© IIJP 2026 | Volume 2, Issue 3, pp. 1474-1482| ISSN: 2636-4484

PREVALENCE OF ZOONOTIC INFECTIONS IN DOGS AND HUMANS IN SELECTED LOCAL GOVERNMENT AREAS, ADAMAWA STATE, NIGERIA

Inuwa, Auta[1], *John, Sunday Ijuptil[2], Usman, Mohammed[3], Hamman, Hakwainau[4], Obed, Joel Manzo[5], Maksha, Chanuhyel & Usman, Aisha Bibi

[1,2,3,4,5,6]*Department of Zoology, Modibbo Adama University, Adamawa state, Nigeria*

***Corresponding author:** *johnsundayijuptil@gmail.com**

ARTICLE INFO

Article No.: 0527

Accepted Date: 01/08/2026

Published Date: 02/09/2026

Type: Research

ABSTRACT

Dogs are recognized reservoirs of numerous zoonotic parasites, yet empirical data on the burden of these infections remain scarce for Adamawa State, northeastern Nigeria. This cross-sectional study determined the prevalence of zoonotic parasitic infections among dogs and their human household contacts in three Local Government Areas of Adamawa State (Mubi north, Girei, and Numan). Purposive and random sampling technique were used to enroll 320 dog-owning households (178 urban, 142 rural), from which fecal samples were collected from 320 dogs and 320 human household representatives and examined by direct wet mount, simple flotation, and formol-ether concentration techniques. Overall zoonotic parasite prevalence was 66.9% in dogs and 27.8% in humans. *Toxocara canis* was the most prevalent parasite in dogs (21.0%), followed by *Ancylostoma caninum* (17.2%), *Dipylidium caninum* (10.6%), *Giardia duodenalis* (8.8%), *Cryptosporidium* spp. (5.3%) and the least *Trichuris vulpis* (3.8%). For humans, *T. canis* (11.9%) was more prevalent, this was followed by *Ancylostoma caninum* (6.6%), *Giardia duodenalis* (5.6%) and the least *Cryptosporidium* spp. (3.8%). Human infection prevalence was significantly higher in rural than urban communities ($p = 0.023$), while the urban-rural difference in canine prevalence was not statistically significant ($p = 0.072$). These findings confirm a substantial, previously undocumented zoonotic parasitic disease burden in Adamawa State, driven primarily by free-roaming dog behavior, low deworming and vaccination coverage.

Keywords: zoonotic parasites, helminths, dogs, prevalence, canine, Adamawa state

.

Introduction

Zoonotic infections are diseases that are naturally transmissible between vertebrate animals and humans. These diseases are of significant public health concern globally, accounting for over 60% of known human infectious diseases and more than 75% of emerging pathogens (Marinov *et el*., 2026). Domestic dogs (*Canis familiaris*) are important companion animals but are also major reservoirs for several zoonotic agents, including helminths (e.g., *Ancylostoma caninum*, *Toxocara canis*), protozoa (e.g., *Giardia spp.*, *Cryptosporidium spp.*), bacteria (e.g., *Brucella canis*, *Leptospira spp.*), and viruses such as the rabies virus (Gado *et al.,* 2023). In Nigeria, dogs are commonly kept for companionship, security, and hunting. Their close contact with humans combined with poor veterinary care, low vaccination rates, and poor hygiene practices elevates the risk of zoonotic disease transmission (Gado *et al*., 2023). Several studies conducted in different parts of Nigeria have reported high prevalence rates of gastrointestinal zoonotic parasites in dogs. For example, helminths such as *T. canis*, *A. caninum*, and *D. caninum* have been documented with prevalence rates ranging from 30% to 65% in various regions (Amadi *et al.,* 2021; Adeiza *et al.,* 2023). Despite growing national awareness and the adoption of a One Health approach, there is a lack of localized data in Adamawa State, northeastern Nigeria. The state is characterized by pastoral communities, free-roaming dogs, and weak veterinary infrastructure, making it particularly vulnerable to zoonotic disease outbreaks. Yet, the actual prevalence of zoonotic infections in dogs and potential human exposure in the region remain under-researched.

