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Prevalence of gastrointestinal parasites of domestic ruminants amongst pastoralists in three Local Government Areas of Bauchi Western Agricultural Zone, Bauchi, Nigeria

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ABSTRACT: Gastrointestinal parasite infections of ruminant animals cause economic loss to farmers and low nutritional value to consumers. This study was carried out to determine the prevalence of gastrointestinal parasites in domestic ruminants such as cattle, sheep and goats and the relationship between the species, sex, age, location, season and breed of the respective animals within the period of May to October 2021, amongst pastoralists in three local government areas of Bauchi Western Agricultural Zone, Bauchi State, Nigeria. A total of 938 faecal samples were examined using floatation and sedimentation techniques. Out of the 938 samples examined, 756 (80.60%) were infected. The results from the faecal examination revealed the presence of eighteen (18) gastrointestinal parasites namely; Fasciola, Cooperia, Balantidium, Oesophagostonum, Bunostonum, Haemanchus, Tricharis, Coccidia, Strongyloides, Trichstrongylus, Chabertia, Nematodirus, Dicrocoelium, Ostertasia, Moniezia, Paramphistomum, Schistosoma and Marshallagia. The most prevalent helminth encountered was Fasciola 369 (39.34%) while schitosoma 2 (0.21%) was the least prevalent parasite. Sokoto Gudali, Uda and Kano brown breeds of cattle, sheep and goats, harboured more gastrointestinal parasites than their breed counterpart which are the White Fulani breed of cattle, Balami and 'Yankasa breed of sheep as well as Red Bauchi breeds of goats respectively. Statistically, there was a significant difference ($p<0.05$) with respect to the species of animal but no statistical difference ($p>0.05$) with respect to sex, age, season and breed of the animals. Pasture dressing, rotational grazing, and strategic deworming programmes in combination with control of intermediate hosts will lead to more effective control of the parasite as helminthiasis causes great economic losses to livestock farmers and the nation's Gross Domestic Products. Furthermore, future investigations are recommended to evaluate the economic impact of gastrointestinal parasites in the study area.

Keywords: Floatation, helminths, livestock, pasture, sedimentation.

INTRODUCTION

In Nigeria, livestock is one of the most potential sub-sectors of Agriculture which plays an indispensable role in promoting human health and the national economy of the country. Livestock not only assists in upgrading the financial conditions but also makes a substantial contribution to human nutrition. Most animals are reared in houses under the traditional husbandry practices where small ruminants especially goats and sheep are mainly reared for several reasons including meat, wool and skin production. The production and productivity of animals are greatly hampered by different diseases including gastrointestinal parasite infections. Gastro intestinal parasitism is a worldwide problem (Regassa *et al.,* 2006).

The losses caused by these parasites are attributed to acute illness and death, premature slaughter and rejection of some parts at meat inspection. Indirect loss includes the

diminution of productive potential such as decreased growth rate, weight loss in young growing calves and late maturity of slaughter stock (Hansen and Perry, 1994). Production losses caused by helminth diseases of these animals are a major factor in extending the cycle of poverty and a major food security issue in developing countries. According to Iyangbe and Orewa (2009), the average Nigerian consumes 6 to 8 g per day of animal protein as against the Food and Agriculture Organization (FAO) recommendation of 35 g. In order to show the need for increased meat consumption, the value (35 g) is a big challenge to livestock producers. Therefore, to feed and meet the protein requirement for the Nigerian populace, there must be a corresponding increase in food and livestock production. This could be achieved in terms of production by minimizing worm infestation through a concerted awareness of control measures and treatments. Those problems make it imperative to determine the prevalence of gastrointestinal parasites in domestic ruminants such as cattle, sheep and goats. As observed in this study, gastrointestinal parasites were widespread in cattle, sheep and goats.

