Assessment of Helminth Infections in Goats Slaughtered in an Abattoir in a suburb of Accra, Ghana

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Abstract

A cross-sectional study to evaluate parasitic infections in small ruminants was conducted in an abattoir in a suburb of Accra from January to March 2015. Samples from various sections of the gut of 35 goats, either reared in Ghana or imported from Burkina Faso, were analyzed using the Kato-Katz technique. The overall prevalence was 100%. The proportions of goats infected with each parasite type were 100%, 94.4%, 88.6%,80.5%, 68.6 62.8% and 44.4% respectively for *Strongyloides* sp., tapeworms, *Ascaris* sp., *Fasciola hepatica*, *Trichuris* sp., *Haemonchus contortus* and *Schistosoma haematobium*. The proportion of animals infected with *Haemonchus contortus* was significantly higher in imported goats than those reared locally (p<0.05). The mean intensity of infection was low for all the parasites. However, high diversity of parasites with 80% of goats having at least four parasite types was observed. The data show high multiple infections in the goats brought to the slaughter house and suggest the need to institute appropriate measures to curb the problem.

Introduction

Small ruminant production is a major source of livelihood for many in the developing world particularly the rural poor (Acharya and Singh, 1992; Peacock, 2005; Kumar *et al*., 2006; Dossa *et al*., 2008; Duku *et al*., 2011). Small ruminants also play an important role in the food and nutritional security of millions of rural people (Kumar and Roy, 2013) and help balance human nutrition (Adam *et al*., 2010). The importance of small ruminant production in Ghana, particularly northern rural Ghana (Otchere, 1986; Mahama, 2012), cannot be overemphasized.

Several factors such as poor nutrition and diseases (Tibbo *et al*., 2004) account for low productivity in small ruminants. Helminth infection is one such key factor, as it constitutes one of the most important constraints to small ruminant production (Tibbo *et al*., 2004; Zeryehun, 2012). The infections pose serious problems to small ruminant production in the developing world particularly where sanitation and nutrition are poor (Sharkhuu, 2001 & Faye *et al*., 2003) and suitable environmental factors that influence the development, survival, distribution or migratory behavior of free-living stages of helminths are present (Stromberg, 1997). The result is enormous economic losses due to weight loss and mortality in heavily-infected animals (Ngategize *et al*., 1993; Lebbie *et al*., 1994; Wanyangu and Bain, 1994), condemnation of affected organs at slaughter (Kumsa and Wossene, 2006), lowered fertility and productivity (Lebbie *et al*., 1994; Teklye, 1991), among others.

The control of helminth infection in small ruminants, therefore, requires serious attention to increase their productivity and to improve the livelihood of farmers. This study assessed helminth infection in goats slaughtered in an abattoir in a suburb of Accra, Ghana.

Materials and methods

Study population

Thirty-five (35) goats brought to an abattoir in a suburb of Accra, from January to March 2015 were included in the study. Fifteen of the goats were reared in Ghana and 20 imported from Burkina Faso.

Sample collection and analysis

All animals that were brought to the abattoir on the days of visitation were sampled. Faecal samples, of about ten grams (10 g) each, were taken from sections of small and large intestines of the gut, placed in suitable leak-proof plastic containers, tightly closed, labeled and transported on ice to the laboratory for examination. The faecal samples were also examined macroscopically for their consistency as watery, loose, soft or solid and presence of worms or segments of cestodes. Information on the animals with regard to source and purpose for slaughter were also obtained by interviewing the owners of the animals.

Samples were processed using the Kato-Katz technique (Katz *et al*., 1972). Briefly, some faecal matter was placed on a sheet of newspaper and a nylon screen was pressed on top such that some of the faeces sieved through the screen and accumulated on top of the screen. The sieved faeces was added to a 41.7 mg template placed on a microscope slide till the hole in the template was completely filled and excess faeces removed from the edge of the hole. After carefully removing the template, the sieved faecal matter was covered with a pre-soaked cellophane strip. The slide was then inverted and the faecal matter spread evenly by pressing. The slide was left for an hour and examined under a light microscope. The intensities of infection were determined as eggs per gram of faecal matter (EPG).

