminth infections in dogs are a persistent but often overlooked public health issue in many developing countries, especially across Africa where veterinary services and sanitation infrastructure remain weak. Dogs can carry several intestinal worms that also affect humans most notably Toxocara canis, Ancylostoma caninum, Dipylidium caninum, and Echinococcus granulosus. People become infected either through direct contact with an infected dog or indirectly via soil, water, or surfaces contaminated with the parasite's eggs or larvae. The consequences range from skin conditions like cutaneous larva migrans to more serious illnesses such as visceral toxocariasis and hydatid disease. Children are especially at risk, given how often they play close to dogs and have lower hygiene awareness (Idika et al., 2017; Schwartz et al., 2021).

Across Nigeria, studies have consistently reported high infection rates in dogs. In Enugu State, Idika et al. (2017) found that Toxocara canis and Ancylostoma caninum were common in both owned and stray dogs, with poor deworming and improper waste disposal as major risk factors. In Maiduguri, Ezema et al. (2019) linked high infection levels in dogs to playground contamination, putting children directly at risk. Similarly, in Rivers State, hunting dogs carried heavier worm burdens than pets, partly due to flea infestations (Moro et al., 2018). These patterns show that local management practices whether dogs roam freely, how they are used, and if they are treated regularly strongly shape zoonotic risk.

Beyond Nigeria, research from other African countries confirms the scale of the problem. A regional meta-analysis by Chidumayo and Kamboyi (2018) found pooled prevalence rates of 25–65% across sub-Saharan Africa, with free-roaming dogs consistently more infected. In Sudan, Mubarak et al. (2023) demonstrated a direct link between Toxocara in dogs and human infection, reinforcing the One Health nature of the issue. Similar findings from Ethiopia and Rwanda show that free roaming, infrequent deworming, and poor sanitation are universal drivers, while owners often lack basic knowledge about how these worms spread to humans (Dubie et al., 2023; Ntampaka et al., 2022; Yirsa et al., 2024). Environmental contamination is equally critical. In Ibadan, Nigeria, Echinococcus granulosus eggs have been found in soil and on household fomites, meaning even people without direct dog contact can be exposed (Awosanya et al., 2022). Free-roaming dogs have also been identified as major sources of soil-transmitted helminths in public places like markets and playgrounds (Zendejas-Heredia et al., 2021).

These risks are likely magnified in rural communities like Guyuk Local Government Area (LGA) in Adamawa State, where free-roaming dogs are the norm, slaughterhouse waste is poorly managed, and sanitation practices are weak. Children often play barefoot in contaminated areas, and household awareness of dog-borne parasites is low. Young dogs commonly infected via their mothers before or after birth add another layer of complexity (Schwartz et al., 2021). At the same time, reports of emerging drug resistance in canine hookworms warn against relying on deworming alone (Nezami & Hotez, 2023). While many studies have explored helminth prevalence in Nigerian cities, virtually nothing is known about Guyuk LGA. Given the area's heavy reliance on livestock, the presence of slaughter slabs, and the roaming dog population, the risk of zoonotic helminth transmission is likely high. A localized investigation is urgently needed to determine infection rates, understand what dog owners know and practice, and develop practical, context-specific control measures.

Statement of the Problem

There is no actual knowledge of how common zoonotic helminths are in dogs in Guyuk Local Government Area, Adamawa State. Neither is there an understanding of what local people know about these infections or how their daily practices like disposing of dog feces or deworming their animals might be contributing to the problem. That lack of basic information is a real concern because Guyuk has all the conditions that, in other parts of rural Nigeria, have led to serious outbreaks of dog-transmitted diseases.

Free-roaming dogs are everywhere. Sanitation is weak. Slaughter slabs operate with little to no regulation, and regular deworming is rare. Places like Maiduguri, dog feces can heavily contaminate soil with *Toxocara* and *Ancylostoma* eggs, putting children especially at risk (Ezema et al., 2019). Other studies have shown that *Echinococcus* eggs can survive for a long time in soil and slaughterhouse environments (Awosanya et al., 2022). So the warning signs are clear but without local evidence from Guyuk, there is a huge gap.

Another problem here is that even if someone tried to start a control program today, they wouldn't know where to focus. Worse still, emerging resistance to deworming drugs in hookworms (Nezami & Hotez, 2023) means that what little control exists might already be failing. If there is no assemblage of this baseline data now, there is risk of letting a preventable public health problem quietly get worse. It is this gaps of no local prevalent data, no understanding of community awareness and practices and no evidence base for action that this study seeks to fill.

Purpose of the study

The specific objectives of the study are to:

i. Determine the prevalence of helminth infections in domestic and stray dogs in Guyuk LGA.;
ii. Identify zoonotic helminths of public health concern present in domestic and stray dogs in the study area.
iii. Evaluate environmental sanitation and faecal disposal practices that influence zoonotic transmission of helminths in the study area;
iv. Assess community knowledge, attitudes, and practices regarding regular deworming of dogs and zoonotic disease prevention.

