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Oesophagostomosis, moniaziasis and trichuriasis of small ruminants slaughtered in north-western, Nigeria

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Abstract

Gastro-intestinal helminths have been recognised as a major constraint to both small and large-scale small ruminants production in developing countries. The study was carried out in north-western Nigeria to determine the prevalence and adult worm burden of intestinal helminths of small ruminants. A cross-sectional study was carried out in small ruminants for the period of 12 months. For this study, the intestines (small and large intestines) were collected from 300 small ruminants (200 goats and 100 sheep) at necropsy and examined by the Hansen and Perry method. Out of the 300 small ruminants examined during the study period, the intestines revealed the presence of *Oesophagostomum* sp, *Trichuris* sp and *Moniezia* sp with prevalence rate of 13.3%, 40.7% and 22% respectively. The mean adult worn burden for *Oesophagostomum* sp, *Trichuris* sp and *Moniezia* sp were 18.35±5.546 (1-108), 9.459±1.623 (1-29) and 10.02±1.502 (2-29) respectively. Considering the sex of the small ruminants, the prevalence for *Trichuris* sp (44.9% in male and 28% in female) being the most prevalent followed respectively by *Moniezia* sp (22.2% in male and 28% in female) and *Oesophagostomum* sp (13.3% in both sexes). The mean adult worm counts were generally low in both male (21.68±10.18 *Oesophagostomum* sp, 8.88±1.96 *Trichurisspp* and 10.02±1.90 *Moniezia* sp) and Female (18.60±10.39 *Oesophagostomum* sp, 9.90±2.00 *Trichuris* sp and 11.47±2.00 *Moniezia* sp). The prevalence and the mean adult worm counts showed the same trend irrespectively of the sex, age and species of small ruminants. There was no seasonal variation in the prevalence and mean adult worm counts recovered from small ruminants, except for the prevalence of *Oesphagostomum spp* and *Trichuris* sp that was statistically significant difference between the dry season and rainy season. The study established that sheep and goats suffer from low grade infection of *Oesophagostomum* sp, *Trichuris* sp and *Moniezia* sp. It is therefore recommended that the pathological lesions of these parasites especially *Oesophagostomum* sp on the small ruminants be carried out to estimate the economic and production loses.

Keywords: moniaziasis, oesophagostomosis, prevalence, small ruminant, trichuriasis and worm burden.

Introduction

In Nigeria, small ruminants, especially sheep and goats constitute an important source of animal protein. A lot of social-economic importance is therefore attached to these animals by their owners. In some cases, these animals may be the only realizable wealth of a rural household [1]. In Nigeria, the total numbers of goats and sheep were 53.8 and 33.9 million, respectively [2]. This constitutes 6.2% and 3.1% of the world total population of goats and sheep respectively [2]. Despite the large population of goats and sheep in Nigeria, they are constraint by helminthosis [3]. Helminthosis has been found as one of the causes of the production losses. This occurs primarily through reduce weight gain, poor meat, milk and wool production, carcase and offal condemnation and impaired reproductive performance, hypoproteinemia and pathogenic complications such as anaemia, diarrhoea, oedema and recumbence [4,5,6]. The severity of infections depends on the genera of helminth parasites involved, animal species, the number of infective stages on pasture, ineffective parasite

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removal from the host animals due to poor drug administration techniques, and local environmental conditions such as humidity, temperature, rainfall, vegetation and management practices [7,8,9,10,11].

If the loss from helminthosis is to be reduced, then effort is needed to control these helmintic infections. This need detailed information regarding species of parasites present, intensity of the infection, the host infected, effort of sex, age, season, breed and various environmental factors in a particular region [6]. Several studies have been conducted on small ruminant on helminthosis at various regions [12, 13]. Most of the studies were restricted to parasitic gastro-enteritis,bursate nematodes such as *Haemonchous contortus* and *Trichostrongylus* sp that are known to be pathogenic to the small ruminants with little consideration give to small and large intestinal parasites such *as Oesophagostom* sp, *Moniezaspp* and *Trichuris* sp. However, heavy challenge with these parasites particularly in young animals may be associated with anorexia, weight loss, moderate anaemia and inflammation of the intestinal mucosa [14].

