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Gastrointestinal Parasites in Children and Dogs (*Canis lupus familiaris*) in Agbarho, Delta State, Nigeria: Prevalence, Intensity, and Seasonal Distribution

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Abstract

Intestinal parasitic infections remain a major public health challenge in resource-limited settings, particularly in communities where humans and domestic animals share environments that facilitate parasite transmission. This study aimed to determine the prevalence, infection intensity, and seasonal distribution of intestinal parasites among children and dogs in Ughelli North Local Government Area, Delta State, Nigeria. A cross-sectional design was employed, involving the examination of 200 stool samples from children and 186 fecal samples from dogs using standard parasitological techniques. Among children, 226 parasite infections were recorded because of co-infections, with *Ascaris lumbricoides* being the most prevalent species (57.9%), followed by *Entamoeba coli* (24.7%), *Entamoeba histolytica* (9.7%), *Trichuris trichiura* (7.0%), and *Giardia duodenalis* (0.4%). Among dogs, 357 parasite detections were recorded, predominantly comprising *Trichuris vulpis* (74.7%), *Toxocara canis* (59.6%), and *Ancylostoma caninum* (57.5%). Infection intensity was highest for *A. lumbricoides* in children (22.56 ± 20.23 eggs per gram [EPG]) and *T. canis* in dogs (38.02 ± 29.25 EPG). Parasite prevalence was higher during the wet season, with transmission peaking between July and August. However, statistical analyses revealed no significant associations among the parasite species examined ($p > .05$). These findings demonstrate a substantial burden of intestinal parasitic infections, indicating extensive environmental contamination and potential zoonotic overlap between children and dogs. Integrated control measures combining mass deworming, improved sanitation, health education, and coordinated One Health interventions are therefore essential to reduce transmission and the associated disease burden.

Keywords: Gastrointestinal Parasites; Infection Intensity; One Health; Seasonal Distribution; Zoonotic Transmission

INTRODUCTION

Gastrointestinal (GI) parasites remain among the most significant infectious agents affecting both humans and domestic animals worldwide. These parasites include protozoa and helminths—namely nematodes, cestodes, and trematodes—which inhabit the digestive tract of their hosts and derive nutrients at the host's expense, often resulting in compromised health and productivity (Sajid et al., 2025; Otranto et al., 2015). Among these groups, nematodes are particularly important due to their extensive host–parasite interactions, capacity to modulate host immune responses, and increasing resistance to therapeutic interventions (King & Li, 2018; Thompson, 2023).

The global epidemiology of GI parasites has been significantly influenced by increased human mobility, animal trade, and changing dietary practices. Consumption of raw or undercooked animal products has facilitated the transmission of a wide range of zoonotic parasites, including protozoa (e.g., *Toxoplasma*), trematodes (e.g., *Fasciola*, *Paragonimus*), cestodes (e.g., *Taenia*, *Diphyllobothrium*), and nematodes (e.g., *Trichinella*, *Gnathostoma*) (Macpherson, 2005). In tropical and subtropical regions, environmental conditions such as high temperature, humidity, and poor sanitation further enhance the survival and transmission of infective stages (Hotez et al., 2020).

In humans, soil-transmitted helminths (STHs)—including *Ascaris lumbricoides*, *Trichuris trichiura*, and hookworms (*Ancylostoma duodenale* and *Necator americanus*)—continue to pose a major public health challenge. It is estimated that approximately 1.5 billion people, representing about 24% of the global population, are infected with these parasites (World Health Organization, 2023). The burden is disproportionately higher in low-resource settings, particularly in sub-Saharan Africa, Asia, and South America, where inadequate access to clean water, sanitation, and hygiene persists. These infections contribute significantly to anemia, malnutrition, stunted growth, and impaired cognitive development, especially among children (Jourdan et al., 2018). Additionally, protozoan infections such as *Giardia duodenalis* and *Entamoeba histolytica* are common causes of gastrointestinal morbidity, leading to diarrhea, malabsorption, and weight loss (Fletcher et al., 2022).