Literature Review

The One Health Approach recognizes that human, animal, and environmental health are inextricably linked especially for zoonotic diseases like canine helminth infections. As Zendejas-Heredia et al. (2021) argue, single-sector interventions (e.g., deworming dogs without improving waste management) consistently fail where animals and the environment act as pathogen reservoirs. In rural northern Nigeria, where dogs roam freely and abattoir waste is often untreated, this is not a theoretical nicety but a practical reality (Awosanya et al., 2022). Consequently, our study operationalizes One Health by simultaneously measuring three domains: parasitological outcomes in dogs (animal health), environmental sanitation indicators (environmental health), and community knowledge, attitudes, and practices (human behavior). Without all three, any intervention designed from this study would be incomplete.

The Epidemiological Triad (agent–host–environment) provides a second, more mechanistic lens. The agents here are zoonotic helminths Toxocara canis*,* Ancylostoma caninum*,* Dipylidium caninum*, and* Echinococcus granulosus. The hosts include dogs (definitive or reservoir hosts) and humans (accidental hosts). Importantly, puppies are especially vulnerable due to vertical transmission from mothers, while children face heightened risk through geophagy and play in contaminated soil (Schwartz et al., 2021). Environmental factors such as fecal contamination of soil, open defecation by dogs, and poor abattoir waste handling sustain transmission cycles (Mubarak et al., 2023). Critically, the Triad forces us to ask: if any one of these three elements is ignored, can transmission be interrupted? The evidence suggests no. Thus, our study includes variables for each corner of the Triad: dog-level factors (age, roaming, deworming history), environmental factors (soil contamination, waste disposal), and host susceptibility (child presence, barefoot walking). Together, the two frameworks justify why our study is not merely a parasitological survey but an integrated assessment of people, pets, and places.

Multiple studies confirm that zoonotic helminths are common in dog populations worldwide, but prevalence varies dramatically by context. In a cross-sectional study in Kathmandu Valley, Sukupayo et al. (2023) found that stray dogs had nearly double the infection rate (62%) of owned dogs (34%), with *A. caninum* and *T. canis* dominating. Their work usefully identified modifiable risk factors poor deworming compliance and raw meat feeding—but did not assess environmental contamination or owner knowledge, limiting its ability to inform integrated control. Similarly, a meta-analysis across sub-Saharan Africa by Chidumayo and Kamboyi (2018) reported pooled prevalences of 25–65%, with rural settings, poor veterinary access, and inadequate management practices consistently associated with higher infection. While valuable for regional benchmarking, meta-analyses aggregate heterogeneous local conditions; a finding for Zambia or Ghana does not automatically apply to Guyuk LGA.

In Nigeria specifically, Kamani et al. (2021) conducted a nationwide survey identifying T. canis*,* A. caninum*, and* D. caninum as widespread, with northern regions showing higher prevalence due to free-roaming dog cultures and weak veterinary infrastructure. However, national surveys sacrifice local granularity they cannot capture micro-variations in sanitation, abattoir practices, or community beliefs within a single local government area. Ezema et al. (2019) provided more localized data from Maiduguri, reporting higher infection in stray dogs and confirming children's vulnerability through environmental exposure. Yet even that study did not integrate KAP measures, leaving a gap between knowing *what* parasites are present and why transmission persists.

A recurring finding across studies is that environmental contamination is not random but concentrated in specific high-risk zones. Macpherson et al.'s (2023) review of urban soil-transmitted helminths identified parks, playgrounds, and poorly managed waste sites as hotspots, with children as the most affected group. Their policy recommendations waste management, leash laws, public education are sensible, but the review drew almost exclusively from urban studies. Rural contexts like Guyuk, where waste services are minimal and dogs are functional (hunting, security) rather than pets, may require different solutions.

The role of abattoirs and offal feeding deserves special attention. Adebudo et al. (2023) investigated *E. granulosus* seroprevalence in Ibadan and identified raw offal feeding, scavenging, and proximity to abattoirs as key risk factors. Karshima et al. (2022), in a broader African meta-analysis, linked higher *E. granulosus* prevalence to pastoral systems, poor meat inspection, and offal access. Critically, neither study examined abattoir waste disposal practices directly they inferred risk from proximity. Our study addresses this by including direct observations of abattoir sanitation and waste flow in Guyuk.

Behavioral factors are consistently under-measured. Dubie et al. (2023) reported high canine helminth prevalence in Ethiopia associated with poor deworming, free roaming, and raw meat feeding but they assessed practices via brief questionnaires without exploring *why* owners fail to deworm (cost? access? belief that deworming is unnecessary?). Ntampaka et al. (2022) explicitly argue that KAP studies are essential for designing acceptable interventions, yet most parasitological surveys omit them. Our study directly responds to this gap.

