

# DIVERSITY OF GASTROINTESTINAL PARASITES AFFECTING SOME DOMESTIC ANIMALS IN PLATEAU STATE, NORTH CENTRAL NIGERIA

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## ABSTRACT

Gastrointestinal parasitism is of great concern to the health, production potential and draft ability of animals. This study was conducted to investigate and provide additional information on the diversity and prevalence of gastrointestinal parasites affecting animals in Nigeria with emphases on Plateau State, North-central Nigeria. Faecal samples from 1,174 animals (avian 362, cattle 295, goats 147, sheep 120, pigs 54, dogs 88, rabbits 49 and rats 59) were subjected to floatation and sedimentation techniques. A variety of gastrointestinal parasites ranging from cestodes, trematodes, nematodes and protozoans were detected in the screened animals. *Ascaridia galli* and *Eimeria tenella* were the most prevalent gastrointestinal parasite found in avian species. *Strongyloides papillosus*, *Strongyle* species and *Oesophagostomum radiatum* were the most significant affecting cattle, while *Strongyle* species were the most prevalent in goats. Amongst sheep, *Moniezia expansa* and *Cysticercus hydatigena* were the most plenteous. *Hyostrogylus rubidus*, *Ancylostoma caninum*, *Eimeria* species and *Hymenolepis nana* were the most prevalent gastrointestinal parasites of pigs, dogs, rabbits and rats respectively. The result of this study shows that a variety of gastrointestinal parasites are found to infect animals in Plateau State, North Central Nigeria. There is therefore a great need to curtail the effect of gastrointestinal parasites in animals so as to maximize production among animals and thereby increase the nation's income from the animal sector.

**Key words:** Gastrointestinal parasites, diversity, prevalence, animals, Plateau state

## INTRODUCTION

Gastrointestinal parasite infections inflict a major constraint to animals' well-being and productive performance (Regassa *et al.*, 2006; Adedipe *et al.*, 2014). Lowered fertility, reduced work capacity, involuntary culling, a reduction in food intake and lower weight gains, reduction in lower milk production, treatment costs, and mortality in heavily parasitized animals are some of the ways gastrointestinal parasites inflict animal health and production (Regassa *et al.*, 2006). Predisposing factors of gastrointestinal parasite infections are grazing habits, climatic condition (temperature, rainfall and humidity), nutritional deficiency, poor management practice (improper care of animals, unhygienic environment etc), pasture management, immunological status, vector, presence of intermediate host, the number of infective larvae and eggs in the environment and close contact with infected animals (Adedipe *et al.*, 2014; Jegede *et al.*, 2015).

Gastrointestinal parasitic infections such as helminthoses and coccidiosis are world-wide problems to some animals, but their impact is greater in Sub-Saharan Africa due to the availability of a wide range of agro-ecological factors suitable for diversified hosts and parasite species (Regassa *et al.*, 2006; Owhoeli *et al.*, 2014). Gastrointestinal parasites are known to be widespread in Nigeria (Adedipe *et al.*, 2014; Owhoeli *et al.*, 2014; Jegede *et al.*, 2015). Losses due to gastrointestinal tract (GIT) parasitism can be classified as direct or indirect in effect (Jegede *et al.*, 2015). Direct losses are due to acute illness and death, forced premature slaughter and rejection of parts of the carcass at meat inspection in abattoirs. Acute parasitic conditions can be recognized, and affected animals are generally treated by the farmer and thus direct losses can be avoided (Jegede *et al.*, 2015). In contrast, sub-clinical levels of parasitism cause indirect and more subtle losses and do not induce obvious clinical signs (Barger *et al.*, 1994). This type of parasitism is regarded as the most important cause of economic loss, as it is a flock or herd problem, unlike the acute syndrome, and tends to affect animals on a low plane of nutrition as well as lactating animals (Ndarathi *et al.*, 1989). Subclinical levels of parasitism reduce potential productivity of animals and reduce feed conversion (Ndarathi *et al.*, 1989). It is difficult to assess the economic effects of such subclinical infections but it is important to quantify them.

Proper understanding of the diversity, prevalence, distribution and risk factors of disease causing agents is an important prerequisite for the rational design of effective preventive and control programme against such disease. Although studies have been carried out with respect to diversity and prevalence of gastrointestinal parasites in animals in Nigeria, most of the studies are confined to a limited species of animals, hence the need for an extension of such studies to more animal species. This study is therefore targeted at investigating the diversity and prevalence of gastrointestinal parasites of animals in Plateau State so as to provide relevant information in this regard.

