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REVIEW

Prevalence Study of Gastrointestinal Helminth in Domestic Dogs *(Canis familiaris)* Slaughtered in Selected Abattoirs in Plateau State, Nigeria

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Abstract:

Being that dogs are domestic animals to man, they are also consumed as meat. This study therefore aimed to determine the presence of gastrointestinal helminth of dogs in the two Local Government Areas of Plateau State, Nigeria namely Jos South and Pankshin and also to identify possible risk factors of zoonosis. Gastrointestinal content of 228 slaughtered dogs in abattoirs were selected randomly from Unguwarkare in Jos South and Kurum, in Pankshin LGAs. Samples were conveyed to the parasitological division of the National Veterinary Research Institute (N.V.R.I) Vom, Plateau State, Nigeria for analysis. The Post-mortem Differential Parasite Counts procedure as described by the Food and Agriculture Organization (FAO) was used for the analysis. Of the total 228 feacal samples analysed, 138 (60.53%) were positive for at least one of the intestinal parasites. Among the gastrointestinal helminth, *Taenia pisiformis, Dipylidium caninum* and *Echinococusgranulosus* were the cestodes recorded with prevalence of 36.84%, 12.72% and 1.75% respectively. Nematodes recorded were *Ancylostoma caninum* (3.51%), *Toxocaracanis* (4.83%) and *Trichurisvulpis* (0.88%).

However, from the 114 samples collected from Unguwarkare study area, 77(67.54%) were positive for the various intestinal helminthes which include Taenia spp. (42.98%), *D. caninum* (1316%) and *E. granulosus* (2.63%). As for the nematodes, *A. caninum, T. canis* and *T. vulpis* recorded 3.51%, 2.63% and 0.88% prevalences respectively. The parasites recorded from the remaining 114 samples analysed at Kurum include 28.95% *T. pisiformis,* 12.28% *D. caninum* and 0.88% *E. granulosus* while the nematodes recorded were*T. Canis* (7.02%), *A. caninum* (3.51%) and *T. vulpis* (0.88%). The study revealed the presence of zoonotic gastrointestinal helminthes in dogs in the study areas with highest infection rate recorded at Unguwarkare in Jos South LGA compared with those of Kurum community of Pankshin LGA. Therefore, the general public in the said areas are at high risk of being infected with any of the zoonotic parasites.

Keywords: Dogs, gastrointestinal, helminth, prevalence, zoonosis, Unguwarkare, Kurum, Jos south, Pankshin.

Introduction

Zoonotic infections are infections of animals that are transmissible to humans. These infections may be caused by viruses, bacteria, parasites or fungi. Zoonotic infections are known to be among the most common on earth and are responsible for over 60% of human infectious diseases [1].

Domestic and wild dogs are known to harbor some parasites that may directly or indirectly be transmitted to humans as well as other animals [2]. These parasites include Taenia spp., *Echinococusgranulosus, Ancylostoma caninum, Toxocaracanis, Dipylidium caninum*, *Isospora*spp., *Babesia* spp., *Hepatozoancanis*, *Erlichia*spp. and *Dirofilaria*spp [3,4 and5].

Human infection with helminthes parasites may occur from close association with dogs or ingestion of contaminated food or drink containing the infective stage of the parasite, thus leading to diseases like the visceral and ocular migrants caused by *T. canis* and cutaneous larval migrants caused by *A. brasiliense* [6].

In Nigeria, gastrointestinal helminthes parasites of dogs are currently endemic in 20 of the 36 States [7,8]. Some of the emerging infections are due to the prevailing socio-economic conditions in Nigeria which have made it difficult for many dog owners to adequately provide food, shelter and basic health needs for their dogs. These have resulted in increased number of dogs scavenging for food on the streets and increasing the risk of human infection among the communities.

The effects of parasites on dogs and their owners are in two fold. Parasites can cause poor performance in infected animal leading to gross economic loss. Secondly, they can transmit diseases that may infect man. It is therefore imperative to understand the type of parasite infecting dogs at any point in time since dog parasites like most other parasites have become dynamic in their distribution depending on a variety of constantly changing environmental factors that makes control difficult [10]. This is particularly important in Plateau State, Nigeria where dogs are not only kept as companion animal but as a source of meat.