Dogs (*Canis lupus familiaris*), as common companion animals, serve as important reservoirs of GI parasites with zoonotic potential. Frequently reported canine parasites include *Toxocara canis*, *Ancylostoma caninum*, *Dipylidium caninum*, *Trichuris vulpis*, and *Giardia duodenalis* (Traversa, 2012). Infected dogs may exhibit clinical signs such as diarrhea, weight loss, anemia, and poor body condition, with puppies and immunocompromised animals being particularly vulnerable (Taylor et al., 2016). Of greater concern is the zoonotic transmission of these parasites to humans. For instance, *T. canis* eggs shed in dog feces can contaminate soil and lead to visceral or ocular larva migrans in humans, while *A. caninum* larvae can cause cutaneous larva migrans. Similarly, certain genotypes of *Giardia duodenalis* are transmissible between dogs and humans (Macpherson, 2013; Ballweber et al., 2010).

Environmental contamination, inadequate waste management, poor veterinary care, and limited public awareness play crucial roles in sustaining the transmission cycle of GI parasites. Stray and free-roaming dogs, in particular, act as reservoirs, continuously shedding infective stages into the environment and facilitating zoonotic transmission in both urban and rural settings (Overgaauw & van Knapen, 2013; Sharma et al., 2022). Furthermore, climate change and global warming are increasingly recognized as drivers of the emergence and re-emergence of parasitic zoonoses, as they influence host distribution, parasite development, and transmission dynamics (Rupasinghe et al., 2022).

The persistence of GI parasitic infections in tropical regions is largely attributed to favorable environmental conditions that support year-round transmission, coupled with socioeconomic factors such as poverty, overcrowding, and limited access to healthcare services (Pullan & Brooker, 2012). These challenges underscore the need for sustainable and integrated control strategies.

Addressing GI parasitism effectively requires a multidisciplinary "One Health" approach that integrates human, animal, and environmental health interventions. Such strategies include regular deworming programs, improved sanitation and hygiene practices, public health education, responsible pet ownership, and control of stray dog populations (Robertson et al., 2021; Horefti, 2023). By adopting this holistic framework, it is possible to reduce infection prevalence, interrupt transmission cycles, and improve overall community health outcomes.

Despite these efforts, significant gaps remain in surveillance, diagnosis, and awareness, particularly in rural and peri-urban communities. In areas such as Agbarho in Ughelli North Local Government Area of Delta State, where close interaction between humans and dogs is common, there is limited data on the prevalence, diversity, and seasonal dynamics of GI parasites. This lack of localized epidemiological information hinders the development of targeted and effective intervention strategies.

Therefore, this study aims to investigate the prevalence and distribution of gastrointestinal parasites among children and dogs in Agbarho, Ughelli North Local Government Area of Delta State. Specifically, it seeks to determine the prevalence of GI parasites in children and dogs and to assess their seasonal distribution patterns, thereby providing evidence-based data to support integrated control measures and public health policy.

MATERIALS AND METHODS

Study Area

This study was conducted in Agbarho town, located in Ughelli North Local Government Area of Delta State, Nigeria (Latitude 5°35'N and Longitude 5°52'E). Agbarho is one of the most densely populated towns in Delta State, with an estimated population exceeding 500,000 inhabitants. The town comprises several communities, including Oguname, Ophori, Oviri, Oghara of Agbarho, Uvwiamuge, Ughrugheli, Uvwiama Ekrerhavwe, Ikwegwu Okrherhe, Orhokpokpor, Orho-Agbarho, and Ekwerhe.