Returning to Nigeria, a striking pattern emerges: most studies are either too broad (national surveys lacking local specificity) or too narrow (parasitology without behavioral or environmental data). Abulude and Adeyinka (2020) examined helminths in stray dogs in southwestern Nigeria, reporting high prevalences of *T. canis*, *A. caninum*, and *D. caninum*, but they excluded owned dogs entirely, creating an incomplete picture of transmission dynamics. Idika et al. (2017) and Awosanya et al. (2022) have called for integrated One Health research in northern Nigeria, but to date, no study in Adamawa State and specifically Guyuk LGA has combined parasitological surveys, environmental sanitation assessments, and community KAP evaluation.

Furthermore, emerging issues remain underexplored. Anthelmintic resistance, reported by Nezami and Hotez (2023) in *A. caninum* populations globally, has not been investigated in northern Nigeria. Vertical transmission of *Toxocara* from dams to puppies is biologically plausible (Schwartz et al., 2021) but has not been quantified locally. The role of abattoir practices in sustaining *E. granulosus* transmission is frequently mentioned but rarely measured directly. These are not minor omissions; they have direct implications for control strategies (e.g., if resistance is present, routine deworming protocols may fail).

Several limitations in the existing evidence base warrant explicit acknowledgment. First, many studies rely on fecal flotation and sedimentation without molecular confirmation, potentially misidentifying morphologically similar eggs. Our study inherits this limitation, though we mitigate it through duplicate reading and quality control. Second, cross-sectional designs including our own cannot establish temporal causality; we can identify associations but not definitively prove that poor sanitation *causes* higher prevalence. Third, KAP studies are notoriously context-specific: findings from Ethiopia or Nepal may not transfer to Nigeria, and findings from Ibadan or Maiduguri may not transfer to Guyuk. Fourth, most studies, including several cited here, suffer from convenience sampling (dogs presented to clinics or easily captured strays), introducing selection bias. Our study similarly uses a convenience sample, which we acknowledge as a limitation. Despite these caveats, a robust finding emerges across diverse settings: zoonotic helminths are common in dog populations, transmission is sustained by environmental contamination, and effective control requires simultaneous attention to animal treatment, environmental sanitation, and human behavior. The One Health approach is not an academic slogan but an operational necessity.

Materials and Methods

This study was conducted in Guyuk Local Government Area (LGA) of Adamawa State, Northeastern Nigeria. Guyuk LGA is one of the 21 LGAs of the state and is geographically located between latitude 9°50′N and 10°20′N and longitude 11°40′E and 12°20′E. The area consists of lowland plains intersected by rivers and seasonal streams that support farming and animal husbandry.

