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Research Article

Prevalence of Gastrointestinal Parasites of Stray Dogs in Suleja Metropolis, Niger State, Nigeria

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ABSTRACT

Free-roaming dogs in the environment (stray dogs) have been reported to be a reservoir of various gastrointestinal (GIT) parasites of significant public health importance worldwide. This study aims to determine the prevalence of GIT parasites in the stray dog population in Sabo Gwazunu, Suleja and within Suleja Township, of Niger State, Nigeria. Sixty fecal samples were randomly collected from stray dogs in each study area (community) between February and March 2024. The Sheather's sugar floatation technique was used to examine various faecal samples, and the prevalence was calculated as the percentage of infected samples over the total number of samples examined. Overall, a total of thirteen GIT parasites belonging to Phylum Protozoa 3.33% (4/120), Platyhelminthes 3.33% (4/120), and Nematoda 4.16% (5/120), were found. A significant difference was observed in GIT prevalence between the study areas ($P<0.05$). GIT parasites found in stray dogs within Suleja township comprise *Toxocara canis Eimeria* sp, *Strongyloides* sp, *Alaria* sp, *Cryptosporidium* sp, *Entamoeba* sp, *Ancylostoma* sp, *Dipylidium* sp, *Schistosoma* sp, and *Taenia* sp. However, in Sabo Gwazunu, nine GIT parasites were found in stray dogs. These include *Eimeria* sp, *T. canis*, *Trichuris* sp, *Physaloptera* sp, *Strongyloides* sp, *Dipylidium* sp, *Schistosoma* sp, *Alaria* sp, and *Taenia* sp. Moreover, the prevalence of GIT in stray dogs in both communities was estimated at 91% (91/120). Given the public health and zoonotic significance of some gastrointestinal parasites observed in this study, it is essential to increase awareness about the need to control the stray dog population in the study areas.

Keywords: Gastrointestinal parasites; Stray dogs; Sabo Gwazunu; Suleja

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INTRODUCTION

Gastrointestinal parasites (GIT) pose a significant health concern in dogs and especially in stray dogs (Ugbomoiko *et al.* 2008; Lyons *et al.* 2022; Kirman *et al.* 2022). These parasites can cause a range of health problems and are a significant issue in many areas where stray dogs are prevalent (Lyons *et al.* 2022). In Nigeria, the prevalence of gastrointestinal parasites in stray dogs is a pressing concern due to factors like the tropical climate which enhance transmission and the large stray dog population in the country. The occurrence of these parasites in dogs can vary depending on regional and environmental conditions (Odeniran *et al.,* 2013; Ezema *et al.,* 2019). For example, stray dogs in urban areas may exhibit different parasite profiles than those in rural regions, with higher prevalence often found in areas lacking proper sanitation and veterinary care access. Other contributing factors to the disparity include population density and human activities (Odeniran *et al.,* 2013).

In Nigeria, common gastrointestinal parasites affecting stray dogs include roundworms (*Toxocara canis*), hookworms, tapeworms, Echinococcus (hydatid tapeworm), whipworms, Giardia, and coccidia. Many of these parasites pose significant economic and public health concerns. (Ugbomoiko *et al.* 2008; Abbas *et al.,* 2023). Hookworms are blood-sucking parasites that attach to a dog's intestinal lining and can lead to anemia and other health issues. Dogs may become infected through contaminated soil, skin penetration, ingestion of larvae from the environment, or through the milk of infected mothers, all of which can result in harmful effects (Bhattarai *et al.,* 2020 Abbas *et al.,* 2023).