Of particular significance is *O. columbianum* which is related to the migration of larvae in muscularis mucosa of the large intestine resulting in a fibroblastic response around the larvae forming fibrous nodules. The extensive nodular formation interferes with digestion, absorption and bowel movement. The diarrhoea often coincides with the emergence of larvae from the nodules. The nodules are frequently invaded with pyogenic bacteria which cause suppuration. Rupture of the nodules may cause peritonitis and multiple adhesions[14].

There is paucity of information as regards small and large intestinal parasites in this region. Most of the studies were based on faecal sample analysis which most times will not give the true worm burdens of these parasites. This study was therefore designed to provide baseline data on prevalence and burden of small and large intestinal adult parasites of small ruminants in north-western, Nigeria.

Materials and methods

Study area

The study was carried out in Dogarawa (Trading) Slaughter Slab in Zaria of Kaduna State, north-western Nigeria, from November 2011 to October 2012. Zaria is characterised by a tropical climate with two main seasons; a rainy season (May to October) and a dry season (November to April). The monthly mean temperature records show a range from 13.8 to 37.1^{0}C and an annual rainfall of 1,417.3 mm. The relative humidity was highest (83.8%) in the month of August and lowest (18.0%) in the month of March [15]. Animals reared in the area include cattle, sheep, goats and poultry. The small ruminants reared in this area are mostly managed under the extensive system. Although this system of management is cheap and less labour-intensive, it is characterized by low productivity and high losses due to accidents, diseases and theft [16]. The sheep available in the study-area was mostly Yankasa breed and the goats were Red Sokoto breed. These animals are usually bought by butchers from livestock traders in Zaria environs, nearby villages and town markets within the region to the Dogarawa Slaughter Slab for slaughter.

Figure 1. Map of Kaduna State showing the study-area.

Study design and sampling method

The study-design in this study was cross-sectional type. The formula of Thrusfield [17] was used to calculate sample size and a sample size of 300 goats and sheep were arrived at. The simple random sampling strategy was used to select 200 goats and 100 sheep. Proportionate sample method was used to select goats and sheep since goats were slaughtered more in the study-area. As most of the animals were obtained from different markets, it was very difficult to trace the exact origin of the animals. The age of the animals were estimated by their dentition [18] and sexes determined by their genitalia. In this study, animal less than two years were considered young while those above two years were considered adult. This was for convinience since small ruminants slaughter in Dogarawa Slaughter Slab is mostly a year and above. Twenty to thirty samples for both goats and sheep were collected per month over a period of 12 months.

Sample collection and examination

Necropsy worm recovery

The entire intestines (small and large intestines) were collected from each of 200 goats and 100 sheep following slaughtered and evisceration at the Dogarawa Slaughter Slab in the study-area. Section of the intestine was ligated with ropeat both ends to separate it from the next in order to avoid leakage and mixing of contents. Each intestine was collected into a labelled polythene bag as soon as possible, and transported immediately to the Helminthology Laboratory in the Department of Parasitology and Entomology, Ahmadu Bello University (ABU), Zaria for examination. Worm collection, identification and counting were made in accordance with procedures and techniques described by Hansen and Perry [8].

The small and large intestines were placed separately on a clean tray and each wassliced open longitudinally and mucusae were carefully examined, scraped and washed to remove any adhering worms. The contents were then washed several times using tap water, paying particular attention to cleaning between the folds of the mucous membranes. The contents were washed using tap-water into a bucket to recover smaller parasites. The parasites were recovered by passing the content through a sieve of 100 ìm diameter mesh which was later back-washed into another container. The entire washings from small and large intestines were completely examined individually for worms.The parasites were picked with wire loop with the aid of an illuminator (Picker x-ray in Veterinary Helminthology Laboratory ABU- Zaria). The helminths present in each section were identified and counted [8, 19].