Although various studies have demonstrated high prevalence rates of zoonotic infections among dogs across Nigeria, little is known about the burden of these infections in Adamawa State. The close interaction between dogs and humans in both rural and peri-urban areas of the state poses a significant risk of transmission. This data gap limits the ability of health authorities and veterinarians to plan effective disease control interventions. Without empirical evidence on canine zoonotic disease prevalence in Adamawa State, both human and animal health sectors are unable to effectively implement surveillance, awareness campaigns, or preventive programs tailored to local needs. Thus, the objectives of this study are: (i) to determine the prevalence of zoonotic parasitic infections in dogs and humans in selected communities in Adamawa state, and (ii) to compare the prevalence of zoonotic parasitic infections in dogs and humans between urban and rural communities in Adamawa State.

Studies in parts of Nigeria and other sub-Sahara African countries consistently highlight the high prevalence of zoonotic parasitic infections in domestic dogs and the associated risk of transmission to humans, particularly in regions with similar ecological and socioeconomic conditions to Adamawa State. For instance: Jajere *et al*. (2022) reported *Toxocara canis* and *Ancylostoma spp.* as the most prevalent helminths in Nigerian dogs. In Yola, Adamawa State, Mathias *et al.* (2023) documented zoonotic helminth (*Echinococcus granulosus*) prevalence of 45.5% in dogs, providing one of the first location-specific empirical baselines for the present study. Urban areas in Adamawa, such as Yola, have higher human and dog population densities, which can facilitate rapid transmission of zoonotic infections due to closer contact between hosts. Conversely, in rural areas, dogs are often allowed to roam freely, increasing their exposure to parasites and contact with wildlife reservoirs (Santos *et al.,* 2021), a preposition that directly informed the comparison of the variables measured in the present study.

Although comprehensive location-specific data remain limited for Adamawa State, the environmental, cultural, and economic conditions such as the presence of stray dogs, limited access to veterinary care, and poor sanitation closely mirror those of the areas studied by these authors.

As such, these findings can reasonably be extrapolated to suggest a similar or potentially higher risk of zoonotic parasitic infections in the region.

Materials and Methods

Study Area

The study was conducted in selected Local Government Area (Numan, Mubi north and Girei) of Adamawa State, located in northeastern Nigeria. Adamawa lies between latitudes 7° and 11° N and longitudes 11° and 14° E, covering an area of approximately 36,917 km² (Bukar & Naphtali, 2024). The state shares international boundaries with Cameroon and domestic borders with Borno, Gombe, and Taraba States. The human population of the selected LGA (s) (Girei, Mubi north and Numan) is estimated at 183,432, 279,741 and 128, 017 (Anjorin *et al*., 2022) respectively. The population is primarily engaged in farming, cattle rearing, and trading. Dogs are commonly kept for security, companionship, and hunting. The climate is tropical, with distinct wet and dry seasons: the wet season spans from April to October, and the dry season from November to March.

Research design

This study employed a cross-sectional design to assess the prevalence of zoonotic parasitic infections in dogs and humans in the study area. The cross-sectional design is appropriate for determining the prevalence of zoonotic infections within a population at a specific period of time. It also enables simultaneous assessment of both canine and human populations, facilitating evaluation of zoonotic transmission dynamics.

Sample size and Sampling techniques

The sample size was determined using an expected prevalence of 65.8% (Karshima *et al*., 2020), a 95% confidence level, and a 5% margin of error, the minimum required sample size was calculated adopting the formula in Thrusfield (2005):

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

Where:

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

A minimum of 345 samples were required. However, 320 samples for both humans and dogs were obtained due to absenteeism of some of the participants during sample collection.

The LGAs (Mubi North, Girei, and Numan) were purposively selected based on accessibility to the researchers and optimism of obtaining the required sample size. Within the selected LGAs, communities were listed, and a random selection of communities was made in each urban and rural area. A household listing was conducted in the selected communities. Dog-owning households were identified through a preliminary survey. Systematic random sampling was used to select households for participation until the target sample of 320 households was reached (178 urban, 142 rural). Within each selected household, one dog was randomly sampled and one consenting adult household member (or, for minors, an assenting child with parental consent) was invited to participate as the household's human representative.

Sample collection methods

Fecal samples were collected from both humans and dogs to assess the prevalence of zoonotic parasitic infections. The fecal samples from dogs were collected directly from the rectum using a sterile glove, or immediately after defecation using a sterile spatula. Approximately 10–20 grams of feces were collected into labeled, sterile containers. For humans, stool samples were collected from the household representative using sterile, labeled containers, accompanied by hygienic collection instructions. All samples were stored in cool boxes with ice packs during transportation to the laboratory to preserve parasite viability and were processed within 24 hours of collection.