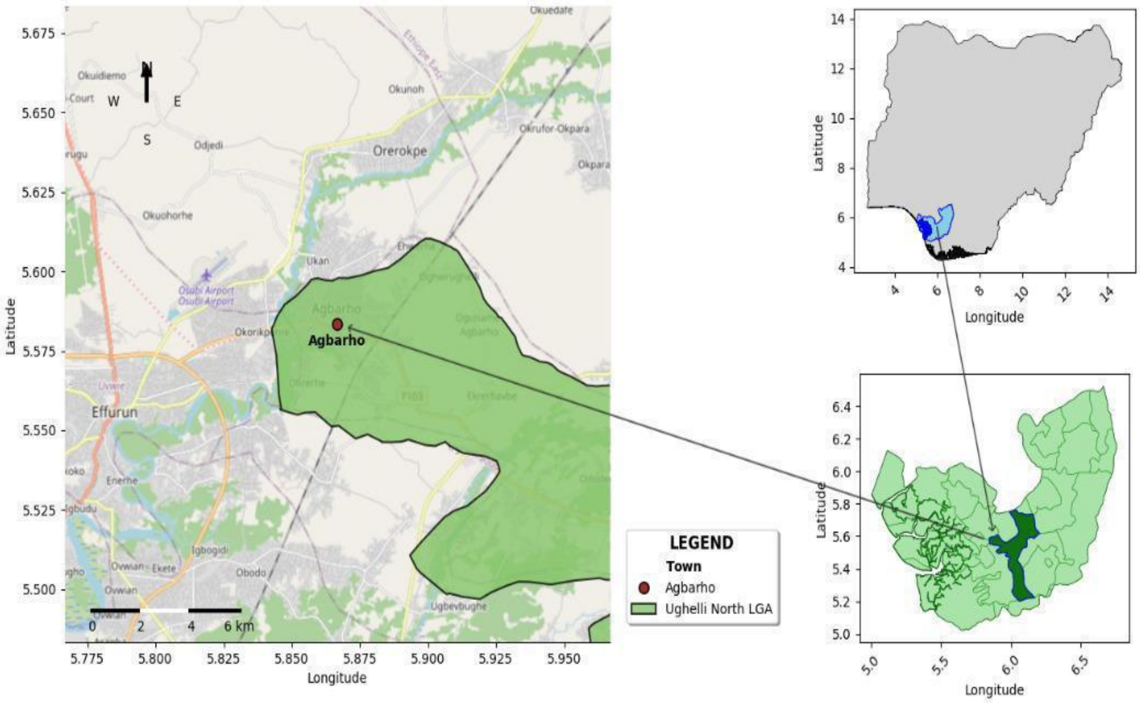

Figure 1: Map of the study area
Source: http://www.maphill.com

The inhabitants are predominantly engaged in farming and trading activities. The study area is characterized by a mixed urban–rural setting, where close interaction between humans and domestic animals, particularly dogs (*Canis lupus familiaris*), is common. This ecological and socio-environmental setting makes the area suitable for investigating zoonotic transmission of gastrointestinal parasites.

Study Design

A cross-sectional study design was employed and conducted over a period of one year. The study population consisted of school-aged children residing in households that owned domesticated dogs. Stool samples were collected from both children and dogs within the same households to assess shared exposure to gastrointestinal parasites.

Households were randomly selected within the study area to minimize selection bias. Only households with at least one school-aged child and one domesticated dog were included. This design allowed for the evaluation of parasite prevalence within a shared environmental context.

Ethical Considerations

Ethical approval for the study was obtained from the Research and Ethics Committee of Delta State University, Abraka. Informed consent was obtained from parents or guardians of participating children, as well as from dog owners, after providing a clear explanation of the study objectives and procedures. All protocols involving human and animal subjects were conducted in accordance with established ethical guidelines. Confidentiality of participants' information was strictly maintained throughout the study.

Sample Size Determination

The sample size was determined using the Krejcie and Morgan formula for finite populations:

$$n = \frac{N \times Z^2}{1 + (N - 1) \times Z^2}$$

Where:

(n) = required sample size

(N) = population size (500,000)

(Z) = Z-score at 95% confidence level (1.96)

Substitution of values yielded an estimated sample size of approximately 384. However, due to logistical constraints and study design considerations, a total of 200 children and 186 dogs were included in the study.

Sample Collection and Preservation

A total of 200 stool samples from school-aged children and 186 fecal samples from dogs were collected using sterile, labeled containers containing 10% formalin as preservative. Sampling containers were distributed to parents or guardians and dog owners, who were instructed on proper sample collection using the provided spatula.

All samples were retrieved within 24 hours of distribution and transported to the Advanced Research Centre, Delta State University, Abraka, for laboratory analysis.

Parasitological Examination

Stool samples were processed using standard parasitological techniques to detect and identify gastrointestinal parasites.