## MATERIALS AND METHODS

### Study area

This study was carried out in Jos North local government area of Plateau State, North-central Nigeria. Jos North covers an area of 291 square kilometers with a population of 429,300 at the 2006 census (NBS, 2012). Plateau State covers an area of 27,147 square kilometers and is one of the largest state in Nigeria, and is almost centrally located between latitude 8° 24' N and longitude 8° 32' and 10° 38' east of the Greenwich meridian. The state has a high altitude ranging from approximately 1,200 to a peak of

1,829 meters above sea level. Plateau state has a near temperate climate with a mean annual rainfall of between 131.75 cm to 146 cm and an average annual temperature ranging between 16.3°C and 28.1°C. It records a mean relative humidity of between 46.9% and 51.3% (NBS, 2012; Bolajoko *et al.*, 2016).

**Sampling and processing**

Briefly, fecal samples from 1,174 animals (avian 362, cattle 295, goats 147, sheep 120, pigs 54, dogs 88, rabbits 49 and rats 59) raised in Jos North local government Area were submitted to the Parasitology laboratory of the National Veterinary Research Institute, Vom, for gastrointestinal parasite screening. The samples were submitted between January and December 2012. Microscopic examinations of faecal samples were carried out after using standard laboratory methods of floatation and sedimentation techniques as described by Cheesbrough (2005). Eggs or oocysts were viewed using the light microscope at x 40 objective and identified as described by Soulsby (1986) and Urquhart *et al.* (1987).

**Statistical analysis**

Data was analyzed using descriptive statistics that was conducted using percentages and tabulations. The 95% confidence interval was used to determine the range in the level of prevalence of each gastrointestinal parasite. All statistical tests were conducted using statistical package for social sciences (SPSS) version 22 (SPSS Inc., Chicago).

**RESULTS**

Of the 1,174 animal faeces that were screened, avian faecal sample were the most numerous been 362 (30.83 %; 95 % CI: 28.24 – 33.52), followed by that of cattle and goats been 295 (25.13 %; 95 % CI: 22.71 – 27.67) and 147 (12.52 %; 95 % CI: 10.72 – 14.51) respectively. Rabbits and pigs faecal samples were the least numerous been 49 (4.17 %; 95 % CI: 3.14 – 5.44) and 54 (4.60 %; 95 % CI: 3.51 – 5.92) respectively Table 1.

The diversity and prevalence of gastrointestinal species of animals in Plateau State, North Central Nigeria is presented in Table 2. Four genera of helminth and a genus of enteric protozoa were detected among avians in our study with *Ascaridia galli* (21/362; 5.8 %; 95 % CI: 3.72 – 8.58) been the most prevalent helminth and *Eimeria tenella* (16/362; 4.42 %; 95 % CI: 2.64 – 6.93) been the most prevalent protozoan.

**Table 1:** Demographic information of animals studied for gastrointestinal parasites in Plateau State, North Central Nigeria.

Species	Number of animals	Percentage (%)	95 % CI
Avian	362	30.83	28.24 – 33.52
Cattle	295	25.13	22.71 – 27.67
Goats	147	12.52	10.72 – 14.51
Sheep	120	10.22	8.59 – 12.05
Pigs	54	4.60	3.51 – 5.92
Dogs	88	7.50	6.09 – 9.11
Rabbits	49	4.17	3.14 – 5.44
Rats	59	5.03	3.88 – 6.39
<b>Total</b>	<b>1,174</b>		