Materials and methods

Study areas

The study was conducted in two selected Local Government Areas of Plateau State namely, Jos south and Pankshin LGAs.

Unguwarkare dog abattoir is located in Jos south LGA. The LGA is on coordinate 9°48'00″N 8°52'00″E and occupies an area of 5,104km^2 (1,971m^2). It has a population of 306,716 at the 2006 census and Berom is the major ethnic group that thrives mainly on farming and mining. The LGA has a cool climatic condition due to its high altitude of about 1.7766m (5829 ft) above sea level. Coldest periods are between November and February with an average mean daily temperature of 18^{0}C, 30.4^{0}C in March and 12.7^{0}C in January [11].

While Kurum dog abattoir is located in Pankshin LGA. The LGA occupies an area of about 1,524 km^2 and has a population of 191,685 as at 2006 census. Ngas is the major tribe spoken beside chip and Mupun. Ngas people thrive mainly by agriculture.

Sampled population

The sampled population was made up of dogs meant for slaughter at Unguwarkare and kurum slaughter slabs. Dogs of all breeds, age and sex were sampled during the study.

Sample collection

The gastro-intestinal content of the slaughtered dogs was collected after ligating the gastro-esophageal to recto- junctions. The whole content is poured into a labelled polythene bag and transported in ice parked thermo-cooler flask at -4^{0}C to the Parasitological Department of the National Veterinary Research Institute (NVRI) Vom, Plateau State, Nigeria for analysis. Periodical sample collection was done between August 2015 and April 2016 until a total of 228 samples were collected.

Examination of faecal sample

Faecal samples were examined by the post-mortem differential parasite counts as described by Food and Agriculture Organization [12].

The preserved intestinal content was poured into a total content jar and the remaining washing with water added to make 3 litre total of volume of content. Using a ladle, the content is vigorously stirred until all the materials are mixed. Two hundred (200ml) of the content was then transferred to the wash jar in 5 steps of 40 ml per step and the mixing continuous using the ladle container. The content in the wash jar was further more filed with water and then secured by screwing the lid. The inverted jar was shaken until much of the fluid was shaken out. The process was repeated until all faecal culture matter was removed. The mixture was stained with Lugols iodine and parasites present were identified and counted. Classification of the worms was done using keys provided by [13].

Statistical analysis

Data generated from the study were analyzed using Statistical Package for Social Sciences (SPSS) Computer software, version 20. Chi-square test was used to test association between the prevalence of intestinal helminthes of dogs with factors such as age, sex, breed, season and study area of the sampled dogs. In all cases, 95% confidence intervals and $p<0.05$ were set for significance.

Prevalence was calculated by dividing the number of sampled dogs harbouring any parasite by the total dogs examined and multiplied by one hundred [14].

Results

The overall prevalence of gastrointestinal helminthes among the 228 sampled dogs in both Uguwankare and Kurum slaughter slabs was 60.53% (138/228) (Table 1). Out of this, the prevalence of cestodes was as follows: *T. pisiformis (36.84%), D. caninum* (12.72%) and *E. granulosus (*1.75%). Nematodes encountered were *T. canis* (4.83%), *A. caninum* (3.51%) and *T. vulpis* (0.88%). There was a significant difference in the prevalence of cestodes and nematodes among sampled dogs ($p<0.05$). The prevalence of mixed infection resulting from infection by more than one helminth was 3.95% (9/228). Worm burden data shows that out of the total 2,593 worms collected from the 228 sampled dogs, 1,865 (71.92%) were *T. pisiformis,* 351 (13.54%) *D. caninum,* while *A. caninum* and *T. canis* were 162(6.25%) and 164 (6.32%) respectively. *T. vulpis* and *Echinococusgranulosus* accounting for 1.12% (29) and 0.85% (22) of the total worm burden among the sampled dogs.