Data analysis

The data on the number of eggs were entered into MS excel and analyzed with GraphPad Prism (GraphPad Prism, GraphPad Software, San Diego, CA, USA). Prevalences were compared using a z- test. $P<0.05$ was considered significant.

Results

Characteristics of Study Animals

A total of 35 goats were sampled out of which 20 were imported from Burkina Faso whiles the remaining 15 were reared in Ghana.

Prevalence of Helminthic Infections

Five nematode genera, *Strongyloides*, *Ascaris*, *Trichuris*, *Haemonchus* and *Bunostomum*, some cestodes, and two trematode genera, *Fasciola and Schistosoma were* identified in the goats. The proportions of goats infected with each parasite type were: *Strongyloides* sp. (100,0%), *Ascaris* sp., (88.6%), *Trichuris* sp. (68.6%) and *Haemonchus contortus* (62.8%). Tapeworms, *Fasciola hepatica and Schistosoma haematobium* were identified in 4.4%, 80.5% and 44.4% of the goats, respectively (Table 1). *Bunostomum* sp. was also found in 20% of the goats, though the Kato katz method has been observed to be unsuitable for hookworm identification (Dacombe *et al*., 2007 & Tarafder *et al*., 2010).

The proportions of goats infected with various parasites did not differ significantly between local and imported animals for most parasites. However, the proportions of animals infected with *Haemonchus contortus* was significantly higher in imported goats compared to locally reared ones ($P < 0.05$) (Table 1).

TABLE 1
Proportion of Goats infected with various Parasites

Parasites *Nematodes*	*Total N = 35*	*Local goats, n = 15* *(%)*	*Goats imported, n = 20*
Ascaris sp.	88.6	80	95
Haemonchus contortus	62.8	46.7	75
Trichuris sp.	68.6	73.3	65
Strongyloides sp.	100.0	100	100
Cestodes			
Tapeworms	94.4	100	92.3
Trematodes			
Schistosoma haematobium	44.4	50	42.3
Fasciola hepatica	80.5	80	80.8

Intensity of Infection

The mean intensity of infection, measured as number of eggs per gram of faecal matter (EPG), was low (< 500 EPG) for all the parasites, according to established classification of infection intensity (Soulsby, 1982). However, it was highest for *Strongyloides* sp. (127.2±57 EPG), followed by Tapeworms (99.6±14.8 EPG) and *Fasciola hepatica (*43.6±10.0 EPG) with *Schistosoma haematobium,* the least (8.9±2.9 EPG). There were no significant differences in intensity of infection with the various parasites between locally reared and imported goats (Table 2).

Multiple Infection

All the goats had more than one parasite types with 14.3% of them infected with, as high as, seven different parasites. Also, 80% of the goats had at least four parasite types. Fig. 1 shows the rate of multiple infections.

Discussion

Gastrointestinal parasitic infections in ruminants are world-wide problems that

TABLE 2
Mean Intensities of parasitic infection in Goats

Parasites *Nematodes*	*All*	*Local goats, n =15* *Mean intensity ± SEM* (EPG**)*	*Goats imported, n = 20*
Ascaris sp.	29.8 ± 4.3	22.2 ± 1.3	35.3 ± 2.4
Haemonchus contortus	16.8 ± 13	15.2 ± 10.2	18.0 ± 13.6
Strongyloides sp.	127.2 ± 57	132.0 ± 62.2	124.8 ± 57.7
Trichuris sp.	15.1 ± 9.8	18.2 ± 5.9	12.6 ± 9.3
Cestodes			
Tapeworms	99.6 ± 14.8	98.7 ± 25.8	100.0 ± 18.6
Trematodes			
Schistosoma haematobium	8.9 ± 2.9	5.3 ± 3.5	10.7 ± 4.0
Fasciola hepatica	43.6 ± 10.0	58.7 ± 23.4	36.0 ± 9.6