CI = Confidence Interval

**Table 2:** Diversity and Prevalence of gastrointestinal parasites of animals in Plateau State, North Central Nigeria

Animal (Number)	Gastrointestinal Parasite	Number Infected	Prevalence (%)	95 % CI
Avian (362)	<i>Eimeria tenella</i>	16	4.42	2.64 – 6.93
	<i>Eimeria necatrix</i>	13	3.59	2.01 – 5.91
	<i>Eimeria maxima</i>	15	4.14	2.43 – 6.59
	<i>Eimeria mitis</i>	14	3.87	2.22 – 6.25
	<i>Ascaridia galli</i>	21	5.80	3.72 – 8.58
	<i>Heterakis gallinarum</i>	1	0.28	0.01 – 1.36
	<i>Davainea proglottina</i>	1	0.28	0.01 – 1.36
	<i>Railiitina</i> specie	2	0.55	0.09 – 1.81
	Cattle (295)	<i>Toxocara vitulorum</i>	10	3.39
<i>Bunostomum phlebotomum</i>		2	0.68	0.11 – 2.22
<i>Eimeria bovis</i>		4	1.36	20.43 – 3.24
<i>Fasciola gigantica</i>		2	0.68	0.11 – 2.22
<i>Moniezia benedeni</i>		3	1.02	0.26 – 2.74
<i>Moniezia expansa</i>		5	1.69	0.62 – 3.72
<i>Oesophagostomum radiatum</i>		45	15.25	11.49 – 19.72
<i>Paramphistomum cervi</i>		10	3.39	1.73 – 5.96
<i>Strongyloides papillosus</i>		56	18.98	14.81 – 23.76
<i>Strongyle</i> type eggs		47	15.93	12.08 – 20.45
Goats (147)	<i>Dicrocoelium dendriticum</i>	12	8.16	4.50 – 13.46
	<i>Eimeria</i> specie	2	1.36	0.23 – 4.42
	<i>Haemonchus contortus</i>	3	2.04	0.52 – 5.45
	<i>Paramphistomum cervi</i>	4	2.72	0.87 – 6.43
	<i>Fasciola gigantica</i>	3	2.04	0.52 – 5.45
	<i>Moniezia expansa</i>	6	4.08	1.67 – 8.29
	<i>Oesophagostomum columbianum</i>	30	20.41	14.48 – 27.50
	<i>Strongyloides papillosus</i>	15	10.20	6.05 – 15.92
	<i>Strongyle</i> type eggs	71	48.30	40.29 – 56.37
	Sheep (120)	<i>Eimeria</i> species	15	12.5
<i>Haemonchus contortus</i>		10	8.33	4.31 – 14.35
<i>Trichostrongylus</i> species		56	46.67	37.87 – 55.62
<i>Trichuris globulosa</i>		3	2.50	0.64 – 6.65
<i>Moniezia expansa</i>		76	63.33	54.44 – 71.59
<i>Cysticercus hydatigena</i>		88	73.33	64.89 – 80.66

**Table 2:** continued

Animal (Number)	Gastrointestinal Parasite	Number Infected	Prevalence (%)	95 % CI
Pigs (54)	<i>Hyostrongylus rubidus</i>	12	22.22	12.64 – 34.72
	<i>Trichuris suis</i>	4	7.41	2.40 – 16.91
	<i>Paragonimus</i> specie	2	3.70	0.63 – 11.70
	<i>Ascaris suum</i>	3	5.56	1.43 – 14.38
	<i>Bunostomium</i> specie	1	1.85	0.09 – 8.794
	<i>Oesophagostomum</i> specie	1	1.85	0.09 – 8.794
	<i>Strongyloides</i> specie	2	3.70	0.63 – 11.70
Dogs (88)	<i>Isopora</i> specie	24	27.27	18.75 – 37.27
	<i>Toxocara canis</i>	44	50.00	39.64 – 60.36
	<i>Taenia ovis</i>	16	18.18	11.15 – 27.28
	<i>Ancylostoma caninum</i>	60	68.18	57.92 – 77.26
Rabbits (49)	<i>Eimeria stiedae</i>	20	40.82	27.77 – 54.92
	<i>Eimeria magna</i>	16	32.65	20.67 – 46.63
	<i>Taenia</i> species	8	16.33	7.88 – 28.66
Rats (59)	<i>Hymenolepis nana</i>	6	10.17	4.23 – 19.95
	<i>Heterakis spumosa</i>	4	6.78	2.19 – 15.55
	<i>Eimeria</i> species	1	1.69	0.08 – 8.08
	<i>Taenia</i> species	1	1.69	0.08 – 8.08

CI = Confidence Interval

*Heterakis gallinarum* (0.28 %) and *Davainea proglottina* (0.28 %) were the least prevalent helminth, while *Eimeria necatrix* (3.59 %) was the least prevalent protozoan detected. Fifty six of the 295 (18.98 %; 95 % CI: 14.81 – 23.76) cattle faeces screened were positive for *Strongyloides papillosus*, while 2 of the 295 (0.68 %; 95 % CI: 0.11 – 2.22) cattle faeces were positive for both *Bunostomum phlebotomum* and *Fasciola gigantica* respectively.