Table 1: Overall prevalence of intestinal parasites in dogs slaughtered at Unguwan kare and Kurum abattoirs

Intestinal Parasites	No. of dogs examine	No. of Dogs Infected	% No. of Dogs Infected	No. of worms Collected	Relative %
Cestodes					
Taenia pisiformis		84	36.84	1,865	71.92
Dipylidium caninum		29	12.72	351	13.54
Echinococus granulosus		04	01.75	22	00.85
Nematodes					
Ancylostoma caninum		08	03.51	162	06.25
Toxocara canis		11	04.83	164	06.32
Trichuris vulpis		02	00.88	29	01.12
**Co- infection*		09	03.95		
Total	**228**	**138**	**60.53**	**2,593**	**100**

*non-additive

χ^2=214.26 , df= 5 , p-value=0.00

The prevalence of gastrointestinal helminthes among the 114 sampled dogs at Unguwankare was 67.54% (77/114) (Table 2). Out of this, 51(44.74%) of the sampled dogs were infected with *T. pisiformis*, 15(13.16%) *D. caninum* and 3(2.63%) *E. granulosus.* The prevalence of nematodes was 4(3.51%) *A. caninum,* 3(2.63%) *T. canis* and 1(0.88%) *T. vulpis.* Cestodes infection in dogs at Kurum was 33(28.95%) *Taenia spp.* 14(12.28%) *D. caninum* and 1(0.88%) *E. granulosus* while *T. canis,A. caninum* and *T. vulpis*had prevalence of 7.02%, 3.51% and 0.88% respectively.

Co-infection in Unguwarkare was 2.63% at Unguwankare and 5.26% at Kurum. The parasite distribution differ significantly ($p<0.05$) in both study areas with infection rate (67.54%) been recorded at Unguwarkare than at Kurum (53.51%) slaughter slabs.

Table 2: Distribution of intestinal-parasites of slaughtered dogs in Unguwan kare and Kurum abattoirs

	Study Location (n=228)			
	Unguwan kare (n=114)		Karum (n=114)	
Intestinal Parasites	**No. of dogs Infected**	**% Infection**	**No. of Dogs Infected**	**% Infection**
Cestodes				
Taenia pisiformis	51	44.74	33	28.95
Dipylidium caninum	15	13.16	14	12.28
Echinococus granulosus	03	02.63	01	00.88
Nematodes				
Ancylostoma caninum	04	03.51	04	03.51
Toxocara canis	03	02.63	08	07.02
Trichuris vulpis	01	00.88	01	00.88
**Co- infection*	03	02.63	06	05.26
Total	**77**	**67.54**	**61**	**53.51**

*non-additive

χ^2=4.70 , df= 1 , p-value=0.0302

Table 3 shows the distribution of gastrointestinal helminthes among dogs by age group. No significant difference was observed in the prevalence of parasites recorded among the age group (p>0.05), although younger dogs aged ≤2 years recorded relatively higher prevalence (61.11%) than dogs that are older (>2years) with prevalence of 60.14%. Among dogs aged ≤2 years, *T.pisiformis* has the highest prevalence of 41.11% while *D. caninum* was found to infect only 12.22% of the sampled dogs in this age group. However, no case of *E. granulosus* was recorded among dogs of ≤2 years, although dogs aged >2years harboured the parasite.

Taenia pisiformis and *D. caninum* were the commonest parasite species among dogs >2 years with prevalence of 34.06% and 13.04% respectively. *Echinococusgranulosus* which was not recorded among dogs ≤2 years had a prevalence of 2.90% among older dogs (>2years).

With regards to nematodes infection, both young (≤2 yrs) and old (>2yrs) dogs were infected by *A. caninum, T. canis*and *T. vulpis.* The prevalence of the three (3) nematodes among younger dogs was *A. caninum;* 2.22%, *T. canis;* 4.44% and

*T. vulpis*1.11%. Similarly, prevalence among the older dogs was *A. caninum;* 4.35%, *T. canis;* 5.07% and *T. vulpis;* 0.72%.

There was no significant difference in the distribution of helminths across different age group.