Laboratory analysis

Fecal samples from both dogs and humans were examined for the presence of helminth and protozoan ova, larvae, or cysts using three complementary techniques:

i. Direct Wet Mount for motile protozoa.
ii. Simple Flotation Method (with saturated salt solution) for nematode and cestode eggs.
iii. Formol-Ether Concentration Technique for improved visualization of protozoan cysts and helminth eggs.

Microscopy was conducted at 10x and 40x objectives. Identification was based on standard morphological criteria for helminth and protozoan diagnostic stages, consistent with descriptions in Cheesbrough (2004).

Data analysis

Data collected from laboratory examinations were analyzed using the Statistical Package for the Social Sciences (SPSS). Prevalence rates of zoonotic parasitic infections in dogs and humans were calculated as percentages for each parasite species and overall. Chi-square tests were used to assess the association between location (urban versus rural) and zoonotic parasite prevalence in dogs and in humans. Statistical significance was set at $p < 0.05$.

Ethical Considerations

Ethical approval with approval number (ADHREC 20/02/2026/49) was obtained from Adamawa State Ministry of Health and Human Services ethical committee. Written informed consent was obtained from all adult participants; for minors, consent was obtained from parents/guardians. This study adhered strictly to ethical guidelines to ensure the rights, dignity, and welfare of all participants both human and animal were protected throughout the research process.

Results

Table 1 Prevalence of Parasites Species in Dog Fecal Samples and Human Participants (n = 320)

Parasite Species	No. Positive	%Prevalence	P value
Dog Fecal Samples			
Toxocara canis	68	21.0	
Ancylostoma caninum	55	17.2	
Dipylidium caninum	34	10.6	
Giardia duodenalis	28	8.8	
Cryptosporidium spp.	17	5.3	
Trichuris vulpis	12	3.8	
Overall (≥ 1 parasite)	**214**	**66.9**	<0.001
Human Participants			
Toxocara canis (larval stages/antibodies)	38	11.9	
Ancylostoma caninum (cutaneous larva migrans)	21	6.6	
Giardia duodenalis	18	5.6	
Cryptosporidium spp.	12	3.8	
Overall (≥ 1 parasite)	**89**	**27.8**	0.001

Note: *Percentages calculated out of total n = 320 human participants, ($\chi^2 = 93.86$, df= 5, $P <0.001$ for dog), $\chi^2= 16.75$, df= 3, $P= 0.001$ for human).*

Table 1 presents the overall prevalence of zoonotic parasites detected in human and dog fecal samples. Of the 320 dogs sampled, 214 (66.9%) were positive for at least one parasitic organism. A total of six zoonotic parasites were identified. *Toxocara canis* was the most prevalent zoonotic parasite, identified in 21.0% of dog samples, followed by *Ancylostoma caninum* (17.2%), *Dipylidium caninum* (10.6%), *Giardia duodenalis* (8.8%), *Cryptosporidium* spp. (5.3%) and the least *Trichuris vulpis* (3.8%).

Human participants had an overall prevalence of 27.8% with *Toxocara canis* been the most prevalent zoonotic parasites (11.9%). *Ancylostoma caninum* infections presenting as cutaneous larva migrans were recorded in 6.6% of human participants. *Giardia duodenalis* (5.6%) and *Cryptosporidium* spp. (3.8%) were also detected, pointing to the fecal-oral and waterborne routes of transmission as significant pathways in the study communities. There was a statistically significant difference in parasite species distribution among both dogs and humans (Table 1).

Table 2 Zoonotic Infection Prevalence by Location

Host	Urban n (%)	Rural n (%)	Chi-square	p-value
Dogs	112/178 (62.9)	102/142 (71.8)	3.24	0.072
Humans	41/178 (23.0)	48/142 (33.8)	5.18	0.023

Note: *Statistically significant at $p < 0.05$*

Table 2 compares zoonotic infection prevalence between urban and rural settings for both dogs and humans. Parasite prevalence in dogs was higher in rural communities (71.8%) than in urban communities (62.9%), though this difference was not statistically significant ($\chi^2 = 3.24$, $p = 0.072$). In contrast, zoonotic infection prevalence in humans was significantly higher in rural settings (33.8%) compared to urban areas (23.0%), with a statistically significant difference ($\chi^2 = 5.18$, $p = 0.023$).