*Strongyle* like eggs (71/147; 48.30 %; 95 % CI: 40.29 – 56.37) and *Oesophagostomum columbianum* (30/147; 20.41 %; 95 % CI: 14.48 – 27.50) were the most prevalent gastrointestinal parasite eggs detected from goats while *Eimeria* species was the least prevalent (2/147; 1.36 %; 95 % CI: 0.23 – 4.42). Six gastrointestinal parasite species (*Eimeria* species, *Haemonchus contortus*, *Trichostrongylus* species, *Trichuris globulosa*, *Moniezia expansa* and *Cysticercus hydatigena*) were detected in sheep with *Cysticercus hydatigena* (88/120; 73.33 %; 95 % CI: 64.89 – 80.66) and *Moniezia expansa* (76/120 63.33 %; 95 % CI: 54.44 – 71.59) been the most prevalent, while *Trichuris globulosa* (3/120; 2.50 %; 95 % CI: 0.64 – 6.65) and *Haemonchus contortus* (10/120; 8.33 %; 95 % CI: 4.31 – 14.35) were the least prevalent. *Hyostromylus rubidus* (12/54; 22.22 %; 95 % CI: 12.64 – 34.72), *Ancylostoma caninum* (60/88; 68.18 %; 95 % CI: 57.92 – 77.26), *Eimeria stiedae* (20/49; 40.82 %; 95 % CI: 27.77 – 54.92) and *Hymenolepis nana* (6/59; 10.17 %; 95 % CI: 4.23 – 19.95) were the most prevalent gastrointestinal parasites detected in pigs, dogs, rabbits and rats respectively.

## DISCUSSION

The findings of this study shows that a large variety of gastrointestinal parasites that includes cestodes, trematodes, nematodes and protozoans affects animals in the study area, thus providing valuable information on the burden and economic losses incurred from these parasites on animals in Nigeria as these animals are basically raised for the purpose of production, security, hunting and income generation. The effect of gastrointestinal parasites on the production and welfare of animals makes it important to add to the existing knowledge about the diversity and prevalence of these parasites in animals in Nigeria. The large number of avian, cattle, goats and sheep samples presented during the study period may suggest that these are the most raised animal species in the area.

Eight gastrointestinal parasite species (*Eimeria tenella*, *Eimeria necatrix*, *Eimeria maxima*, *Eimeria mitis*, *Ascaridia galli*, *Heterakis gallinarum*, *Davainea proglottina* and *Raillietina* species) were detected from avians in this study. These species has been previously reported in Nigeria (Kolade & Agbolade 2014; Udoh et al., 2014). *Ascaridia galli* and *Eimeria* species were the most prevalent gastrointestinal parasites affecting avians in this study. Similar to our findings, Kolade & Agbolade (2014) and Udoh et al. (2014) reported *Ascaridia galli* and *Eimeria* species to be the most prevalent gastrointestinal parasites affecting avians in their respective works conducted in Kaduna state (north-central Nigeria) and Ogun state (south-west Nigeria) respectively. Both group of researchers also reported low prevalences of *Heterakis gallinarum*, *Davainea proglottina* and *Raillietina* species as we observed. This may imply that *Ascaridia galli* and *Eimeria* species are the major gastrointestinal parasites affecting birds in Nigeria. The high prevalence of *Strongyloides papillosus*, *Strongyle* species (as *Strongyle* type eggs) and *Oesophagostomum radiatum* seen in cattle from our study is similar to that of Adedipe et al. (2014) who reported that *Strongyle* species are the most prevalent gastrointestinal parasite affecting cattle in their work carried out in Ibadan Oyo State, Nigeria. Similarly, Biu et al. (2009) and Zawua et al. (2016) reported high prevalence of *Strongyloides* species and *Oesophagostomum* species respectively in their studies carried out in Bornu and Sokoto states respectively. The high prevalence of these helminths may be associated to the lifecycle of these parasites as they

(nematodes) do not need intermediate host in their life cycle and transmission.