Statistical analysis of data

The results obtained were reduced to Tables and the prevalence of parasite species was calculated as number of individuals of a host species infected with a particular parasite species divide by number of host examined times 100. Data obtained for adult counts were expressed as mean± SEM. *Chi*-square and *t*-test were used to test for association of variables like sex, age species and season of the year. Value of $p<0.05$ was considered significant. GraphPad[20] Prism Version 4.0 Windows from Graphpad Software, San Diego, California, USA (www.graphpad.com) was used to analyze the data.

Results

Out of the 300 small ruminants examined during the study period, 40, 122 and 66 of small ruminants were positive for *Oesophagostomum* sp, *Trichuris* sp and *Moniezia* sp respectively (Table 1). The prevalence and mean adult counts of helminths recovered from small ruminants by sex are shown in Table 2. The difference between the sexes of small ruminants was not statistically significant ($p>0.05$). Though there was difference in prevalence of *Trichuris spp* between male and female of small ruminants. Considering the age of small ruminants in Table 3, the difference in prevalence rate and worm burden was not significant ($p>0.05$).

The prevalence and worm burden of goats and sheep are shown in Table 4. There was statistically significant difference in the prevalence of *Trichuris* sp and in worm load of *Moniezia spp* among the species of small ruminants. Table 5 shows the seasonal variation of prevalence and mean adult worm counts recovered from small ruminants. There was statistically significant difference in the prevalence of *Oesphagostomum* sp and *Trichuris* sp between the dry season and rainy season.

Table 1. Prevalence, counts and predilection sites of adult helminths recovered from small ruminants slaughtered in Dogarawa Slaughter Slab in north-western, Nigeria.

Helminths	Prevalence (%)	Predilection site	Mean worm counts	Range
Oesophagostomum spp	40 (13.3)	Large intestine	18.35±5.546	1-108
Trichuris spp	122 (40.7)	Large intestine	9.459±1.623	1-29
Moniezia spp	66 (22)	Small intestine	10.02±1.502	2-30

Table 2. Prevalence and mean counts of adult helminth recovered from small ruminants by sex slaughtered in Dogarawa Slaughter Slab in north-western Nigeria.

Helminth spp	Prevalence (%)	Mean worm counts	Prevalence (%)	Mean worm counts
	Male ($n=225$)		Female ($n=75$)	
Oesophagostomum spp	30 (13.3)	21.68±10.18	10 (13.3)	18.60±10.39
Trichuris spp	101 (44.9)[a]	8.88±1.96	21 (28)[b]	9.90±2.00
Moniezia spp	50 (22.2)	10.02±1.90	16 (21.3)	11.47±2.0

Superscripts with different alphabet within the same row are statistically significant.

Table 3. Prevalence and mean counts of adult helminth recovered from small ruminants by age slaughtered in Dogarawa Slaughter Slab in north-western, Nigeria.

Helminth spp	Prevalence (%)	Mean worm counts	Prevalence (%)	Mean worm counts
	Young (*n*=140) (>2 years)		Adult (*n*=160) (<2 years)	
Oesophagostomum spp	21 (15)	11.62±5.05	19 (11.9)	30.68±14.82
Trichuris spp	56 (40)	11.80±3.55	66 (41.3)	5.92±1.01
Moniezia spp	31 (22.1)	10.13±2.82	35 (21.9)	10.06±1.43

Superscripts with different alphabet within the same row are statistically significant.

Table 4. Prevalence and mean counts of adult helminth recovered from small ruminants by species slaughtered in Dogarawa Slaughter Slab in north-western, Nigeria.

Helminth spp	Prevalence (%)	Mean worm counts	Prevalence (%)	Mean worm counts
	Goats (*n*=200)		Sheep (*n*=100)	
Oesophagostomum spp	27 (13.5)	16.41±7.29	13 (13)	22.38±8.14
Trichuris spp	95 (47.5)[a]	9.42±2.03	27 (27)[b]	9.59±1.78
Moniezia spp	42 (21)	8.02±3.28[a]	24 (24)	13.54±3.28[b]

Superscripts with different alphabet within the same row are statistically significant.