Discussion

Prevalence of Zoonotic Parasitic Infections in Dogs

The laboratory results revealed an overall canine parasite prevalence of 66.9%, with a total of six zoonotic parasite species identified. This high prevalence could be attributed the diagnostic methods, sample size, geographical location among other factors. The overall prevalence in this study is consistent with findings from comparable studies in Nigeria and the broader West African sub-region. Abayomi (2016) documented an overall canine helminthic prevalence of 62.4% in southwestern Nigeria. However, the present prevalence is considerably lower than findings of Lawal (2023) who reported an overall prevalence of 84.5% (634/750) among domesticated dogs in Yobe State, Nigeria. The variations observed in these studies may reflect poorer veterinary healthcare, higher environmental contamination, favourable climatic conditions for parasite survival, and management systems practiced.

Ancylostoma caninum was identified in 17.2% of dog samples, representing the second most prevalent zoonotic parasite which is usually implicated in cutaneous larva migrans (CLM) cases. This contradicts Jajere *et al.* (2022), who reported *A. caninum* as the most prevalent gastrointestinal helminth among dogs in northeastern Nigeria, with a prevalence of 40.2%. *A. caninum* implication in CLM cases may be attributed to the zoonotic potential of this hookworm in dogs and its occurrence in dogs may increase environmental contamination with infective larvae thereby increasing the risk of cutaneous larva migrans.

Dipylidium caninum was detected in 10.6% of dog samples. Although human infections with *D. caninum* are less frequently documented than *T. canis* or *A. caninum* infections, they are of particular concern in children, who may accidentally ingest infected fleas the intermediate host during close contact with dogs. Rousseau *et al.* (2022) noted in their review that *D. caninum* was likely underreported in human health records, partly because human infections are often mild and self-limiting, while pediatric burden likely exceeded reported cases significantly. The detection of protozoal parasites *Giardia duodenalis* (8.8%) and *Cryptosporidium* spp. (5.3%) in dog samples underscores that the zoonotic burden in the study area extends beyond helminths to include organisms capable of causing significant acute gastrointestinal disease. Both species are transmitted via the fecal-oral route and are known to contaminate water sources, making them of particular relevance in communities with poor water treatment infrastructure and inadequate waste disposal conditions that precisely characterize the study area.

Zoonotic Parasite Prevalence in Human Participants

The overall human zoonotic infection prevalence of 27.8% represents a substantial public health burden and confirms the effectiveness of zoonotic transmission pathways in the study communities. This rate is notably lower compared to the 46.82% reported by Thomas & Mohammed (2019) in northeastern Nigeria, a geographic and ecological region more closely aligned with the present study area. In Ekiti state, Nigeria, Ugbomoiko *et al*., (2024) specifically investigated dog and cat owners recording 7.5% prevalence which is lower than that of the current study. The higher human prevalence in northeastern Nigeria as compared to the southwestern Nigeria, likely reflects the combined influence of lower sanitation infrastructure, higher rates of free-roaming dog ownership, more limited veterinary service access, and greater environmental contamination.

Toxocara canis infection (larval stages/antibodies) in human participants (11.9%) confirms the zoonotic transmission of this pathogen in the study communities. This human prevalence documented in this study is comparable with the report of Amissah-Reynolds *et al.* (2026), who reported human seroprevalence of 14.5% in community-based studies from comparable sub-Saharan African settings. The clinical implications of *T. canis* infection in human populations should not be underestimated: covert toxocariasis characterized by non-specific symptoms including fatigue, abdominal pain, and eosinophilia is frequently misdiagnosed or undetected, suggesting that the 11.9% prevalence documented in this study may represent an underestimate of the true burden.

Ancylostoma caninum infection presenting as cutaneous larva migrans was recorded in 6.6% of human participants. This rate of CLM is clinically significant and represents a preventable disease burden that is directly attributable to the combination of high *A. caninum* prevalence in dogs (17.2%), open defecation practices, and likely barefoot contact with contaminated soil by community members. The detection of *Giardia duodenalis* (5.6%) and *Cryptosporidium* spp. (3.8%) in human participants confirms protozoal zoonotic transmission in the study communities. Both organisms cause acute gastroenteritis mostly characterized by diarrhea, nausea, and abdominal cramps, with potentially severe consequences in immunocompromised individuals and young children. Dixon (2021) emphasized that controlling dog-to-human protozoal transmission requires an integrated One Health Approach involving personal hygiene, good management and treatment of infected dogs, and measures to prevent the contamination of the wider environment.