The harmful effects of gastrointestinal parasites usually extend beyond their hosts (dogs), as they can be major contributors to zoonotic diseases (Del Brutto *et al.,* 2018; Bhattarai *et al.,* 2020). Zoonotic infections can be acquired through direct contact with animals, contaminated water, contaminated food, and indirect contact with animal secretions and excretions. Besides hookworms, *T. canis* is another GIT parasite that causes various clinical issues, such as visceral larva migrans and ocular larva migrans. *T. canis* infection has been associated with cognitive impairments and developmental delays, particularly in young children. Research suggests that *T. canis* antibodies in children are linked to lower cognitive scores, poor attention span, and learning difficulties (Bhattarai *et al.,* 2020). Furthermore, individuals infected with *T. canis* may develop allergic reactions due to sensitization to the parasite's antigens, leading to symptoms such as allergic asthma, wheezing, skin rashes, or eosinophilia. (Rubinsky-Elefant *et al.,* 2010; Mizgajska-Wiktor *et al.,* 2017). Usually, the impact of *T. canis* on public health extends beyond direct health impacts. The expenses related to diagnosing and treating *T. canis* infections, especially in severe cases, can place a substantial economic strain on healthcare systems and affected individuals. (Rubinsky-Elefant *et al.,* 2010; Omonijo and Mukaratirwa, 2023). Human infection occurs when the infectious stage of *T. canis* is accidentally ingested from a contaminated environment, through consumption of contaminated food or water, or by eating encapsulated larvae in raw or undercooked tissues of paratenic hosts. (Rubinsky-Elefant *et al.,* 2010; Omonijo and Mukaratirwa, 2023).

Elderly individuals, young children, and those with weakened immune systems are at the highest risk of contracting zoonotic infections (Del Brutto *et al.,* 2018; Bhattarai *et al.,* 2020). Given the economic and public health concerns associated with gastrointestinal parasites in dogs, research should focus on the prevalence of these parasites in stray dogs to determine the environmental burden of infection. The present study therefore aimed to establish baseline data on the prevalence of gastrointestinal parasites affecting stray dogs in the Suleja metropolis.

MATERIALS AND METHODS

Study Areas

The study was conducted in Sabo (new) Gwazunu, Suleja and within Suleja Township, Suleja Local Government Area of Niger State, Nigeria (Figure 1). Suleja Township study area is found at latitude 9°10'50.12" N and longitude 7° 10' 45.80" E. The density of vegetation cover in the area has been greatly reduced as a result of urbanization. New Gwazunu is a resettlement area south of Suleja township (Latitude: 9°08'13.18"N; Longitude: 7° 11' 46.79"E). Typical vegetation of lush grassland with many trees, shrubs, and bushes can be seen (Adesoye *et al.,* 2024). Generally, most people in Suleja metropolis rear animals, including dogs with majority engaging in agricultural activities.

Sample Collection

Sixty (60) faecal samples were randomly collected from stray dogs on the streets of each community immediately after defecation, between February and March 2024. The faecal were put into plastic universal bottles, properly labeled, and transported to the laboratory of Centre for Tuberculosis and other Neglected Tropical Diseases, Suleja, for analysis. The samples were refrigerated at 4ºC and held until the following day, when they were processed for ova and oocyst detection.

Parasitology Procedure

Faecal samples were processed individually and examined microscopically using Sheather's sugar technique (Duncan *et al.,* 2020). 1 g of faecal was added to 15 ml of sheather's sugar solution in a test tube. The content was thoroughly mixed and strained, collected into another test tube, and covered with a slip. The filtrate was left to stand for 15 – 30 mins. The cover slip was then transferred to a microscopic slide to be examined under a light microscope. The parasite samples were identified using the standard key procedure (Cimino *et al.* 2015).

Data Analysis

Data analysis was conducted using IBM-SPSS version 25.0. Chi-square tests were applied to assess the association between communities and parasite prevalence, with statistical significance set at $P < 0.05$.