From our study, *Dicrocoelium dendriticum*, *Eimeria* species, *Haemonchus contortus*, *Paramphistomum cervi*, *Fasciola gigantica*, *Moniezia expansa*, *Oesophagostomum columbianum*, *Strongyloides papillosus* and *Strongyle* species were the gastrointestinal parasites detected in goats, while *Eimeria* species, *Haemonchus contortus*, *Trichostrongylus* species, *Trichuris globulosa*, *Moniezia expansa* and *Cysticercus hydatigena* were detected in sheep. These parasites have been reported to affect goats and sheep in Nigeria (Owhoeli et al., 2014; Agbajelola & Falohun, 2015; Jegede et al., 2015; Okorafor et al., 2015). In line with our findings, Okorafor et al. (2015) reported that *Strongyle* species were the most prevalent gastrointestinal parasite affecting goats in their studies carried out in Oyo state. High prevalence of *Trichostrongylus colubriformis* has been reported among sheep in the Federal Capital Territory, Abuja (Jegede et al., 2015).

*Hyostromylus rubidus*, *Trichuris suis* and *Ascaris suum* were the most prevalent gastrointestinal parasites of pigs from our study. Similarly, Sowemimo et al. (2012) reported that *Trichuris suis* was the most prevalent gastrointestinal parasite affecting pigs in Oyo state, while Aiyedun & Oludairo (2016) documented that *Hyostromylus* species and *Ascaris suum* were the most prevalent gastrointestinal parasite of pigs in their study conducted in Kwara state, Nigeria. Interestingly, *Hyostromylus rubidus*, *Trichuris suis* and *Ascaris suum* were the only gastrointestinal parasites detected in a study carried out in Nsukka, South-East Nigeria by Wosu (2015). This suggests that these three parasites are the most endemic parasites of pigs in Nigeria.

*Isopora* species, *Ancylostoma caninum*, *Taenia ovis* and *Toxocara canis* were the gastrointestinal parasites detected in dogs from our study with *Ancylostoma caninum* and *Toxocara canis* been the most prevalent. Similar to our finding, *Ancylostoma caninum* and *Toxocara canis* has been reported to be the most prevalent gastrointestinal parasites of dogs in Nigeria (Adamu et al., 2012; Mustapha et al., 2016; Idika et al., 2017), Ghana (Johnson et al., 2015), Cameroon (Komtangi et al., 2005), Cuba (Puebla et al., 2015) and Mexico (Torres-Chablé et al., 2015).

*Eimeria* parasites were the most prevalent parasites of the rabbit gastrointestinal tract from our study. This may interpret that coccidiosis is the major gastrointestinal disease of rabbits in Nigeria and the tropics. *Hymenolepis nana* was the most prevalent gastrointestinal parasite of rats from our study. This Platyhelminthes has been reported to be an important parasite affecting the gastrointestinal tracts of rats in Nigeria (Ademola & Ola-Fadunsin, 2012; Egbunu & Dada, 2016), Addis Ababa (Gudissa et al., 2011), Malaysia (Siti Shafiyah et al., 2012) and India (Sharma et al., 2013). High prevalence of *Heterakis spumosa* has been reported among rats in Ibadan (Ayinmode et al., 2016); also Pakdel et al. (2013) reported *Heterakis spumosa* as one of the most prevalent helminth of rats in their study carried out in Iran.

## Conclusion

From this study, it shows that a variety of gastrointestinal parasites are found to infect domestic animals in Plateau State, North Central Nigeria. There is therefore a great need to curtail the effect and prevalence of gastrointestinal parasites in animals by carrying out periodic deworming programs and the practice of hygienic and good management practices, so as to maximize

production and draft purposes of animals and thereby increase the nation's income from the animal sector.

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#### REFERENCES

Ali, K.M., Chatterjee, K., De D., Bera, T.K. & Ghosh, D. (2009). Efficacy of aqueous extract of seed of *Holarrhena antidysenterica* for the management of diabetes in experimental model rat: A correlative study with antihyperlipidemic activity. *International Journal of Applied Research in Natural Product*, 2, 13–21.

Adamu, N.B., Adamu, J.Y. & Salisu, L. (2012). Prevalence of ecto-, endo- and haemoparasites in slaughtered dogs in Maiduguri, Nigeria. *Revue de Médecine Vétérinaire*, 163(4):178-182

Adedipe, O.D., Uwalaka, E.C., Akinseye, V.O., Adediran, O.A. & Cadmus, S.I.B. (2014). Gastrointestinal Helminths in Slaughtered Cattle in Ibadan, South-Western Nigeria. *Journal of Veterinary Medicine*, 6 pages.