Table 3: Distribution of gastrointestinal parasites of dogs based on age

	Age					
	≤ 2 yrs			**>2 yrs**		
Intestinal Parasites	**No. of dogs examined**	**No. of dogs Infected**	**% Infected**	**No. of Dogs Examined**	**No of dogs Infected**	**% Infected**
Cestodes						
Taenia pisiformis		37	41.11		47	34.06
Dipylidium caninum		11	12.22		18	13.04
Echinococcus granulosus		-	-		04	02.90
Nematodes						
Ancylostoma caninum		02	02.22		06	04.35
Toxocara canis		04	04.44		07	05.07
Trichuris vulpis		01	01.11		01	00.72
**Co- infection*		03	03.33		06	04.35
Total	**90**	**55**	**61.11**	**138**	**83**	**60.14**

*Non additive

χ^2=0.021 , df=1 , p-value=0.884

The analysis of helminths among dogs based on sex is presented in Table 4. Female dogs had significantly higher infection rate (65.38%) than male dogs (55.10%). Among the cestodes found to infect male dogs, *Taenia pisiformis* infect 34.69%, *D. caninum* 11.22% and in *E. granulosus* 1.02%. Nematodes recorded among male dogs were *A. caninum* and *T. Canis* with infection rate of 4.08% each. Among the female dogs, *T. Pisiformis* also recorded the highest prevalence of 38.46%, *D. caninum* with 13.85% and 2.31% *E. granulosus* 2.31%. While nematodes infection due to *T. Canis* recorded the highest prevalence of 5.38% followed by *A. caninum* and *T. Vulpis* with prevalence of 3.08% and 1.54% respectively. Mixed infection accounted for 3.06% in the male and 4.62% in the female dogs.

Table 4: Distribution of gastrointestinal parasites of dogs based on sex

	Sex					
	Male			Female		
Intestinal Parasites	**No. of dogs examined**	**No. of dogs Infected**	**% Infected**	**No. of Dogs Examined**	**No of dogs Infected**	**% Infected**
Cestodes						
Taenia pisiformis		34	34.69		50	38.46
Dipylidium caninum		11	11.22		18	13.85
Echinococus granulosus		01	01.02		03	02.31
Nematodes						
Ancylostoma caninum		04	04.08		04	03.08
Toxocara canis		04	04.08		07	05.38
Trichuris vulpis		-	-		02	01.54
**Co- infection*		03	03.06		06	04.62
Total	**98**	**54**	**55.10**	**130**	**85**	**65.38**

*non-additive

χ^2=2.482 , df=1, p-value=0.115

The distribution of gastrointestinal helminths in relation to dog breed in the study area is presented on Table 5. Among the local dog breed examined 136(62.39%) were infected by the cestodes and nematodes. Eighty three (38.07%) of the dogs were infected by *Taenia spp.*, 28(12.84%) *D. caninum* and 4(1.83%) by *E. granulosus*. While *T. canis* were infected by 11(5.05%), 8(3.67%) by *A. caninum* and 2 (0.92%) by *T. vulpis*. Among the mixed dog breed examined 2(28.57%) were found to be infected by Taenia spp., (14.29%) and *D. caninum* (14.29%). Although, neither the exotic nor mixed dog breeds recorded mixed infection by the various gastrointestinal helminths recorded. Nine (4.13%) of the local dogs harbour mixed infection. Statistical analysis showed that local dog breeds significantly ($p<0.05$) had higher prevalence of gastrointestinal helminths than other breeds of dogs in this study.

Table 5: Distribution of gastrointestinal parasites of dogs based on breed

	Breed								
	Local			Exotic			Mixed		
Intestinal Parasites	**No. of dogs examined**	**No. of dogs Infected**	**% Infected**	**No. of dogs examined**	**No. of dogs Infected**	**% Infected**	**No. of Dogs examined**	**No of dogs Infected**	**% Infected**
Cestodes									
Taenia pisiformis		83	38,07	-	-	-	-	01	14.29
Dipylidium caninum		28	12.84	-	-	-	-	01	14.29
Echinococus granulosus		04	01.83						
Nematodes									
Ancylostoma caninum		08	03.67						
Toxocara canis		11	05.05						
Trichuris vulpis		02	00.92						
**Co-infection*		09	04.13						
Total	**218**	**136**	**62.39**	**03**			**07**	**02**	**28.57**

*non-additive

χ^2=232.54 , df=5 , p-value=0.00

Analysis of seasonal data shows that 80/114(70.18%) of the sampled dogs were infected in the wet season while 58/114(50.63%) infection occured in the dry season (Table 6). In the wet season, Taenia spp. had the highest prevalence of 38.60% followed by *D. caninum* and *E. granulosus* with prevalence of 22.50% and 2.63% respectively. While the prevalence of*T. canis, A. caninum* and *T. vulpis* within the same period was 10.00%, 6.25% and 2.50%. Mixed infection with the various helminths was 7.50%. Relatively lower prevalence (50.63%) of the helminths was recorded among dogs examined during the dry season. Cestodes recorded were Taenia spp. 35.09%, *D. caninum* 18.97% and *E. granulosus* 0.88%.