MATERIALS AND METHODS

The study was conducted in three Local Government Areas of (Dass, Tafawa Balewa and Toro) Bauchi Western Agricultural Zone, Bauchi State. The State is located in North-Eastern Nigeria; Sudan Savannah and Sahel Savannah zone. It lies between latitude 9°30' and 12°30'N and Longitude 11°50' and 8°42'E, with an elevation of 628 metres height (2,060 feet). It has a land mass of 49,119 km^2 (18.965 Sqml) representing 5.3% of Nigerian total land mass. It has a population of 4,653,066 with a density of 95 km^2 (NPC, 2006). It has twenty local government areas with about forty (40) different languages (Gists, 2013). The livestock population is estimated to be 1.8 million (cattle), 3.4 million (Goats) and 2.8 million (sheep) (Bauchi State Ministry of Agriculture and Rural Development, 2004).

The research is designed as a cross-sectional study to determine the prevalence of gastrointestinal parasites of domestic ruminants in settled pastoralists in three local government areas of Bauchi Western Agricultural Zone, Bauchi State, Nigeria. The three local government that were purposively selected includes Toro, Tafawa Balewa and Dass. This study was carried out within five (5) months (May to October 2021).

Faecal samples were obtained randomly from freshly defecated faeces of domestic ruminants kept under the traditional system amongst pastoralists in the selected local government areas. About 2-2 g of the faecal samples were collected using white polythene bags.

All samples collected from the field were labeled properly and transported in ice packed cooler to the Bauchi National Veterinary Research Institute (NVRI) Diagnostic Laboratory and stored at +4°C until processed. Floatation and sedimentation methods were used for this study. All the data on age, species, sex, breed, season, location and level of parasitic infections were collected and prevalence was calculated using SPSS version 16 (2015). Descriptive statistics was used to determine the prevalence of the parasite and chi-squire text (X^2) analysis was used to determine the differences in all the factors. Confidence levels were set at a 95% ($p < 0.05$) level of significance.

RESULTS

Statistically, there was no significant difference between the prevalence of eighteen (18) gastrointestinal parasites obtained from cattle, sheep and goat faecal samples. *Fasciola spp* has the highest prevalence of 369(39.34%) and the lowest prevalence was *Schistosoma* with 2 (0.21%) (Table 1).

The overall distribution of 85.37, 77.83 and 76.83% was obtained in species of cattle, sheep and goats respectively (Table 2). The species of cattle has the highest prevalence of 85.37% followed by sheep with 77.83% and the least was goats with 76.83%. The chi-square value ($x^2 = 25.79$, $df = 2$, $p = 0.05$) indicated that there was a significant difference in the prevalence of gastrointestinal parasites in relation to the species of ruminants.

The overall distribution of gastrointestinal parasites, based on sex in domestic ruminants were 85.83, 84.21, 78.29, 77.30, 78.52 and 74.77% was obtained from cows, bulls, ewes, ram, does, and bucks respectively (Table 3). The cows have the highest prevalence of 85.83% against bull (84.21%), ewes (78.29%) as against ram (77.30%) and does (78.52%) as against buck (74.77%). The chi-square value indicated that there were no significant differences between the different sex groups of all the animals ($p > 0.05$).

Prevalence of gastrointestinal parasites was high in cattle 0 – 3 years 92.61%, sheep 0 – 3 years 85.46% and goats 0 – 3 years 79.75% as against cattle > 4 years 73.29%, sheep > 4 years 58.43% and goats > 4 years 72.29% (Table 4). The chi-square value indicated that there was no significant difference between different age groups of all the animals ($p > 0.05$).

The overall distribution of 83.84, 89.76, 80.23, 72.60, 83.61, 73.96 and 87.04% were obtained from breeds of White Fulani, Sokoto Gudali, Yankasa, Balami, Uda, Red Bauchi and Kano Brown, respectively (Table 5). The breed of Sokoto Gudali has the highest prevalence of 89.76% followed by Kano Brown at 87.04% and Uda at 83.61% as against its counterpart breeds of White Fulani, Yankasa, Balami and Red Bauchi with 83.84, 80.23, 72.60 and 73.96%, respectively. There was no significant difference ($p> 0.05$) in the prevalence of gastrointestinal parasites in relation to the breed of the animals.

There were significant differences in the distribution of

Table 1: Prevalence of gastrointestinal parasite in cattle, sheep and goats in Bauchi State (n = 938).