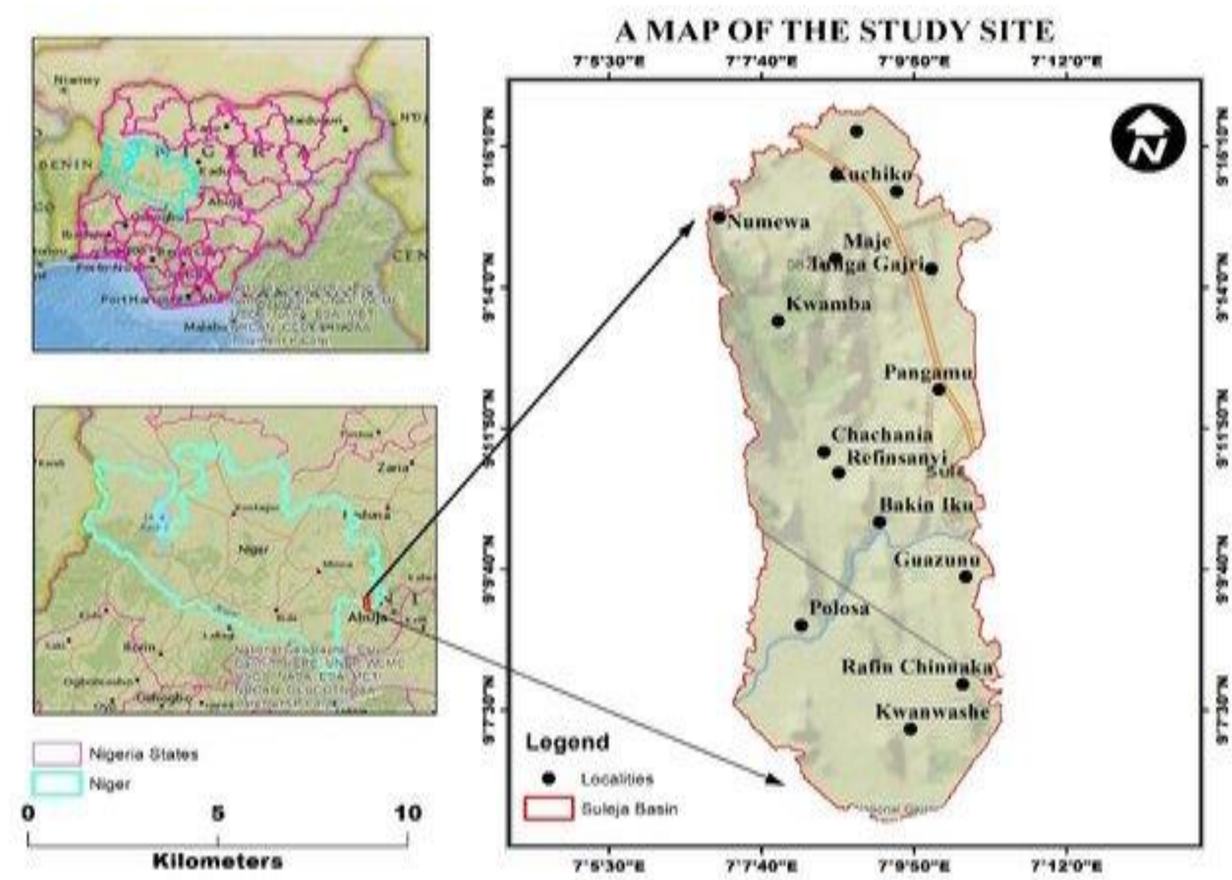

Figure 1. Map of Nigeria and Suleja Metropolis

RESULTS

Prevalence of Gastrointestinal Parasites from Stray Dogs in Suleja Township and and Sabo Gwazunu, Niger State

A total of thirteen species gastrointestinal parasites belonging to Phylum Protozoa (*Cryptosporidium* sp and *Eimeria* sp., *Entamoeba* sp and *Hartmannella* sp), Phylum Nematoda (*T. canis*, *Trichuris* sp, *Physaloptera* sp, *Strongyloides* sp, *Ancylostoma* sp), and Phylum Platyhelminthes (*Alaria* sp, *Dipylidium* sp, *Schistosoma* sp, and *Taenia* sp) were found in stray dogs in both Suleja township and Sabo Gwazunu. In Suleja Township, eleven species GIT parasites were found, and these include *Hartmannella* sp, *Eimeria* sp, *T. canis*, *Strongyloides* sp, *Alaria* sp, *Cryptosporidium* sp, *Entamoeba* sp, *Ancylostoma* sp, *Dipylidium* sp, *Schistosoma* sp, and *Taenia* sp. However, in Sabo Gwazunu, only nine species GIT parasites were found. These include *Eimeria* sp, *T. canis*, *Trichuris* sp, *Physaloptera* sp, *Strongyloides* sp, *Dipylidium* sp, *Schistosoma* sp, *Hartmannella* sp, and *Taenia* sp. (Table 1). The prevalence of GIT parasites between the two study sites showed a significant difference ($P<0.05$). Across the two study communities, *T. canis* was observed to have the highest prevalence of 46.66% (28/100), followed by *Dipylidium* sp, 30.00% (18/120), *Taenia* sp, Overall, the prevalence of GIT parasites in both communities was estimated at 75.83% (91/120).