Ademola, I.O. & Ola-Fadunsin, S.D. (2012). Prevalence of gastrointestinal parasites of laboratory animals in Ibadan, Nigeria. *Tropical Veterinarian*, 30(1):32-38.

Agbajelola, V.I. & Falohun, O.O. (2015). Prevalence of Intestinal Helminths and Protozoa Parasites of Ruminants in Minna, North Central, Nigeria. *IOSR Journal of Agriculture and Veterinary Science*, 8(11):62-67.

Aiyedun, J.O. & Oludairo, O.O. (2016). Prevalence of intestinal parasitism of swine in a North Central State of Nigeria. *Journal of Advanced Veterinary and Animal Research*, 3(3):278-281.

Ayinmode, A.B., Ndudim, N.F. & Obebe, O.O. (2016). Prevalence of Gastrointestinal Parasites of Rodents in Ibadan, Nigeria. *Nigerian Veterinary Journal*, 36(2):1158-1164.

Barger, I.A., Siale, K., Banks, D.J.D. & Jambre, L.F. (1994). Rotational grazing for control of gastrointestinal nematodes of goats in a wet tropical environment. *Veterinary Parasitology*, 53: 109-116.

Biu, A.A., Maimunatu, A. & Salamatu A.F. (2009). A faecal survey of gastro intestinal parasites of ruminants on the University of Maiduguri Research Farm. *International Journal of Biomedical and Health Sciences*, 5(3):115-1119.

Bolajoko, M., Ahmed, M.S., Okewole, P.A., Kumbish, P., Muhammad, M. & Fyfe, J. (2016). Prevalence and Demographic Distribution of Canine Rabies In Plateau State, Nigeria, 2004 – 2009. *Bulletin of Animal Health and Production in Africa*, 64(1):127-136.

Cheesbrough, M. (2005). *District Laboratory Practice in Tropical Countries*, Cambridge University Press, New York.

Egbunu, A. A. & Dada, E. O. (2016). Prevalence of Intestinal Helminth Parasites of domestic rats in selected sites around students hall of residence in the Federal University of Technology, Akure, Nigeria. *International Journal of Current Microbiology and Applied Sciences*, 5(4):918-923.

Gudissa, T., Mazengia, H., Alemu, S. & Nigussie. H. (2011). Prevalence of gastrointestinal parasites of laboratory animals at Ethiopian Health and Nutrition Research

Institute (EHNRI), Addis Ababa. *Journal of Infectious Diseases and Immunity*, 3(1):1-5.

Idika, I.K., Onuorah, E.C., Obi, C.F., Umeakuana, P.U., Nwosu, C.O., Onah, D.N. & Chiejina, S.N. (2017). Prevalence of gastrointestinal helminth infections of dog in Enugu State, South Eastern Nigeria. *Parasite Epidemiology and Control*, 2:97-104.

Jegede, O.C., Adejoh, A.A., Obeta, S.S. & Olayemi, O.D. (2015). Gastrointestinal Parasites of Sheep and Goats in Gwagwalada Area Council, Federal Capital Territory, Abuja, Nigeria; with a Special Reference to sex, breed and age. *Alexandria Journal of Veterinary Sciences*, 46:170-176.

Johnson, S.A.M., Gakuya, D.W., Mbuthia, P.G., Mande, J.D. & Maingi, N. (2015). Prevalence of gastrointestinal helminths and management practices for dogs in the Greater Accra region of Ghana. *Heliyon*, 11 pages.

Kolade, O.E. & Agbolade, O.M. (2014). Intestinal Parasites of Local and Exotic Domestic Fowls in Owoyele, Yewa North, Ogun State, Nigeria. *Landmark Research Journal of Agriculture and Soil Sciences (LRJASS)*, 1(6):082-085.

Komtangi, M.C., Mpoame, M., Payne, V.K. & Ngufor, M.N. (2005). Prevalence of gastrointestinal helminths of dogs in Dschang, Cameroon. *Journal of the Cameroon Academy of Sciences*, 5(1):11-14.

Mustapha, F.B., Balami, S.B., Malgwi, S.A., Adamu, S.G. & Wakil, Y. (2016). Prevalence of Gastrointestinal Parasites of Hunting Dogs in Maiduguri, Borno state, Nigeria. *IOSR Journal of Agriculture and Veterinary Science*, 9(8):39-42.