Table 5. Seasonal prevalence and mean counts of adult helminth recovered from small ruminants slaughtered in Dogarawa Slaughter Slab in north-western, Nigeria.

Helminth spp	Prevalence (%)	Mean worm counts	Prevalence (%)	Mean worm counts
	Dry season (*n*=137)		Wet season(*n*=163)	
Oesophagostomum spp	26 (19)[a]	19.88±7.540	14 (8.6)[b]	15.50±7.719
Trichuris spp	65 (47.4)[a]	11.92±2.774	57 (35)[b]	6.65±1.373
Moniezia spp	24 (17.5)	11.08±3.404	42 (25.8)	9.41±1.371

Superscripts with different alphabet within the same row are statistically significant.

Discussion

The current study revealed the present of *Oesophagostomum* sp, *Trichuris* sp and *Moniezia* sp in small ruminants with prevalence rate of 13.3%, 40.7% and 22% respectively. The prevalence and worm burdens recorded in this study were higher than that of Nwosu*et al* [21], in semi arid zone of North-eastern Nigeria where hot dry climate prevail. Some nematodes such as *Strongyloides*, *Cooperia*, *Bunostomum* sp recovered from small ruminants in Nwosu *et al* [21] and north-western [10,11] Nigeria were not encountered in the present study. Although, the prevalence and worm burden agreed with the same helminths present in this study [10,11, 22].

In this study, a higher prevalence of *Trichuris* sp was observed in male than in female with significant difference. This contradicts the result of Dagnachew *et al* [23] who have almost the same prevalence of *Trichuris* sp in both sexes. The prevalence and worm burden for *Oesophagostomum* and *Moniezia* sp were not significant between the sexes and this agreed with the result of Dagnachew *et al* [23]. Considering the age of small ruminants, young and adult animals have almost the same prevalence and worm burden for the three helminths without significant difference. This agrees with the finding of Githigia *et al* [24]. However, this is in contrast with many authors [23, 25, 26] where they recoded higher prevalence

and worm burdens in young animals. In this case, adult animals would have developed acquired immunity [27, 28] against heiminth infections as they mature due to repeated exposure [23] and this will help expel the parasite before it becomes established in the gastro-intestinal tract. The possible explanation for insignificant different between the ages in this study might be due to management practices by the owners. There are also some instances where younger animals were reported to be resistance to parasitic infection [28].

The result of this study also show that goats have higher prevalence of *Trichuris* sp than sheep with significant difference and this was in agreement with the result of Raza*et al* [29]. In this case, it is assumed that sheep do have a considerably higher immunological response to gastrointestinal parasites compared with that of goats [27]. However, *Oesophagostomum* sp and *Moniezia* spwere not significant between the species. Significant higher prevalence and worm burdens for *Oesophagostomum* sp and *Trichuris* sp infections in small ruminants were also obtained during the dry season. This finding is in contrast with that of Sissay [30] who reported *Oesophagostomum* sp throughout the year. The discrepancy in recovery of *Oesophagostomum* sp might be due to accumulation of larva stage of *Oesophagostomum* sp in gastro-intestinal tract of small ruminants from the previous rainy season. *Monieziaspp* was recorded higher during wet season. The findings on *Moniezia* sp disagrees with some other reports which recorded higher prevalence during early dry season [31,32]. While other reports reported different peaks [33,34].This inconsistency may indicate variable determinants for *Moniezia* sp in the different study seen.

In conclusion, the study established that sheep and goats suffer from low grade infection of *Oesophagostomum* sp, *Trichuris* sp and *Moniezia sp*. These helminths may have limited pathogenicity since there clinical and pathological features are often masked with more pathogenic species. However, heavy challenge with these parasites may be associated with weight loss, anoxia, anaemia, inflammation of the intestinal mucosa. It is therefore recommended that the pathological lesions of these parasites especially *Oesophagostomum* sp on the small ruminants be carried out to estimate the economic and production loses.