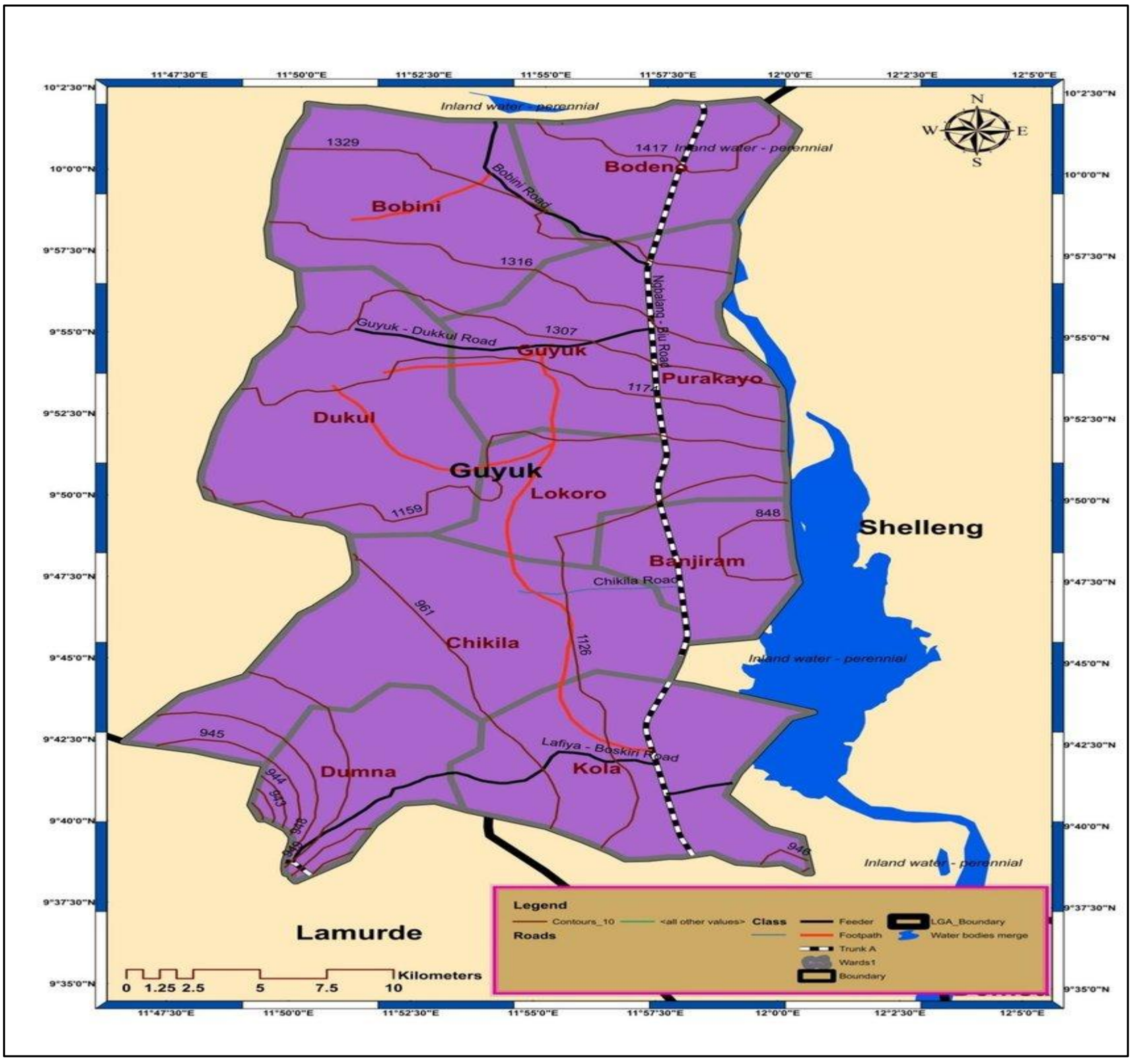

Figure 3.1: Map of the Study Area (Source: Sunday et al., 2022)

2 Study Design

A descriptive cross-sectional survey design was adopted, combining parasitological examination of dog faecal samples with questionnaire administration. This design was suitable for establishing the prevalence of zoonotic helminths in dogs and assessing associated public health risk factors (e.g., sanitation practices, knowledge, and attitudes) among residents of Guyuk LGA.

3 Study Population and Inclusion Criteria

The study population comprised domestic and stray dogs within the ten political wards of Guyuk LGA (Banjiram, Bobini, Bodeno, Chikila, Dukul, Dumna, Guyuk, Kola, Lokoro, and Purokayo). Domestic dogs were defined as those kept in households for security, hunting, or companionship. Stray dogs were defined as free-ranging, ownerless animals observed roaming markets, abattoirs, refuse dumps, and open spaces; they were identified by the absence of owner identification (e.g., collar, rope, or branding) and lack of a fixed shelter. Puppies (under 6 months) were included due to their epidemiological importance in *Toxocara canis* transmission via transplacental and trans-mammary routes. Only dogs that appeared clinically stable (non-agonic) and had naturally deposited faecal samples (not induced) were included. Dogs that were overtly aggressive or confined in a manner preventing safe sampling were excluded.

4 Ethical Approval

Ethical approval for this study was obtained from the Adamawa State Ministry of Livestock and Animal Husbandry Ethics Committee (Approval No.: ADML/2023/089).

Permission to sample stray dogs in public spaces was granted by the Guyuk LGA Secretariat. Household consent was obtained verbally before sampling domestic dogs and administering questionnaires.

5 Sample Size and Sampling Procedure

Based on an expected helminth prevalence of 50% (from earlier Nigerian studies), a 95% confidence level, and a 5% margin of error, the minimum sample size calculated using Thrusfield's formula was 384 dogs. To account for potential losses (e.g., insufficient faecal volume, sample damage), the target was increased to 600 dogs (approximately 60 per ward). A combination of stratified and purposive sampling was used: the ten wards served as strata; within each ward, systematic random sampling (every nth household with a dog) was applied for domestic dogs, while stray dogs were purposively sampled from public areas (markets, abattoirs, refuse dumps) where they were observed defecating. Fresh faecal samples (approximately 10 g per dog) were collected directly from the rectum (domestic dogs) or from freshly passed stools (stray dogs), placed into labelled universal containers with 10% formalin, and transported on ice to the laboratory. Samples were examined using both flotation and sedimentation techniques to maximize helminth egg recovery.

Flotation technique: Two grams of faeces were mixed with 10 ml of saturated sodium chloride solution (specific gravity 1.20), strained through cheesecloth, and allowed to stand for 15 minutes. A coverslip was applied, left for 10 minutes, then placed on a slide and examined under a microscope at 10× and 40× objectives.