National Bureau of Statistics (NBS) (2012). "Annual Abstract of Statistics," Federal Republic of Nigeria.

Ndarathi, C.M., Waghela, S. & Semenyee, P.P. (1989). Helminthiasis in Maasai ranches in Kenya. *Bulletin of Animal Health and Production in Africa*, 37:205-208.

Okorafor, U.P., Obebe, O.O., Unigwe, C.R., Atoyebi, T.J. & Ogunleye, O.K. (2015). Studies on the gut parasites of small ruminants reared in some selected farms in Ido local government area, Oyo state, Nigeria. *Applied Research Journal*, 1(3):153-159.

Owhoeli, O., Elele, K. & Gboeloh, L.B. (2014). Prevalence of Gastrointestinal Helminths in Exotic and Indigenous Goats Slaughtered in Selected Abattoirs in Port Harcourt, South-South, Nigeria. *Chinese Journal of Biology*, 8 pages.

Pakdel, N., Naem, S., Rezaei, F. & Abdol-Ali, C. (2013). A survey on helminthic infection in mice (*Mus musculus*) and rats (*Rattus norvegicus* and *Rattus rattus*) in Kermanshah, Iran. *Veterinary Research Forum*, 4 (2):105-109.

Puebla, L.E.Z., Nunez, F.A., Rivero, L.R., Hernandez, Y.R., Garcia, I.S. & Millan, I.A. (2015). Prevalence of Intestinal Parasites in Dogs from Municipality La Lisa, Havana, Cuba. *Veterinary Science & Technology*, 6(5):3 pages.

Regassa, F., Sori, T., Dhuguma, R. & Kiros, Y. (2006). Epidemiology of Gastrointestinal Parasites of Ruminants in Western Oromia, Ethiopia. *International Journal of Applied Research in Veterinary Medicine*. 4(1):51-57.

Sharma, D., Joshi, S., Vatsya, S. & Yadav, C.L. (2013). Prevalence of gastrointestinal helminth infections in rodents of Tarai region of Uttarakhand. *Journal of Parasitic Diseases*, 37(2):181-184

[Siti Shafiyah, C.O., Jamaiah, J., Rohela, M., Lau, Y.L. & Siti Aminah, F.](#) (2012). Prevalence of intestinal and blood

- parasites among wild rats in Kuala Lumpur, Malaysia. [Tropical Biomedicine](#), (4):544-50.
- Soulsby, E.J.L. (1986). *Helminths, Arthropods and Protozoa of Domestic Animals*, (7th ed.). Beilliere Tindall, London, Philadelphia and Toronto.
- Sowemimo, O.A., Asaolu, S.O., Adegoke, F.O. & Ayanniyi, O.O. (2012). Epidemiological survey of gastrointestinal parasites of pigs in Ibadan, Southwest Nigeria. *Journal of Public Health and Epidemiology*, 4(10): 294-298.
- Torres-Chablé, O.M., García-Herrera, R.A., Hernández-Hernández, M., Peralta-Torres, J.A., Ojeda-Robertos, N.F., Blitvich, B.J., Baak-Baak, C.M., García-Rejón, J.E. & Machain-Williams, C.I. (2015). Prevalence of gastrointestinal parasites in domestic dogs in Tabasco, southeastern Mexico. *Brazilian Journal of Veterinary Parasitology*, 6 pages.
- Udoh, N.A., Luka, S.A. & Audu, P.A. (2014). Prevalence of Gastrointestinal Parasites of Domestic Turkey (*Meleagris Gallopavo*) Linnaeus, (1758) Slaughtered in Kaduna Metropolis, Kaduna State, Nigeria. *Journal of Natural Sciences Research*, 4(17):105-109.
- Urquhart, G.M., Armour, J., Duncan, J.L., Dunn, A.M. & Jennings, F.W. (1987). *Veterinary Parasitology*, Longman Group UK Ltd., England.
- Wosu, M.I. (2015). Prevalence of Internal Parasites of Intensively Managed Pigs Located in Nsukka, South-East Nigeria. *Journal of Veterinary Advances*, 5(6): 976-979.
- Zawua, T.P., Amali, O., Amuta, E.U., Sar, T.T. & Anum, O.J. (2016). Intestinal Helminths of Cattle Slaughtered for sale within Gboko Metropolis, Benue State, Nigeria. *Sokoto Journal of Medical Laboratory Science*, 1(1): 77-81