Parasite	No. Infected	%	X^2	P-Value
Fasciola	369	39.34		
Cooperia	141	18.23		
Balantidium	66	7.04		
Oesophagostomum	122	13.01		
Burostonum	91	9.70		
Haemanchus	221	23.56		
Trichuris	39	4.16		
Coccidia	211	22.49		
Strongyloides	86	9.17		
Trichastiongylus	57	6.08		
Chabertia	23	2.45	0.47	0.05
Nematodirus	12	1.28		
Dicrocochium	48	5.12		
Ostertagia	33	3.52		
Moniezia	8	0.85		
Paramphistomum	3	0.32		
Shistosoma	2	0.21		
Marshallagia	9	0.96		
Total	1541			

$X^2 = 0.470$; df = 17; $p > 0.05$.

Table 2. Distribution of gastrointestinal parasites based on the species of cattle, sheep and goats.

Specie	No. Examined	Infected	%	X^2	P-Value
Cattle	376	321	85.37		
Sheep	316	246	77.83	25.79**	0.05
Goats	246	189	76.83		
Total	938	756			

** = Significant @ $p < 0.05$.

Table 3. Distribution of gastrointestinal parasites based on the sex of cattle, sheep and goats.

Specie	Sex	No. Examined	Infected	%	X^2	P-Value
Cattle	Cows	205	176	85.83	0.028^{NS}	0.05
	Bull	171	144	84.21		
Sheep	Ewes	175	137	78.29	0.066^{NS}	0.05
	Ram	141	109	77.30		
Goats	Does	135	106	78.52	0.014^{NS}	0.05
	Buck	111	83	74.77		
Total		938	755			

NS = Not Significant.

gastrointestinal parasites based on season in the study area. The late rainy season shows a high percentage of distribution with 81.24% as against the early rainy season with 79.96% (Table 6).

Based on location in the study area, Toro Local Government Area has the highest prevalence of gastro-

Table 4. Distribution of gastrointestinal parasites based on the age group of cattle, sheep and goats.

Specie	Age	No. Examined	Infected	%	X^2	P-Value
Cattle	0 – 3	230	213	92.61	0.001^{NS}	0.05
	> 4	146	107	73.29		
Sheep	0 – 3	227	197	85.46	2.146^{NS}	0.05
	> 4	89	52	58.43		
Goats	0 – 3	163	130	79.75	0.258^{NS}	0.05
	> 4	83	60	72.29		
Total		938	755			

NS = Not Significant, 0 – 3 = Young, >4 = Adult.

Table 5. Distribution of gastrointestinal parasites based on breed of cattle, sheep and goats.

Specie	Breeds	No. Examined	Infected	%	X^2	P-Value
Cattle	White Fulani	297	249	83.84	0.957^{NS}	0.05
	Sokoto Gudali	79	71	89.76		
Sheep	Yankasa	182	142	80.23	0.572^{NS}	0.05
	Balami	73	53	72.60		
	Uda	61	51	83.61		
Goats	Red Bauchi	192	142	73.96	0.002^{NS}	0.05
	Kano Brown	54	47	87.04		
Total		938	755			

NS = Not Significant.

Table 6. Prevalence of gastrointestinal parasite based on season in ruminant animals (cattle, sheep and goats).

Season	No. examined	Infected	%	X^2	P-Value
Early Rainy Season	469	375	79.96	0.048^{NS}	0.05
Late Rainy Season	469	381	81.24		
Total	938	755			

df = 1, NS = Not Significant.

Table 7. Distribution of gastrointestinal parasite based on location.

LGA	No. examined	Infected	%	X^2	P-value
Tafawa Balewa	314	250	79.62		
Toro	314	259	82.62	0.008^{NS}	0.05
Dass	310	256	82.58		
Total	938	755			

df = 2, NS = Not Significant, LGA = Local Government Area.

intestinal parasites (82.62%), followed by Dass Local Government Area (82.58%) and the least was Tafawa Balewa Local Government Area (79.62%) (Table 7). However, no statistical difference between the local government areas ($p > 0.05$) was observed.

DISCUSSION

Gastrointestinal parasite infections in ruminant animals, particularly cattle, sheep and goats are recognized as a major constraint to livestock production. In most cases,

infectious are subclinical with significant economic losses due to mortality, reduced productivity and reproduction of animals (Moussouni *et al.,* 2018).