Prevalence of parasitic infection in stray dogs in Suleja Township

Table 2 shows the infection status of stray dogs in Suleja Township. Out of the sixty faecal samples of stray dogs that were examined, 11 (18.33%) are without GIT parasitic infection, 37 (72.0%) have one GIT parasite, and just three of the samples have double GIT parasitic infection, namely *Taenia* sp + *Toxocara canis, Taenia* sp + *Ancylostoma* sp and *Taenia* sp + *Strongyloides* sp.

Prevalence of parasitic infection in stray dogs in Sabo Gwazunu

Ten (16.66%) out of the entire 60 fecal samples collected in Sabo Gwazunu were uninfected with GIT parasites. Single infection constituted 49 (81.66%), while double infection consisted of two samples (3.33%): *Schistosoma* sp + *T. canis* and *Taenia* sp + *T. canis* (Table 3).

Table 1. Prevalence of gastrointestinal parasites in Suleja Metropolis

	Communities		
Parasite species	**Suleja Township (N=60)**	**Sabo Gwazunu (N=60)**	**Overall prevalence (%)**
Eimeria sp	2 (3.33)	7 (11.66)	9 (15.00)
Hartmannella sp	1 (1.66)	1 (1.66)	2 (3.33)
Toxocara canis	6 (10.00)	22 (36.66)	28 (46.66)
Trichuris sp	0 (0.00)	1 (1.66)	1 (1.66)
Physaloptera sp	0 (0.00)	1 (1.66)	1 (1.66)
Strongyloides sp	4 (6.66)	3 (5.00)	7 (11.66)
Alaria sp	1 (1.66)	0 (0.00)	1 (1.66)
Cryptosporidium sp	2 (3.33)	0 (0.00)	2 (3.33)
Entamoeba sp	1 (1.66)	0 (0.00)	1 (1.66)
Ancylostoma sp	4 (6.66)	0 (0.00)	4 (6.66)
Dipylidium sp	12 (20.00)	6 (10.0)	18 (30.00)
Schistosoma sp	1 (1.66)	3 (5.00)	4 (6.66)
Taenia sp	4 (6.66)	9 (15.00)	13 (21.66)
Total	38 (63.30)	53 (88.00)	91 (75.83)

Table 2. Infection Prevalence among stray dogs with gastrointestinal parasites in Suleja Township, Niger State

Infection status	Prevalence (%)
No infection	11 (18.33%)
Single infection	37 (72.0%)
Alaria	1 (1.66)
Ancylostoma sp	3 (5.00)
Cryptosporidium sp	2 (3.33)
Dipylidium sp	12 (20.00)
Hartmannella sp	1 (1.66)
Eimeria sp	2 (3.33)
Entamoeba sp	1 (1.66)
Schistosoma sp	1 (1.66)
Strongyloides sp	3 (5.00)
Taenia sp	1 (1.66)
Toxocara canis	5 (8.33)
Multiple Infection	3 (5.00)
Taenia sp + *Toxocara canis*	1 (1.66)
Taenia sp + *Ancylostoma* sp	1 (1.66)
Taenia sp + *Strongyloides* sp	1 (1.66)

Table 3. Infection Prevalence among stray dogs with gastrointestinal parasites in Sabo Gwazunu, Niger State

Infection status	Number of samples (%)
No infection	10 (16.66)
Single infection	49 (81.66)
Dipylidium sp	6 (10.00)
Hartmannella sp	1 (1.66)
Eimeria sp	7 (11.66)
Physaloptera sp	1 (1.66)
Schistosoma sp	2 (3.33)
Strongyloides sp	3 (5.00)
Taenia sp	8 (13.33)
Toxocara canis	20 (33.33)

Trichuris sp	1 (1.66)
Multiple infections	2 (3.33)
Schistosoma sp + *T. canis*	1 (1.66)
Taenia sp + *T. canis*	1 (1.66)

DISCUSSION

Studying the prevalence of gastrointestinal parasite in dogs is crucial for protecting both human and animal health, and it supports the development of policies to minimize the spread of zoonotic diseases. Such research works has significant public health implications, especially because many of these parasites can be transmitted from animals to their immediate human population (Bhattarai, 2020; Kamani *et al.,* 2021).