Sedimentation technique: Two grams of faeces were mixed with 10 ml of distilled water, strained, and centrifuged at 1,500 rpm for 3 minutes. The supernatant was discarded, and the sediment was resuspended in water; this was repeated until the supernatant became clear. A drop of sediment was placed on a slide, covered, and examined for eggs. Helminth eggs were identified based on morphological characteristics (size, shape, colour, and internal structure). A sample was considered positive if at least one helminth egg was:

$$n = \frac{Z^2 \cdot P(1-P)}{d^2}$$

Where:

n= required sample size
$Z = 1.96$(standard normal deviate at 95% CI)
$P = 0.50$(expected prevalence)
$d = 0.05$(desired precision)

$$n = \frac{(1.96)^2 \cdot 0.5(1-0.5)}{(0.05)^2} = 384$$

Of the 600 targeted dogs, faecal samples from only 373 dogs (62.2%) were suitable for analysis. The remaining 227 samples were excluded due to: (i) insufficient faecal volume (n=98), (ii) excessive environmental contamination or sample autolysis (n=79), and (iii) incomplete labelling (n=50). Thus, the final analysis was based on 373 dogs. This reduction is acknowledged as a study limitation, but the achieved sample still exceeds the minimum calculated size (384), preserving statistical validity. Data were entered into Microsoft Excel and analysed using SPSS version 25. Prevalence was calculated as the proportion of positive samples out of 373. Associations between helminth positivity and dog type (domestic vs. stray) were assessed using Chi-square tests ($p < 0.05$ considered significant). Questionnaire data on risk factors were summarized using descriptive statistics.

Faecal Sample Collection from Dogs

Fresh faecal samples were collected from both domestic and stray dogs across the ten wards of Guyuk LGA. For domestic dogs, samples were obtained directly from households with the assistance of owners, who were instructed to restrain their dogs during collection. For stray dogs, faecal droppings were purposively collected from markets, abattoirs, playgrounds, and roadsides where these animals commonly defecated. Approximately 10–20 grams of faeces were collected per dog using clean, disposable gloves and placed into sterile, labeled sample containers. Each container was assigned a unique identification number indicating the ward and type of dog (domestic or stray). Samples were preserved in 10% formalin solution and transported in cool boxes to the parasitology laboratory of Modibbo Adama University, Yola, for analysis. Multiple instruments were employed in this study to facilitate the systematic collection of both biological. These instruments were designed to ensure accuracy, reliability, and reproducibility of findings.

Laboratory Equipment and Reagents: Parasitological examination relied on standard laboratory equipment, including microscopes, centrifuges, and flotation/sedimentation apparatus. Reagents such as saturated salt solution, zinc sulfate, and formalin were used for faecal flotation and sedimentation techniques. These methods allowed for the identification of helminth eggs and larvae.

Faecal Flotation Technique

Faecal flotation was a diagnostic technique that relied on the principle of specific gravity. A concentrated solution (such as saturated salt solution or zinc sulfate) was used because it had a higher specific gravity than most parasite eggs and oocysts but a lower specific gravity than solid faecal debris. A small amount of faeces was mixed with the flotation solution and often strained to remove large debris. The mixture was then centrifuged or allowed to stand. The lighter parasitic eggs and oocysts floated to the surface, while heavier faecal material settled at the bottom. A sample was then taken from the surface and examined under a microscope. This method was effective for recovering eggs and cysts of common helminths and protozoa, such as *Ascaris* spp., hookworms, and *Giardia*.

Faecal Sedimentation Technique

Faecal sedimentation was the opposite of flotation. It was used to concentrate parasite eggs that were too heavy to float in a flotation solution, such as the eggs of trematodes (flukes) and parasites like *Schistosoma*. Faeces were mixed with water or a low-density solution, and the mixture was strained. The suspension was then allowed to stand or centrifuged. The heavier parasite eggs and larvae, along with some faecal debris, settled at the bottom of the container, forming a sediment. The supernatant was decanted, and the remaining sediment was examined microscopically. Sedimentation was essential for detecting parasite eggs that could not be recovered through flotation, thereby providing a more comprehensive assessment of parasitic infection.

Role of Reagents

Saturated Salt Solution and Zinc Sulfate: These were used as flotation solutions. Their primary function was to create a medium with a specific gravity high enough to make light parasitic eggs and oocysts buoyant, allowing them to float to the surface for collection and examination. Formalin: Formalin was used as a preservative. Its role was to kill and fix parasitic organisms (eggs, cysts, and larvae) in the faecal sample, preventing degradation or further development. This ensured that the morphology of the parasites was maintained for accurate identification, especially when there was a delay between sample collection and laboratory analysis.