A total of Eighteen (18) different species of gastrointestinal parasites were detected that infected cattle, sheep and goats in this study. This is similar to the report of Ola-Fadunsin *et al.* (2020) in their finding on "helminth infections of great concern among cattle in Nigeria", that a total of eighteen different species of helminths were detected to infect cattle in the study. *Fasciola* species was the most prevalent parasitic helminth affecting cattle, sheep and goats. This finding is similar to the research conducted on domestic ruminants in Nigeria by Eysker and Ogunsusi (1980), and Biu and Eteng (2001). In this finding, *Fasciola* species appeared to be the most prevalent trematode that infected cattle. It is in line with the reports by Lemy *et al.* (2018) and Umar *et al.* (2018) that *Fasciola* species have been reported as the most prevalent trematode of cattle in Nigeria, with *Fasciola gigantica* being more prevalent among the two species.

There was a significant difference in the rates of infection among the species of ruminant studied. This is in harmony with the report of Yohanna *et al.* (2019) on the prevalence of helminth parasites of ruminants in the abattoir market Jos, Jos South Local Government Area, Plateau State, that all the species of ruminant animals were infected with a wide variety of gastrointestinal parasites including nematodes, cestode, trematode and protozoa. It is also in line with the observation of Schillhorn (1980) who reported that there was a difference regarding rates of infections between species of ruminant animals in Nigeria when exposed to the same condition of infection by infective larvae of the parasite species. In this present finding, the prevalent rates of gastrointestinal parasites were higher in species of cattle than in sheep and goats. This is in agreement with the work of Amuzie *et al.* (2018) on the prevalence of helminths in faecal samples of cattle and goats from Trans Amadi Abattoir Port Harcourt, Nigeria the prevalence of gastrointestinal parasite is higher in cattle than in goats. This finding also showed that sheep harboured more gastrointestinal parasites than goats and sheep. Yohanna *et al.* (2019) stated that cattle were most infected by gastrointestinal parasites followed by sheep while the goats were the least parasite.

In respect to the age of the animals studied, in all the species of cattle, sheep and goats, those within the range of 0 – 3 years (young) recorded the highest prevalence of gastrointestinal parasites. This finding agrees with the reports of Umar *et al.* (2018) in their research on gastrointestinal helminths of slaughtered cattle in Bauchi Central Abattoir, Bauchi State Nigeria. This clearly showed that adult animals could have been harbouring matured worms due to prolonged exposure compared to young animals. It is also in agreement with studies by Fagbemi and Oborisiabon (1992) who showed that adult cattle are more resistant to infection with parasites than young ones and that adult animals developed some immunity.

Similar reports have been described by Shah-Fisher and Ralph (1988). In addition, Smith (1996) reported that young animals are more susceptible to parasitism than adult animals due to their differences in degree of immunity, which is higher in adults than in young ones.

This finding revealed that Sokoto Gudali in the breed of cattle showed more prevalence of gastrointestinal parasites than the White Fulani breed. This is in line with the finding of Ola-Fadunsin *et al.* (2020) in their work "helminth infestation of great concern among cattle in Nigeria" that the breed of Sokoto Gudali was 2.3 times more likely to be infected with helminth species than the white Fulani breed. Similarly, Ola-Fadunsin (2017) in his research on reproductive occurrence and risk factors associated with parasitic infection in Ogun State, Nigeria. The Sokoto Gudali breed was more susceptible to helminths infectious than other cattle breeds. Moreover, in the breed of sheep, Uda harboured more gastrointestinal parasites than Balami and Yankasa. This finding agreed with the report at Orokpo (1991) that Uda sheep is more susceptible to the gastrointestinal parasite than Balami and Yankasa. Likewise, this study revealed that the Kano brown breed of goats was more susceptible to gastrointestinal parasites than Red Bauchi. This finding came in line with the report by Opara *et al.* (2016) in their finding on the "prevalence of haemoparasites of small ruminants in Lafiya, Narasawa State; a Guinea Savannah zone of Nigeria", that Kano brown were second to West African Dwarf in harboring gastrointestinal parasites.