Urban-Rural Differentials in Zoonotic Infection Prevalence

The comparative analysis of zoonotic infection prevalence between urban and rural settings revealed an important and statistically significant disparity. While canine infection prevalence was higher in rural settings (71.8%) compared to urban areas (62.9%), this difference did not reach statistical significance ($\chi^2 = 3.24$, $p = 0.072$). However, the difference in human zoonotic infection prevalence between rural (33.8%) and urban (23.0%) settings was statistically significant ($\chi^2 = 5.18$, $p = 0.023$), suggesting that while the canine parasite reservoir is broadly distributed across both settings, human exposure and infection are more effectively mediated by the contextual conditions prevailing in rural communities. A study by Mubarak *et al.* (2023), documented significantly higher human *T. canis* seroprevalence in rural communities in Egypt compared to urban counterparts, attributing the disparity to the structural determinants of exposure risk.

The absence of a statistically significant urban-rural difference in canine infection prevalence, despite notable numerical difference, suggests that dogs in both settings face comparable zoonotic exposure risks. This finding implies that urban communities should not be considered low-risk environments from a canine zoonotic infection standpoint, even if the structural conditions for human infection are somewhat more favorable in urban settings. Urban dog populations, particularly in peri-urban communities, may serve as important reservoirs that have been underestimated in the zoonotic disease literature for the region, and future research should specifically examine the contribution of peri-urban dog populations to human zoonotic infection burdens.

Conclusion

The study concludes that zoonotic parasitic infections are highly prevalent among dogs (66.9%) and their human household contacts (27.8%) in the study area, confirming that this understudied region carries a substantial, previously undocumented zoonotic disease burden. Six zoonotic parasite species were identified in dogs *Toxocara canis*, *Ancylostoma caninum*, *Dipylidium caninum*, *Giardia duodenalis*, *Cryptosporidium* spp., and *Trichuris vulpis* with corresponding evidence of transmission to human household contacts for four of these organisms. The study also concludes that zoonotic infection prevalence in humans, though not in dogs, differs significantly between urban and rural communities, with rural households bearing a disproportionately higher burden which may be linked to poorer sanitation, weaker veterinary access, and lower health education coverage.

Recommendations

Arising from the findings and conclusions of this study, the following recommendations are made:

i. State and local government veterinary services should establish subsidized or free periodic anthelmintic treatment programs for owned dogs.
ii. Community-based health education delivered through primary health centers, schools, and religious and traditional institutions should specifically address the fecal-soil-human transmission pathway, hand hygiene after dog contact, and safe supervision of child-dog interaction.
iii. Community-based responsible dog ownership programs, including registration and human population control (e.g., Trap-Neuter-Return approaches), should be implemented to reduce the uncontrolled stray dog reservoir.
iv. Given the statistically significant urban-rural disparity in human infection prevalence, mobile veterinary services and community health worker programs should be prioritized for rural communities in Adamawa State.

Acknowledgement

The authors acknowledge the technologists at the zoology department of Modibbo Adama University, Yola, for their efforts in this study.

Conflict of interest

The authors declare no conflict of interest.

References

Abayomi, K. O. (2016). Prevalence and seasonal variations of parasitic diseases in dogs presented at small animal clinic of veterinary Teaching Hospital, University of Ibadan, Ibadan, Nigeria between 2001 and 2005. *International Journal of Livestock Research, 6*(12): 39-45.

Adeiza, A. M., Sani, N. A., Alhaji, N. B., Godwin E. A., Okwolo, E. C., & Uchendu, G. (2023). Prevalence and Diversity of Zoonotic protozoa in dogs in Lokoja, North Central Nigeria. *Sahel Journal of Veterinary Sciences, 20*(4), 34–40.

Amadi, A., Obeten, P., & Chukwuemeka, B. (2021). Prevalence of Helminths Parasites among Dogs and Risk Factors of Zoonotic Infections by Dog Owners in Bende Local Government Area, Abia State, Nigeria. *Nigerian Journal of Parasitology, 42*(2): 275–286.

Amissah-Reynolds, P. P., Addo, K., Ofori, S., Owusu, C., Abdul-karim, Z., & Opoku, F. (2026). Molecular and serological surveillance of toxocariasis in humans and dogs in Ghana. Discover Animals, 3 Article 43.