Direct Wet Mount Examination

A small portion of fresh stool was emulsified in a drop of 0.85% physiological saline on a clean glass slide and covered with a coverslip. The preparation was examined under ×10 and ×40 objective lenses for motile trophozoites and cysts. A Lugol's iodine preparation was also performed to enhance visualization of internal structures (Cheesbrough, 2012).

Formol–Ether Concentration Technique

The concentration of parasite stages was carried out using Ritchie's modified formol–ether technique. Approximately 1 g of fecal material was emulsified in 7 ml of 10% formalin, filtered through gauze, and transferred into a centrifuge tube. Three milliliters of diethyl ether were added, and the mixture was shaken vigorously before centrifugation at 3,000 rpm for 5 minutes.

Following centrifugation, the supernatant was discarded, and the sediment was examined microscopically under ×10 and ×40 objectives for the presence of eggs, larvae, and cysts (Cheesbrough, 2005).

Flotation Technique

The flotation method was performed using saturated sodium chloride solution as described by Zajac and Conboy (2012). Approximately 1–2 g of fecal sample was homogenized, filtered, and centrifuged. The sediment was resuspended in saturated sodium chloride solution to form a convex meniscus, and a coverslip was placed on top for 10–15 minutes. The coverslip was then transferred to a glass slide and examined microscopically.

Parasite Identification

Parasites were identified based on morphological characteristics, including size, shape, shell thickness, and internal structures, using standard identification keys (Cheesbrough, 2012; Zajac & Conboy, 2012).

Quantification of Infection Intensity

The Kato–Katz technique was employed to quantify infection intensity, particularly for helminths such as *Ascaris lumbricoides*. Results were expressed as eggs per gram (EPG) of stool. All procedures followed standard protocols outlined by the World Health Organization (WHO, 2012).

Statistical Analysis

Data obtained from the study were analyzed using PAST version 3 statistical software. Descriptive statistics were used to summarize prevalence and infection intensity, expressed as percentages and mean ± standard deviation, respectively. Inferential statistics were applied to assess differences in parasite prevalence among groups using Student's t-test. Seasonal and monthly variations in parasite occurrence were evaluated using Pearson correlation analysis to determine possible associations between variables. Statistical significance was set at $p < 0.05$.

RESULTS

Prevalence of Gastrointestinal Parasites in Children

A total of 200 stool samples were examined from school-aged children in Ughelli North Local Government Area, Delta State. Out of these, 226 parasitic infections were identified, indicating the presence of multiple infections among individuals.

Table 1: Prevalence of Intestinal Parasites in Children in Ughelli North

Parasites species	No. examined	No. infected	Infection rate
Ascaris	200	131	57.9
E. coli	200	56	24.7
E. Histolitica	200	22	9.7
G. Duodenalis	200	1	0.4
Trichuris sp.	200	16	7.0
Total		226	

As shown in Table 3.1, *Ascaris lumbricoides* was the most prevalent parasite, detected in 131 (57.9%) of the examined samples. This was followed by *Entamoeba coli* with 56 (24.7%), *Entamoeba histolytica* with 22 (9.7%), and *Trichuris trichiura* with 16 (7.0%). *Giardia duodenalis* had the lowest prevalence, occurring in only 1 (0.4%) sample. Statistical analysis revealed no significant difference in parasite prevalence among the species ($t = 1.943$, $p > 0.05$).

Prevalence of Gastrointestinal Parasites in Dogs

A total of 186 fecal samples were collected from dogs, with 357 infections recorded, reflecting a high level of co-infection. As presented in Table 3.2, *Trichuris vulpis* had the highest prevalence (139; 74.7%), followed by *Toxocara canis* (111; 59.6%) and *Ancylostoma caninum* (107; 57.5%).

Table 2: Prevalence of Intestinal Parasites in Dog in Ughelli North

Parasites species	No. examined	No. infected	Infection rate
Toxocara Canis	186	111	59.6
Ancyclostoma Caninum	186	107	57.5
Trichuris vulpis	186	139	74.7
Total		357	

The differences in prevalence among parasite species were statistically significant ($t = 11.8$, $df = 2$, $p < 0.05$), indicating variation in parasite distribution among the canine population.