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References

1. Omeke, B. C. O. 1988. Improving goat productivity in the humid zone of the tropics. *Bulletin of Animal Health and production in Africa*, 36: 126-130.
2. FAOSTAT. 2008. http://faostat.fao.org/default.aspx
3. Pawel, G., Niznikowski, R., Strzelec, E., Popielarczyk, D., Gajewska, A. and Wedrychowtcz, H. 2004. Prevalence of protozoan and helminth internal parasite infections in goat and sheep flocks in Poland., *Arch. Tierz. Dummerstorf*, *47:* 43-49.
4. Menkir, M. S., Arvid, U., Peter, J. W. 2007. Epidemiology and seasonal dynamics of gastro-intestinal nematode infections of sheep in a semi-arid region of eastern Ethiopia. *Veterinary Parasitology 143:* 311-321.
5. Shaib, B. P., Aliyu, A. and Bakshi, J. S. 1997. Nigeria National Agricultural Research Strategy Plan, 1996-2000. Department of Agricultural Sciences, Federal Ministry of Agricultural and Natural Resources, Abuja, p. 108.
6. Kuchai, J. A., Fayaz, A., Chishti, M. Z. and Hidayatullah T. 2013. Impact of host's diet and parasite intensity on morphology of Monieziaexpansa. *Agriculture and Biology Journal of North America.4(2):* 122-125
7. Fakae, B. B. 1990. The epidemiology of helminthiasis in small ruminant under the traditional husbandry system in Eastern Nigeria. *Veterinary Research Commununications, 14 (5)*: 381-391.
8. Hansen, J. and Perry, B. 1994. The Epidemiology, diagnosis and control of helminth parasites of ruminants. *International Livestock Center for Africa, Addis Ababa Ethiopis,* pp. 90-100.
9. Sykes, A. R. 1994. Parasitism and production in farm ruminants. *Animal Production Journal*, *59:* 155-172.
10. Nwosu, C. O., Ogunrinade, A. F. and Fagbemi, B. O. 1996a. The seasonal prevalence of *Haemonchus species* in Red Sokoto (maradi) goats in Nigeria. *Veterinary Research Communications*, 20: 367-370.
11. Nwosu, C. O., Ogunrinde, A. F. and Fagbemi, B. O. 1996b. Prevalence and seasonal changes in the gastro-intestinal helminths of Nigeria goats. *Journal of Helminthology*, *70:* 329-333.
12. Butswat, I. S. R., Zahraddeen, D. and Hussaini, A. S. 2005. Prevalence of peste de pestitsruminante (PPR) and Helminthosis in sheep and goats in Bauchi, Nigeria. *Bulletin of Animal Health Production African, 53:* 131-4.
13. Zahraddeen, D., Butswat, I. S. R., Adamu, C. I. 2011. Helminthosis in domestic ruminants raised under the semi-intensive system in part of northern Guinea Savannah ecological zone of Nigeria. *Journal of Common wealth Veterinary Association*; *27(2)*: 220-4.
14. Lughano, K. and Dominic, K. 1996. *Diseases of small ruminants in sub-Saharan Africa.* A Handbook Funded by Overseas Development Administration Animal Health Programme.
15. Josiah, G. J., Makun, H., Chiezey, N. P. and Tekdek, L. B. 2015. Epidemiological study on abomasal nematodes in slaughtered small ruminants raised in the guinea savannah zone of Nigeria. *Sokoto Journal of Veterinary Sciences*, *13(2):* 34- 41
16. Ajala, M. K. and Gefu, J. O. 2003. Socio-economic factors influencing small ruminants management practices in Kaduna State. *Moor Journal Agricultural Resource*, *4:* 274-280.
17. Thrusfeild, M. 2005. *Veterinary Epidemiology. 2nd*

Lughano, K. and Dominic, K. 1996. Diseases of small ruminants in sub-Saharan Afirica. A *hand book funded by Overseas Development Administration Animal Health Programme.*