Report from this present finding revealed that the late rainy season recorded more gastrointestinal parasite infections than the early rainy season when rainfall was not fully established. This finding agreed with the report of Ogunsusi (1979), in his research on pasture infectivity with trichastrongyloid larvae in the northern guinea savannah of Nigeria. In Nigeria, worm larvae are most abundant on vegetation from May to October when large numbers are ingested with pasture. Umoh *et al.* (1992) in their finding on gastrointestinal parasites in Zaria, Nigeria reported that the period (May – October) coincides with the rainy season and therefore, it confirms rainfall as one of the most epizootiological factors that affect egg and larvae development.

Moreover, Singh *et al.* (2009) reported that parasitic ova, snails and other intermediate hosts get a favourable humid for development in the plane grazing areas with shallow temperature stagnated water. He further stated that animals congregate at the green available around the periphery of such areas and naturally acquire more infection. Similarly, Mannstadt *et al.* (2000) pointed out that the incidence of helminthiasis in northern Nigeria is common during the rainy season due to the high worm burden and feeding of animals on only pasture due to free management systems.

The difference in the prevalence of gastrointestinal in the

three different local government areas obtained in this study may be a result of the variation in the geographical distribution in the different locations. This finding is in agreement with a report by Soulsby (1982) who attributed such situations to the geographical location of the areas. Similarly, it has been reported by Pal and Qayyum (1993), that the prevalence of parasitic gastro-enteritis in a given location is related to the agro-climatic conditions like quantity and quality of pasture, temperature, humidity and grazing behaviour of the host and also, that susceptibility to infestations is influenced by factor of location. The three local government areas covered by this study revealed that the Toro Local Government Area had the highest prevalence in cattle followed by the Tafawa Balewa Local Government Area.

Conclusion

Gastrointestinal parasites were widespread in cattle, sheep and goats as observed in this study. Females carried significantly higher gastrointestinal parasites than males. The prevalence was found to be higher in young ruminants than in adults as well as late rainy season than in the early rainy season. Sokoto Gudali, Uda and Kano brown breeds of cattle, sheep and goats respectively, harboured more gastrointestinal parasites than their breed counterparts i.e. White Fulani, Balami and 'Yankasa as well as Red Bauchi. Statistically, there was a significant difference with respect to the species of animal, but no statistical difference with respect to sex, age, seasons, location and breed of the animals.

CONFLICT OF INTEREST

We have no conflict of interest to declare.

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REFERENCES

Amuzie, C. C., Moslen, M., & Clement, A. (2018). Low prevalence of helminths in faecal samples of cattle and goats from Trans-Amadi Abattoir (Slaughterhouse), Port Harcourt, Nigeria. *SF Environ Journal of Environmental and Earth Science, 1*(1), Article number 1012.

Bauchi State Ministry of Agriculture and Rural Development (2018). Livestock population estimate.

Biu, A. A., & Eteng, F. O. (2001). Some parasites causing diarrhoea amongst kid goats in Maiduguri, Nigeria. In: *Proceedings of the 6th Annual Conference of Animal Science Association of Nigeria. September, 17th – 19th, 2001*. University of Maiduguri Convocation Square. Pp. 232-233.

Eysker, M., & Ogunsusi, R. A. (1980). Observations on epidemiological and clinical aspects of gastrointestinal helminthiasis of sheep in northern Nigeria during the rainy season. *Research in Veterinary Science*, *28*(1), 58-62.

Fagbemi, B. O., & Hillyer, G. V. (1991). Partial purification and characterisation of the proteolytic enzymes of Fasciola gigantica adult worms. *Veterinary parasitology*, *40*(3-4), 217-226.

FAO (1989). Animal Health Year Books. Book and Agricultural Organization Rome. p. 204.

Gists, N. (2013). The 36 States of Nigerian and languages spoken, Retrieved from http://www.latestnaijagist.com

Hansen, B., & Perry, B. (1994). The epidemiology, diagnosis and control of helminth parasites of ruminants. A handbook ILRAD, Nairobi, Kenya, Kenya

Iyangbe, C. O., & Orewa, S. I. (2009). Determinants of daily protein intake among rural and low-income urban households in Nigeria. *American-Eurasian Journal of Scientific Research*, *4*(4), 290-301.