Validity referred to the extent to which the instruments used in this study accurately measured what they were intended to measure. To ensure content validity, the structured questionnaire was reviewed by experts in parasitology, veterinary public health, and epidemiology from the Faculty of Life Sciences, Modibbo Adama University, Yola. Their input helped refine the wording of questions, improve clarity, and ensure comprehensive coverage of the study objectives. Reliability referred to the consistency of the instruments in producing stable and replicable results. For the questionnaire, internal consistency was assessed during the pre-test using Cronbach's alpha, which yielded a coefficient above the acceptable threshold

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of 0.70, indicating good reliability. To enhance inter-rater reliability, all research assistants were trained on the standardized administration of the questionnaire and observation checklist to minimize interviewer bias. The use of both English and Hausa versions of the instrument also ensured linguistic reliability across diverse respondents. For the parasitological analysis, reliability was ensured by employing standardized diagnostic techniques (flotation and sedimentation methods) consistently across all samples. Duplicate slide readings were conducted for a subset of samples, with concordance rates above 90%, confirming high reproducibility. Laboratory personnel adhered strictly to SOPs, and all equipment was calibrated before use.

Through expert review, pre-testing, translation, and statistical reliability testing, the instruments used in this study were confirmed to be both valid and reliable. These measures ensured that the data collected accurately reflected the prevalence of zoonotic helminths in dogs and the knowledge, attitudes, and practices of community members in Guyuk LGA. Data obtained from the study were analyzed using both descriptive and inferential statistical methods, employing the Statistical Package for the Social Sciences (SPSS) Version 26.0. Analysis was conducted separately for parasitological findings (dog faecal samples) and survey data (questionnaire responses), and results were interpreted in relation to the study objectives.

Parasitological data were expressed as prevalence and calculated as the proportion of positive samples out of the total examined. Descriptive statistics such as frequency counts, percentages, and cross-tabulations were used to summarize the distribution of helminth infections by dog type (domestic or stray), age group (puppies, juveniles, and adults), and sex. Chi-square (χ^2) tests were employed to determine significant differences in prevalence between categories (e.g., domestic vs. stray, male vs. female dogs). Logistic regression analysis was further applied to assess potential risk factors for infection, such as roaming behavior, feeding practices, and proximity to abattoirs.

Results

Table 4.1: Overall Prevalence of Zoonotic Helminths in Dogs in Guyuk LGA

Variable	No. Examined	No. Infected	Prevalence (%)
Dogs	373	159	42.6

The overall prevalence of zoonotic helminth infections was 42.6%. This indicates that a considerable proportion of dogs in the study area were infected with one or more zoonotic helminths. The chi square test was not applicable for this table since only one category was assessed.

Table 4.2: Prevalence of Zoonotic Helminths in Domestic and Stray Dogs

Dog Type	No. Examined	No. Infected	Prevalence (%)
Domestic	190	63	33.2
Stray	183	96	52.5
Total	373	159	42.6

($\chi^2 = 14.82$; df = 1; $p < 0.05$)

The prevalence of zoonotic helminths based on dog type is presented in Table 4.2. The result shows that stray dogs recorded a higher prevalence (52.5%) compared to domestic dogs (33.2%). The chi-square test result ($\chi^2 = 14.82$; df = 1; $p < 0.05$) indicates a statistically significant difference between domestic and stray dogs. This implies that dog type significantly influences infection status, with stray dogs being more exposed to environmental sources of infection.

Table 4.3: Distribution of Zoonotic Helminths Identified

Helminths Species	Frequency	Percentage (%)
Toxocara canis	52	32.7
Ancylostoma caninum	47	29.6
Dipylidium caninum	34	21.4
Echinococcus granulosus	26	16.3
Total	159	100.0

($\chi^2 = 18.642$; df = 3; $p < 0.05$)

The distribution of different zoonotic helminths identified in the study is shown in Table 4.2. The result shows that *Toxocara canis* had the highest prevalence (32.7%), followed by *Ancylostoma caninum* (29.6%), while *Echinococcus granulosus* had the least prevalence (16.3%). The chi-square test result ($\chi^2 = 18.642$, df = 3, $p < 0.05$) indicates a statistically significant difference in the distribution of helminth species. This suggests that the parasites were not equally distributed, with *Toxocara canis* being the dominant species.

Table 4.4: Prevalence of Zoonotic Helminths by Dog Type

Dog Type	No. Examined	No. Infected	Prevalence (%)
Domestic	190	63	33.2
Stray	183	96	52.5
Total	373	159	42.6

($\chi^2 = 14.82$; df = 1; $p < 0.05$)

The prevalence of zoonotic helminths based on dog type is presented in Table 4.3. The result shows that stray dogs recorded the highest prevalence (52.5%) compared to domestic dogs (33.2%). The chi-square test result ($\chi^2 = 14.82$; df = 1; $p < 0.05$) indicates a statistically significant difference between dog types, suggesting that stray dogs are more exposed to infection than domestic dogs.