Edition, Blackwell Science Limited, Oxford, United Kingdom, pp. 182-198.
18. Abegaz, S. and Awgichew, K. 2009. Estimation of weights and age of sheep and goats. Technical Bulletin No. 23. *Ethiopian Sheep and Goat Productivity Improvement Programme (ESGPIP)*. United States Agency for International Development (USAID), p. 14.
19. Taylor, M. A., Coop, R. L. and Wall, R. L. 2007. *Veterinary Parasitology. Third Edition*. Blackwell Publishing Ltd. Oxford. United Kingdom., p. 872.
20. Graphpad. 2015. Windows from Graphpad Software. Prism Version 4.0, San Diego, California USA. www.graphpad.com Accessed January 5, 2015.
21. Nwosu, C. O., Madu, P. P and Richards, W. S. 2007. Prevalence and seasonal changes in the population of gastrointestinal nematodes of small ruminants in the semi-arid zone of north-eastern Nigeria. *Veterinary Parasitology*, *144:* 118-124.
22. Chiejina, S. N. 1986. The epizootiology and control of parasitic gastro-enteritis of domesticated ruminants in Nigeria. *Helminthological Abstracts* (Series A), *55:* 413-429.
23. Dagnachew, S., Amamute, A. and Temesgen, W. 2011. Epidemiology of gastrointestinal helminthiasis of small ruminants in selected sites of North Gondar Zone, Northwest Ethiopia. *Ethiopia Veterinary Journal*, *15:* 57-68.
24. Githigia, S. M., Thamsborg, S. M., Maingi, N. and Munyua, W.K. 2005. The epidemiology of gastro-intestinal nematodes in Goats in the low potential areas of Thika District, Kenya. *Bulletin of Animal Health Production in Africa*, *53(1):* 5-12.
25. Keyyu, J. D., Kassuku, A. A., Kyvsgaard, N. C. and Willingham, A. L. 2003. Gastro-intestinal nematodes in indigenous zebu cattle under pastoral and nomadic management systems in the lower plain of Southern highlands of Tanzania. *Veterinary Resource Communication*, *3(5)*: 371-380.
26. Regassa, F., Teshale, S., Reta, D. and Yosef, K. 2006. Epidemiology of gastrointestinal parasites of ruminants in Western Oromia, Ethiopia. *International Journal Applied Resource Veterinary Medicine*, *4(1):* 51-57.
27. Urquhart, G. M., Armour, J., Duncan, J. L., Dunn A. M. and Jennings, F. W. 1996. *Veterinary Parasitology*, *2nd Edition*, Blackwell Science, pp. 213-356.
28. Taswar, Z., Ahmad, S., Lashari, M. H. and Hayat, C. S. 2010. Prevalence of *Haemonchus contortus* in sheep at Research Centre for Conservation of Sahiwal Cattle (RCCSC) Jehangirabad, District Khanewal Punjab, Pakistan. *Pakistan Journal of Zoology*, *42*: 735-739.
29. Raza, M. A., Iqbal, Z., Jabbar, A. and Yaseen, M. 2007. Point prevalence of gastrointestinal helminthiasis in ruminants in southern Punjab. *Pakistan Journal of Helminthology*, *81:* 323-328.
30. Sissay, M. M. 2007. Helminth parasites of sheep and goats in eastern Ethiopia. Doctoral thesis, Swedish University of Agricultural Sciences, Uppsala.
31. Pavlasek, I., Holasova, E. and Jelenova, I. 1990. Dynamics of occurrence of endoparasites in lambs. *Veterinarstvi*, *40:* 540-543.
32. Sievers, G., Jana, M., Cardenas, C. and Nunez, J. 2002. Annual study of the egg and oocyst outputs of gastro-intestinal parasites and lungworm larvae in a sheep station of Magallanes, Cile Arch. *de Medicine Veterinary*, *34:* 37-47.
33. Kaur, A., Bali, H. S. and Duggal, C. L. 1995. Seasonal variation of anoplocephaline cestodes infection in sheep of Punjab. *Indian Journal of Animal Science*, *56:* 30-40.
34. Tilahun, G. 1996. *Epidemiology of helminth parasites of small ruminants in mid-low-land Ethiopia*. In: Parasitology Research in Africa. Proceed. An IFS Workshop, Burkina Faso, 6-10 Stockholm, Sweden, *International Foundation for Science*, 225-269.

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