Seasonal Distribution of Parasites

The seasonal distribution of parasitic infections among children (Figure 2) showed that infection rates were generally higher during the wet season compared to the dry season. *Trichuris trichiura* exhibited the highest occurrence in the wet season (25.0%), followed by *Giardia intestinalis* (23.0%) and *Entamoeba coli* (20.4%). In contrast, *Giardia duodenalis* showed relatively higher occurrence during the dry season (20.0%).

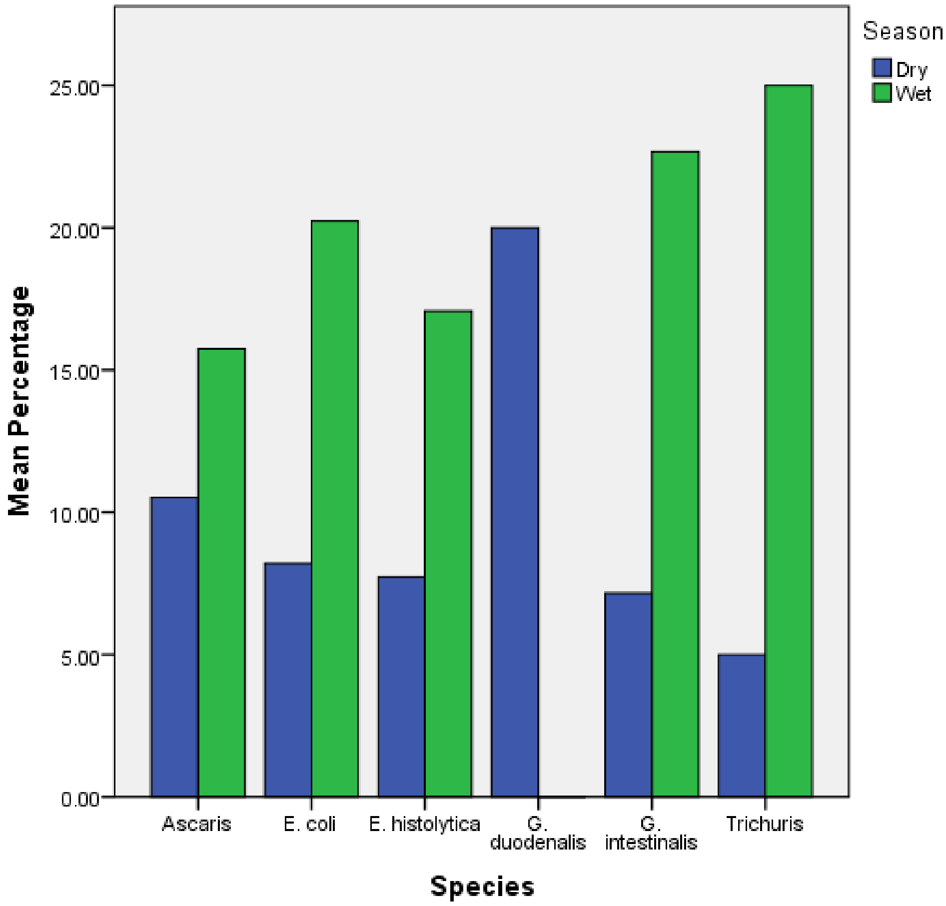

Figure 2: The Seasonal Pattern of the Parasitic Infection Among Children

Similarly, in dogs (Figure 3), all parasite species demonstrated increased prevalence during the wet season. *Toxocara canis* showed the most pronounced seasonal variation, increasing from 7.9% in the dry season to 17.6% in the wet season. Pearson correlation analysis indicated strong positive relationships between certain months (e.g., May–June: $r = 0.997$; July–August: $r = 0.866$), although these associations were not statistically significant ($p > 0.05$).