Lemy, E. E., & Egwunyenga, A. O. (2018). Epidemiological study on some parasitic helminths of cattle in Delta North, Delta State, Nigeria. *Journal of Animal Health and Behavioural Science*, *2*(1), Article number 113.

Mannstadt, M., Sing, A., Leitritz, L., Brenner-Maucher, K., & Bogner, J. (2000). Conservative management of biliary obstruction due to Fasciola hepatica. *Clinical Infectious Diseases*, *31*(5), 1301-1303.

Moussouni, L., Benhanifia, M., Saidi, M., & Ayad, A. (2018). Prevalence of gastrointestinal parasitism infections in cattle of Bass Kabylie area: case of Bejaia Province, Algeria. *Macedonian Veterinary Review*, *41*(1), 73-82.

National Population Commission (NPC) (2006). Federal Republic of Nigeria Census Report. Retrieved 20th November 2021 from https://www.nationalpopulation.gov.ng.

Ogunsusi, R. A. (1979). Pasture infectivity with trichostrongylid larvae in the northern Guinea savanna of Nigeria. *Research in Veterinary Science*, *26*(3), 320-323.

Ola-Fadunsin, S. D. (2017). Retrospective occurrence and risk factors associated with cattle parasitic infections in Osun State, Nigeria. *Nigerian Veterinary Journal*, *38*(3), 193-207.

Ola-Fadunsin, S. D., Ganiyu, I. A., Rabiu, M., Hussain, K., Sanda, I. M., Baba, A. Y., Furo, N. A., & Balogun, R. B. (2020). Helminth infections of great concern among cattle in Nigeria: Insight to its prevalence, species diversity, patterns of infections and risk factors. *Veterinary World*, *13*(2), 338-344.

Opara, M. N., Santali, A., Mohammed, B. R., & Jegede, O. C. (2016). Prevalence of haemoparasites of small ruminants in lafia nassarawa state: A Guinea Savannah Zone of Nigeria. *Journal of Veterinary Advances*, *6*(6), 1251-1257.

Orokpo, J. A. (1991). The effect of breed and environmental factors on worm infection of sheep at Oscar Farm. B. Agric Tech. (Hons). Dissertation; Abubakar Tafawa Balewa University, Bauchi, Nigeria.

Pal, R. A., & Qayyum, M. (1993). Prevalence of gastrointestinal nematodes of sheep and Goats in upper Punjab Pakistan. *Pakistan Veterinary Journal,* 13(3), 138-141.

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.

Schillhorn Van veen, T. W. (1980). Fascioliasis (*Fasciola gigantica*) in West Africa: a review. *Veterinary Bulletin*, *50*(7), 529-533.

Singh, S., Shrivastav, A. B., & Sharma, R. K. (2009). The epidemiology of gastrointestinal parasitism and body condition in free-ranging herbivores. *Journal of Threatened Taxa*, *1*, 535-537.

Smith, G. (1994). The relationship between the sizes of *lymnaea truncutula* naturally infected with *Fasciola hepatica* and the intensity and maturity of radia infection. *Journal of Helminthology, 58*(2):123-127.

Soulsby, E. J. L. (1982). *Helminths, arthropods and protozoan of domesticated animals.* Baillere Tindal, London. 233p.

Umar, Y. A., Babayo, S. A., & Mao, P. S. (2018). Gastrointestinal helminths of slaughtered cattle in Bauchi Central Abattoir, Bauchi state, Nigeria. *GSC Biological and Pharmaceutical Sciences*, *4*(2), *4*(2), 58-65.

Umoh, J. U., Shuibu, Y., & Akerejola, O. O. (1982). Gastrointestinal Parasitism in Clinical Cases of Small Ruminants in Zaria, Kaduna, Nigeria. *Bulletin for Animal Health and Production in Africa*, 30,111-116.

Yohanna, J. A., Dung, O. K., Adejoh, V. A., & Pam, D. D. (2019). Prevalence of helminth parasites of ruminants in abattoir market Jos, Jos South Local Government Area, Plateau State, Nigeria. *International Journal of Biomedical and Health Sciences*, *15*(2), 51-57.