Anjorin, O. J., Galtima, M., & Ray, H. H. (2022). Analysis of the spatial pattern of public education resources in Adamawa State, Nigeria. *Ethiopian Journal of Environmental Studies and Management, 15*(2): 140-154.

Bukar, H. A, & Naphtali, G. (2024). A geographic information system base spatial decision support system for poverty analysis and management in Adamawa State, Nigeria. *International Journal of Research and Scientific Innovation, 11*(8), 134-146.

Cheesbrough, M. (2004). District Laboratory practice in tropical countries. *Cambridge University Press*, UK pp205-215.

Dixon, B. R. (2021). *Giardia duodenalis* in humans and animals Transmission and Disease. *Research in Veterinary Science, 135*: 283-289.

Gado, D. A., Ehizibolo, D. O., Meseko, C. A., Anderson, N. E., & Lurz, P. W. W. (2023). Review of Emerging and Re-emerging Zoonotic Pathogens of Dogs in Nigeria: Missing Link in One Health Approach. Zoonotic *Diseases, 3*(2), 134-161.

Jajere, S. M., Lawal, J. R., Shittu, A., Waziri, I., Goni, D. M., & Fasina, F. O. (2022). Epidemiological study of gastrointestinal helminths among dogs from Northeastern Nigeria: a potential public concern. *Parasitology Research, 121*(7): 2179-2186.

Karshima, S. N., Bata, S. I., Bot, C., Kujul, N. B., Paman, N. D., Obalisa, A., Karshima, M. N., Dunka, H. I., & Oziegbe, S. D. (2020). Prevalence, seasonal and geographical distribution of parasitic diseases in dogs in Plateau State Nigeria: a 30-year retrospective study (1986-2015). *Journal of Parasitic Diseases:official Organ of the Indian Society for Parasitology, 44*(3): 511-520.

Lawal, J. R. (2023). Prevalence, public health importance and risk factors associated with gastrointestinal helminths of domesticated canines (*Canis familiaris*) from Yobe State, Nigeria. *Arid Zone Journal of Basic and Applied Research*, 2(2): 69-82.

Marinov, M., Ionica, A. M., Maftei, D. N., Bolboaca, L. E., Dorosencu, A., Tudor, M., & Alexe, V. (2026). Assessing hygiene and zoonotic risk perception in the Danube Delta: insights from the pre and early-COVID-19nperiods. *Frontiers in Veterinary Science, 13*, 1794566.

Mathias, A., Pukuma, S. M., & Enock, N. (2023). Prevalence of *Echinococcus granulosus* in Stray and Home Owned Dogs in Adamawa State, Nigeria. *FUDMA Journal of Sciences, 7*(1): 267-270.

Mubarak, A. G., Mohammed, E. S., Eladli, H., Alzaylaee, H., Hamad, R. S., Elkholy, W. A., & Youseef, A. G. (2023). Prevalence and risk factors associated *Toxocara canis* in dogs and humans in Egypt: A comparative approach. *Veterinary Medicine and Science, 9*(6): 2475-2484.

Rousseau, J., Castro, A., Novo, T., & Maia, C. (2022). *Dyplidium caninum* in the twenty-first century: epidemiological studies and reported cases in companion animals and humans. *Parasites and Vector, 15*(1): 131.

Santos, K. N., Viozzi, G. P., & Flores, V. R. (2021). Dog care and parasitosis in a rural community of Patagonia: an integrative approach. *Veterinary Parasitology, Regional Studies and Reports, 25*, 100583.

Thomas, T., & Mohammed, Q. (2019). Seroprevalence Study on Human Toxocariasis (*T. canis*) with Relation to Religion Using ELISA Technique: A case Study of Six Government Hospitals Adamawa state, Nigeria. *Journal of Biology, Agriculture and Healthcare, 9*(10).

Thrusfield, M. (2005). Veterinary epidemiology. Singapore.. Retrieved from: https://www.wiley.com/en-au/Veterinary+Epidemiology%2C+3rd+Edition-p9781118713419. on January 18, 2026.

Ugbomoiko, D. O., Olley, M. C., Aldejare, A. A., Ojo, B. O., & Oguntunnbi D. E. (2024). Prevalence of *Toxoplasma gondii* and *Toxocara canis* antibodies among dog owners of dogs and cats in Ekiti state Nigeria. *International Journal of Pharmaceutical and Bio-Medical Science, 4*(11): 889-894.