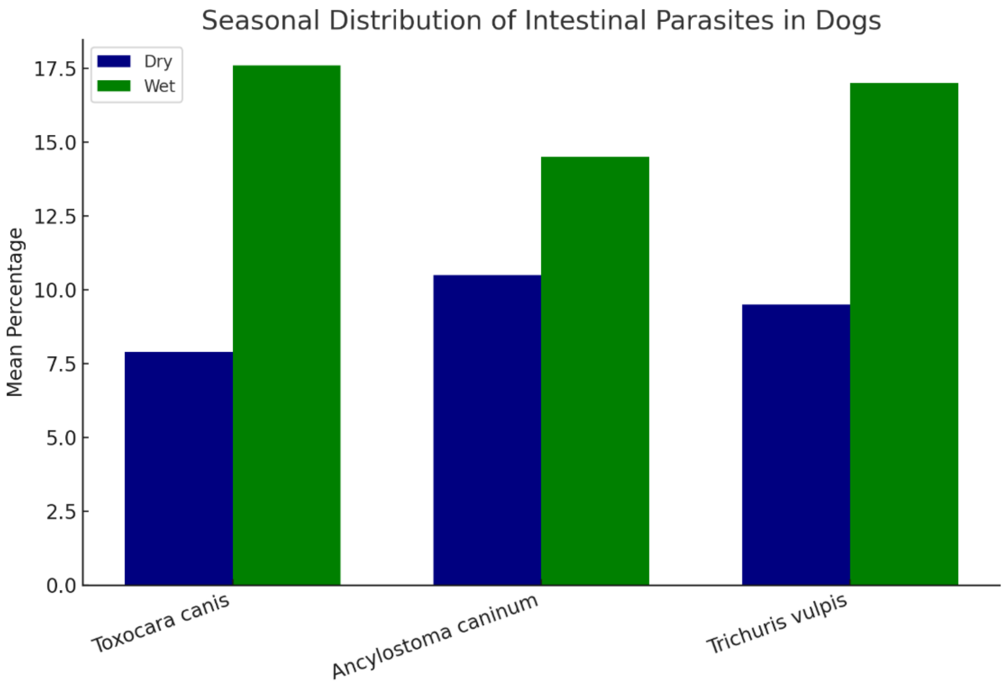

Figure 3: The Seasonal Pattern of the Parasitic Infection Among Dogs

Prevalence and Intensity of Infections

Among children (Table 3), *Ascaris lumbricoides* recorded the highest prevalence (48.4%) and infection intensity (22.56 ± 20.23 EPG). *Entamoeba coli* followed with 29.9% prevalence (13.94 ± 16.16 EPG), while *Entamoeba histolytica* accounted for 13.4% (6.24 ± 11.69 EPG).

Table 3: Prevalence and Intensity of Parasite Infections in Children Fecal Samples

Parasite Species	Positive Samples (n)	Prevalence (%)	Mean EPG ± SD (Positive Samples)
Ascaris lumbricoides	33	48.4	22.56 ± 20.231
E. coli	24	29.9	13.94± 16.160
E. histolytica	12	13.39	6.24 ± 11.687
G. duodenalis	1	1.03	0.48 ± 3.394
Trichuris trichura	6	7.2%	3.36 ± 9.710

Giardia duodenalis had the lowest prevalence (1.03%) with a mean intensity of 0.48 ± 3.39 EPG, and *Trichuris trichiura* recorded 7.2% prevalence with an intensity of 3.36 ± 9.71 EPG. Correlation analysis showed weak associations among parasites, none of which were statistically significant ($p > 0.05$).

In dogs (Table 4), *Toxocara canis* was the most prevalent parasite (72.0%) with the highest mean intensity (38.02 ± 29.25 EPG). *Trichuris vulpis* followed with 46.0% prevalence

(12.00 ± 18.94 EPG), while *Ancylostoma caninum* had the lowest prevalence (34.0%) but relatively high intensity (26.40 ± 32.25 EPG). No statistically significant correlations were observed among parasite species ($p > 0.05$).

Table 4: Prevalence and Intensity of Parasite Infections in Dog Fecal Samples

Parasite Species	Positive Samples (n)	Prevalence (%)	Mean EPG ± SD (Positive Samples)
Toxocara canis	36	72.0	38.02 ± 29.254
Trichuris	23	46.0	12.00 ± 18.94
Ancylostoma canium	17	34.0	26.40 ± 32.25
Total	76		

DISCUSSION

The findings of this study reveal a high prevalence of gastrointestinal parasitic infections among both children and dogs in Ughelli North Local Government Area, Delta State. This is consistent with previous reports from tropical and subtropical regions, where environmental conditions, poor sanitation, and limited access to clean water contribute to the persistence and transmission of parasitic infections (World Health Organization, 2023; Hotez et al., 2020).