Ancylostoma caninum and *T. Canis* recorded prevalence of 3.51% each. The prevalence of mixed infection was 2.03%.

The prevalence of gastrointestinal helminths in dogs between wet and dry seasons were found to be significant ($p<0.05$) with more cases been recorded in the wet than in the dry season.

Table 6: Seasonal distribution of gastrointestinal parasites in dogs at Unguwar kare and Kurum slaughter slabs.

	Season (n=228)			
	Wet (n=114)		**Dry(n=114)**	
Intestinal Parasites	**No. of dogs Infected**	**% Infected**	**No. of Dogs Infected**	**% Infected**
Cestodes				
Taenia pisiformis	44	38.60	40	35.09
Dipylidium caninum	18	22.50	11	18.97
Echinococus granulosus	03	02.63	01	00.88
Nematodes				
Ancylostoma caninum	05	06.25	03	02.63
Toxocara canis	08	10.00	03	03.63
Trichuris vulpis	02	02.50	-	-
**Co- infection*	06	07.50	03	02.63
Total	**80**	**70.18**	**58**	**50.63**

*non-additive

$\chi^2=8.885$, df= 1 , p-value=0.0029

Discussion

The overall prevalence of gastrointestinal helminths obtained in this study is relatively low when compared to reports from other parts of Jos, Nigeria where prevalence was 100% [11] and in Ibionu LGA of Akwaibom State, Nigeria where prevalence was 74% [15]. However, it is relatively low when compared with

reports of [16] in Calabar, [17] in Ile-ife, [18] in Ilorin, [19] in Owerri and [20] in Zuru, Kebbi State, Nigeria.

Variability in access to veterinary services, housing, difference in socio-economic status of dog keepers, personal and environmental hygiene may have contributed to differences in prevalences of intestinal helminths among dogs in different parts of Nigeria and in the study areas in particular.

This disparity in prevalence of intestinal parasite observed among local, cross and exotic breeds of dogs in the present study may be associated with differences in observance of treatment regimen for intestinal helminths. Exotic and cross breed dogs are usually acquired as pets or for security and usually at high cost. Keepers of such dogs invest much ensuring that they are in good health by providing adequate health care through regular deworming and other treatments. While local dog keepers show great negligence to the health of their dogs. The constant exposure of local breeds of dog has been reported to result in the development of environment-based immunity acquired from trickle infectious agents common to an area [21].

Wet and humid conditions which are characteristics of wet seasons in Nigeria are known to create conducive environment for parasites that spent part of their life cycle in the external environment. The significantly high prevalence ($p<0.05$) of intestinal helminths in dogs during the wet season is reflective of the favourable conditions which abounds during this season in Nigeria. This however contrasts dry season which is usually characterized by dry and hot air, high temperature that makes survival of the larval stages difficult. In addition, many helminths undergo hypobiosis to overcome the harsh environmental conditions of the dry season.

The prevalence, density and species composition of parasites observed in dogs in both study areas reflects the degree of endemicity of these parasites and the level of inequalities in the health care service between the study areas. Of significance, is the zoonotic effect of dog roundworm (*T. canis*) in human which may cause visceral larva migrans and in severe cases blindness in infected persons[23], dog hookworm (*A. caninum*) infection endanger humans with the risk for cutaneous larva migrans commonly associated with endemic resource poor communities [22]; dog tapeworm (*E. granulossus*) infection responsible for hepatic and pulmonary pathology, cystecercosis which is a major cause of seizures and epilepsy in humans especially children [20].

This study therefore recommends periodic and continuous sensitization and surveillance to detect parasites of zoonotic significance, adequate cooking of dog meat before consumption, restriction of stray dogs and periodic environmental sanitation should be enforced by the Government of Plateau State, Nigeria. Further study could be carried out on humans associated with dog keeping or handling to determine the level of dog associated human infections in Plateau State, Nigeria.

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