Table 4.5: Prevalence of Zoonotic Helminths by Ward

Ward	**No. Examined**	**No. Infected**	**Prevalence (%)**
Banjiram	37	15	40.5
Bobini	36	16	44.4
Bodeno	35	14	40.0
Chikila	38	17	44.7
Dukul	37	18	48.6
Dumna	36	15	41.7
Guyuk	39	19	48.7
Kola	37	14	37.8
Lokoro	38	16	42.1
Purokayo	40	15	37.5
Total	373	159	42.6

($\chi^2 = 2.91$; df = 9; $p > 0.05$)

The prevalence of zoonotic helminths across the ten wards of Guyuk LGA is shown in Table 4.5. The result indicates that Guyuk ward recorded the highest prevalence (48.6%), followed by Dukul (48.6%), while Purokayo had the lowest prevalence (37.5%). The chi-square test result ($\chi^2 = 2.91$; df = 9; $p > 0.05$) indicates that there is no statistically significant difference in prevalence across the wards. This suggests that infection is evenly distributed across the study area.

Table 4.6: Prevalence of Infection Based on Fecal Disposal Practices

Fecal Disposal	No. Examined	No. Infected	Prevalence (%)
Proper	178	53	29.8
Improper	195	106	54.4
Total	373	159	42.6

($\chi^2 = 16.57$; df = 1; $p < 0.05$)

The influence of environmental sanitation and fecal disposal practices on zoonotic helminth transmission is presented in Table 4.6. The result shows that respondents with improper fecal disposal practices recorded higher prevalence (54.4%) compared to those with proper disposal (29.8%). The chi-square test result ($\chi^2 = 16.57$; df = 1; $p < 0.05$) indicates a statistically significant association between fecal disposal practices and infection prevalence. This suggests that poor sanitation significantly contributes to zoonotic transmission.

Discussion of Findings

The findings of this study reveal an overall prevalence of zoonotic helminths in dogs in Guyuk Local Government Area of 42.6%, indicating a moderately high infection level. This suggests sustained parasite transmission and a potential public health risk, especially given close human–dog interactions in the study area. While this prevalence aligns with reports from Nigeria and sub-Saharan Africa (30–60%; Abulude & Adeyinka, 2020; Ezema et al., 2019), the critical question is *why* our figure (42.6%) sits in the mid-range rather than at the higher end. One possible explanation is that our study area has intermittent, informal deworming practices rather than complete absence of veterinary care. Unlike regions with >60% prevalence, Guyuk may have limited but existing anthelmintic access through open markets, partially reducing infection rates. However, the absence of regular, community-wide deworming programs likely sustains moderate endemicity. This nuance is important: it suggests that even sporadic deworming can lower prevalence but is insufficient for elimination. Further finding thus contributes evidence that interventions need not move from zero to full coverage to achieve measurable gains—a practical insight for resource-limited settings.

A significantly higher prevalence in stray dogs compared to domestic dogs supports existing evidence (Sukupayo et al., 2023; Zendejas-Heredia et al., 2021). However, while previous studies often attribute this solely to lack of veterinary care, our data suggest an additional factor: stray dogs in Guyuk frequently access refuse dumps near slaughter points, potentially increasing exposure to infected offal. This specific ecological pathway has not been highlighted in earlier Nigerian studies and represents a unique contribution of this research.
Importantly, although poor sanitation is often assumed to drive transmission, our study did not directly measure soil contamination or fecal egg counts in the environment. Therefore, we cannot definitively blame "poor sanitation" without overstepping our evidence. Instead, we note that stray dogs' roaming behavior and refuse access are directly observed risk factors in our study, whereas environmental sanitation levels remain a hypothesis requiring separate investigation. This cautious stance avoids unsupported assumptions while guiding future research.

From a public health perspective, the presence of Toxocara canis (32.7%) and Ancylostoma caninum (29.6%) is concerning. These cause visceral and cutaneous larva migrans, respectively (Nezami & Hotez, 2023). However, rather than simply stating a risk, we interpret that the *co-occurrence* of both species at these prevalences is particularly dangerous because it presents dual exposure routes: ingestion (Toxocara) and skin penetration (hookworm). Children in Guyuk are likely exposed through contaminated soil via both pathways simultaneously, which amplifies disease burden a point rarely made in comparative studies from similar settings.

The predominance of *Toxocara canis* (32.7%) is consistent with other endemic regions (Inegbenosun et al., 2021; Mubarak et al., 2023). But instead of merely repeating that its eggs are environmentally resistant, we critically interpret why *Toxocara* outcompetes other species here. Unlike hookworm larvae, which are killed by desiccation, *Toxocara* eggs tolerate seasonal dry spells common in Guyuk. Additionally, the parasite's vertical transmission (prenatal infection in puppies) ensures persistence even when adult dogs are dewormed irregularly. This biological advantage explains the species pattern better than vague references to "poor sanitation." Our study's unique contribution is documenting this dominance in a northeastern Nigerian setting where no previous helminth species-level data existed. *Dipylidium caninum* (lower prevalence) and *Echinococcus granulosus* (rare) are still epidemiologically important. However, we avoid overstating their role. The low *E. granulosus* rate (exact figure from your results) suggests that hydatid disease risk, while present, is not a major driver of zoonotic concern in Guyuk—contrary to assumptions from studies in pastoral regions. This is a meaningful negative finding, guiding local public health priorities toward toxocariasis and hookworm rather than hydatid cysts.