The predominance of *Ascaris lumbricoides* among children aligns with earlier studies conducted in Nigeria and other endemic regions (Ugbomoiko et al., 2008; WHO, 2023). The high prevalence can be attributed to environmental contamination, open defecation, and behavioral factors such as geophagia and poor hygiene practices among children (Zhou et al., 2007). The moderate infection intensity observed suggests a substantial public health burden, as such infections are known to impair nutritional status, growth, and cognitive development (Bethony et al., 2006).

The high occurrence of *Entamoeba coli*, although non-pathogenic, serves as an indicator of fecal contamination and poor environmental hygiene (Stark et al., 2016). Its presence alongside *Entamoeba histolytica* suggests increased exposure to pathogenic protozoa and highlights the risk of amoebiasis within the study population (Fletcher et al., 2022).

The relatively low prevalence of *Giardia duodenalis* and *Trichuris trichiura* may be attributed to environmental and ecological factors influencing the survival of cysts and eggs, as well as seasonal transmission dynamics (Speich et al., 2016). However, these parasites remain epidemiologically important due to their association with diarrheal disease and malnutrition.

Among dogs, the high prevalence of *Toxocara canis* is of significant public health concern. This parasite is widely recognized for its zoonotic potential, causing visceral and ocular larva migrans in humans, particularly in children exposed to contaminated environments (Macpherson, 2013; Traversa, 2012). The high infection intensity observed in this study suggests extensive environmental contamination and highlights the role of dogs as reservoirs of infection.

The prevalence of *Trichuris vulpis* and *Ancylostoma caninum* further indicates widespread environmental contamination. While *T. vulpis* is primarily host-specific, *A. caninum* is of zoonotic importance due to its role in causing cutaneous larva migrans in humans (Hotez et al., 2004; Traversa, 2011).

The observed seasonal variation, with higher prevalence during the wet season, supports the role of environmental factors such as humidity and temperature in enhancing parasite survival and transmission (Hotez et al., 2008; Pullan & Brooker, 2012). Moist soil conditions during the rainy season provide favorable conditions for the development and persistence of infective stages, thereby increasing the risk of transmission.

The detection of similar parasite species in both children and dogs suggests a shared transmission environment and potential zoonotic overlap. This finding supports the One Health concept, which emphasizes the interconnectedness of human, animal, and environmental health (Zinsstag et al., 2011). However, molecular studies would be required to confirm direct cross-species transmission.

Overall, the results of this study are consistent with previous findings in Nigeria and other developing regions (Ugbomoiko et al., 2008; Ekejindu et al., 2019), highlighting the continued burden of gastrointestinal parasitic infections and the need for integrated control strategies. Such strategies should include improved sanitation, public health education, routine deworming programs, and effective management of dog populations to reduce environmental contamination and interrupt transmission cycles.

CONCLUSION

This study demonstrates a high prevalence and intensity of gastrointestinal parasitic infections among children and dogs in Agbarho, Ughelli North Local Government Area of Delta State. The dominance of *Ascaris lumbricoides* in children and *Toxocara canis* in dogs reflects persistent environmental contamination and inadequate sanitation practices within the study area. The detection of zoonotic parasites further highlights the potential for cross-species transmission, posing a significant public health concern.

The higher prevalence of infections during the wet season confirms the influence of environmental factors such as humidity and temperature on parasite survival and transmission. The co-occurrence of similar parasite species in both humans and dogs suggests a shared transmission environment, reinforcing the importance of the One Health approach in addressing parasitic diseases.

The findings underscore the urgent need for coordinated interventions, including improved hygiene and sanitation, routine deworming programs for both humans and dogs, public health education, and effective control of stray and domestic dog populations. Future studies incorporating molecular techniques are recommended to better understand transmission dynamics and confirm zoonotic linkages. Implementing these measures will contribute significantly to reducing the burden of gastrointestinal parasitic infections and improving the health and well-being of affected communities.

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