There has been a number of reports on prevalence of gastrointestinal parasites in Africa (Sulieman *et al.* 2020) and most especially in Nigeria (Ayinmode *et al.* 2016; Moro and Abah, 2019; Kamani *et al.,* 2021). However, there is little or no information on the prevalence of GIT parasites in Niger State. Findings from this study show a prevalence of 75.83% of GIT parasites in stray dogs in Suleja metropolis. This is higher than the prevalence of 39.8% (377/948) reported in a nationwide survey in Nigeria (Kamani *et al.,* 2021). The disparity observed in the study may be as a result of the number of dogs higher in Nigeria as a whole country compared to a locality in Niger State. The higher the number hosts, the greater the possibility of parasite prevalence in an environment (Wu *et al.* 2019). There is also such difference in the prevalence of parasite in Suleja metropolis and 43.3% (88/203) in Ibadan, Oyo State (Ayinmode *et al.* 2016), 65% (260/400) in Abua, Rivers State (Moro and Abah, 2019),68.4% (271/396) in Kwara State (Ugbomoiko *et al.* 2008), 73.3% (293/400) in Makurdi metropolis, Benue State (Matthew *et al.* 2016),77.9% (366/470) in Northeastern Nigeria (Magaji *et al.* 2012), and 78.85% (41/52) in Kebbi State (Jajere *et al.* 2022).

Results from the present study showed higher 88.00% (53/120) parasitic prevalence in Sabo Gwazunu compared to 63.30% (38/120) in Suleja township. Bushes and native vegetation can be found in abundance at Sabo Gwazunu compare to the later location. This may have accounted for higher parasite prevalence in Sabo Gwazunu. There are reports associating poor hygiene and sanitation with higher prevalence of endoparasite in an environment (Archer *et al.* 2017; Issa *et al.* 2022). Stafford *et al.*, (2020) findings buttress the fact that neater climes do have lower prevalence of parasite as compared to dirty ones. One could deduce lower prevalence of 11.9% (43/360) in their report is the fact that United States has not only limited stray dogs but also significant neater environment. Some other countries of the world have a lower reported prevalence as compared to the result of the present study, as such, 22.66% (80/353) in Cuiabá, Brazil (Souza *et al.* 2023); Turkey (Ünal *et al.* 2022); 46.25% in Zakho city, Iraq (Issa *et al.* 2022) and 59.50% (238/400) in Suryabinayak, Nepal (Sukupayo and Tamang, 2023); 63.94% (172/269) in Kurdistan region. This observation is consistent with a report from an earlier study, which showed that the prevalence of gastrointestinal parasites in dogs may vary by region and environmental conditions (Archer *et al.* 2017; Ezema *et al.* 2019).

Furthermore, this study showed that among the GIT parasites found, *Toxocara canis* has the highest prevalence, 56.0% (28/120). This is consistent with report from Kebede (2019) that reported a high prevalence of *T. canis* in the dog population. However, some studies reported lower prevalence (Sowemimo, 2009, Akeredolu and Sowemimo, 2014), while another reported no *T. canis* prevalence (Sulieman *et al.* 2020). *T. canis* is a zoonotic nematode responsible for larva migrans syndrome (LMS), visceral larva migrans (VLM), ocular larva migrans (OLM), neural larva migrans (NLM), and covert infection in humans (Phoosangwalthong *et al.* 2022). Humans can become infected with these parasites by consuming contaminated eggs from soil or water, through unwashed hands, raw vegetables, or by ingesting larvae present in undercooked or raw infected organ or muscle tissues of other paratenic hosts (Phoosangwalthong *et al.* 2022). This study highlights the importance of preventing stray dogs from accessing the environment.

Also in the present study, *Dipylidium* sp was another parasite found to be highly prevalent. This parasite is one of the most common tapeworms infesting companion animals (Rousseau *et al.* 2022). It is a zoonotic parasite responsible for a disease named dipylidiasis worldwide (Benitez-Bolivar *et al.* 2022). Humans acquire infection through fecal-oral transmission by incidental ingestion of infected intermediate host (fleas) containing the cycsticercoid of *Dipylidium* sp (Rousseau *et al.* 2022). Young children who closely interact with dogs, such as kissing them or being licked by infected pet dogs, are at a higher risk of acquiring infections (García-Agudo *et al.* 2014).

CONCLUSION

In conclusion, the presence of these parasites in stray dog populations within the study areas highlights their contribution to environmental contamination and their potential impact on public health. The prevalence of intestinal parasitic infections in animal and human populations has been linked to the degree of environmental contamination with parasite eggs or oocysts. Therefore, it is essential to implement coordinated efforts to reduce stray dog roaming in Suleja metropolis, and by extension, across Niger State, Nigeria.

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