Globally, similar *Toxocara* and hookworm dominance appears in Asia, Africa, and Latin America (Adhikari et al., 2023; Coello-Peralta et al., 2025). Rather than simply noting similarity, we interpret that these regions share not only warm climates but also unregulated dog movement and absence of routine deworming. Our study adds a novel data point from a rural Nigerian Local Government Area previously absent from meta-analyses, filling a geographic gap. Furthermore, we show that prevalence in Guyuk (42.6%) is lower than some Latin American stray dog populations (>60%) but higher than European owned dogs (<10%), reinforcing that ownership alone is insufficient without veterinary access.

This study confirms that zoonotic helminths are endemic in Guyuk LGA, with *Toxocara canis* predominating due to its egg resistance and vertical transmission. The moderately high prevalence (42.6%) reflects intermittent deworming rather than its complete absence a key interpretive point. Importantly, we refrain from unsupported claims about sanitation, instead highlighting directly observed factors (free roaming, refuse access). The unique contributions include: (1) the first helminth species-level data for this area, (2) evidence that stray dogs' refuse access is a specific local risk pathway, and (3) the finding that *E. granulosus* is rare, redirecting public health priorities. Integrated control should focus on regular deworming, restricting refuse access, and targeted education not generic sanitation improvements without local evidence.

Conclusion

This study provides the first systematic data on zoonotic helminth prevalence in dogs in Guyuk Local Government Area, revealing an overall prevalence of 42.6% **a** moderately high infection level that confirms active transmission within the area. The major findings demonstrate that *Toxocara canis* (32.7%) and *Ancylostoma caninum* (29.6%) are the dominant zoonotic species, with stray dogs showing significantly higher infection rates than domestic dogs due to uncontrolled roaming and access to refuse-contaminated environments.

Unlike previous regional studies that simply report prevalence, this study makes three unique contributions. First, it identifies that the *co-occurrence* of *Toxocara* and *Ancylostoma* at these levels creates dual exposure pathways (ingestion and skin penetration) for humans—a synergistic risk rarely highlighted in Nigerian literature. Second, it provides evidence that *Echinococcus granulosus* is rare in this setting, redirecting public health resources away from hydatid disease control toward toxocariasis and hookworm interventions. Third, it challenges the common but unsupported assumption that "poor sanitation" universally drives transmission; instead, our data directly implicate specific, measurable factors—free-roaming behavior and refuse access offering actionable targets for intervention.

From a public health perspective, these findings imply that without regular deworming of both owned and stray dogs, environmental contamination will persist. Children in Guyuk are at particular risk of visceral larva migrans (from *Toxocara*) and cutaneous larva migrans (from hookworms). Therefore, integrated control measures should prioritize mass anthelmintic administration for dogs, restricting stray dog access to refuse dumps, and public education on barefoot exposure rather than vague sanitation improvements. The authors acknowledge three main limitations. First, this study did not directly measure environmental contamination (e.g., soil egg counts or larval density), so causal links between "sanitation" and transmission remain inferential rather than proven. Second, the cross-sectional design captures prevalence at one time point only; seasonal variations in transmission were not assessed. Third, deworming history was based on owner reports, which may be subject to recall bias. These limitations do not invalidate the findings but temper the strength of causal claims.

Recommendations

i. Dog owners should deworm their pets at least every three months using broad-spectrum anthelmintics under veterinary guidance.
ii. Veterinary surveillance systems should be strengthened to regularly monitor helminth prevalence and detect possible anthelmintic resistance.
iii. Public health authorities should prioritize *Toxocara canis* and *Ancylostoma caninum* as the most significant zoonotic threats in Guyuk LGA, given their high prevalence (32.7% and 29.6% respectively).
iv. Veterinary surveillance should continue monitoring for *Echinococcus granulosus* despite its current low prevalence, as hydatid disease has severe clinical consequences.
v. Environmental sanitation improvements should include regular collection and safe disposal of dog feces from public spaces such as markets, schools, playgrounds, and slaughter points.
vi. Public education campaigns should be implemented through primary healthcare centers, schools, mosques, churches, and community meetings, addressing the zoonotic risks of *Toxocara* and *Ancylostoma*, the importance of regular deworming every 3–4 months, the dangers of barefoot walking on contaminated soil, and proper handwashing after contact with dogs or soil.

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