**SEM = standard error mean. **EPG = Eggs per gram of faeces*

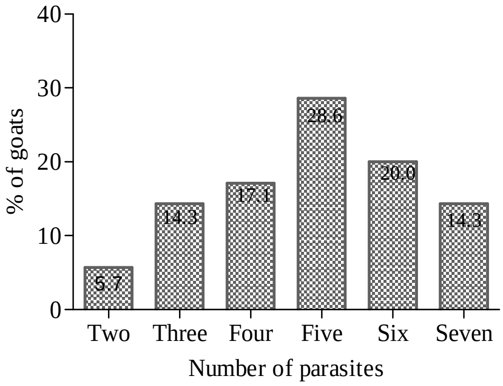

Fig. 1. Percentage of goats infected with multiple parasites

confront the livestock industry with higher severity in many developing countries. Some of the infections are zoonotic, infecting millions of people in endemic developing countries (WHO, 2015). The high prevalence and the wide diversity of helminthic parasites found in this study highlight this problem. The overall prevalence was 100% and at least eight helminths belonging to five nematode genera, two trematode genera and some cestodes were identified (Table 1). This is in line with previous studies that showed high prevalence and wide variety of gastrointestinal parasites in small ruminants and goats in particular (Nwosu *et al.*, 1996 & Ntonifor *et. al.*, 2013).

Strongyloides sp. had the highest prevalence of 100% with the highest mean intensity of 127.2 ± 57. This is not surprising because prevalence of *Strongyloides* spp. is known to be high in ruminants in the tropics and sub-tropics with 93%, 90.4% and 55% previously observed in goats in Nigeria, Cameroon and The Gambia, respectively (Fritsche *et al.*, 1993; Nwosu *et al.*, 1996 & Ntonifor *et al.*, 2013). This indicates that *Strongyloides* infection is still a major problem for small ruminant farmers in Ghana and the sub-region in general.

Tapeworms are also known to be a major parasitic infection in Ghana. The prevalence of tapeworms in this study was 94.4%. At an abattoir in Accra, tapeworms, rumen flukes and hydatid cysts were found in majority of the animals, infecting 82.2% and 67.5% of goats in Tema and Amasaman, respectively (Bannerman-Williams, 2013). Species reported by Bannerman-Williams (2013) included *T. multicep, T. serialis, T. glomerata* and *T. brauni*. However, the prevalence of tapeworms was not shown. Our data indicate high prevalence of tapeworm infection in goats. Tapeworm infections cause taeniasis and cysticercosis, which are associated with severe disease. Therefore, the high prevalence must be of interest to the stakeholders in the ruminant farming industry.

The prevalence of *Ascaris* in the goats examined was 88.6%. Reports on *Ascaris* infections in ruminants are scanty, but a prevalence of 6.1% in cattle in institutions with high level of management systems (Squire *et al.*, 2013) suggests that the prevalence could be much higher in animals raised in small and household farms. The high prevalence calls for further study to determine the *Ascaris* species responsible.

Whereas *Fasciola* spp. was listed as one of the main trematodes that infect goats and sheep in sub-Saharan Africa (Kusiluka and Kambarage, 1996), some previous reports show that *Fasciola* spp. is not among the most prevalent gastrointestinal parasites of goats and sheep in Ghana (Blackie, 2014). However, 80.5% of goats examined in this study were infected with *Fasciola* spp. In a recent study, prevalence of 51.1% was observed in cattle raised in two institutional farms in Southern Ghana with appreciable level of management system (Squire *et al*., 2013), a much lower prevalence than what we have observed in the goats. But the selective monthly deworming for calves 12 months old and less and sick animals (Squire *et al*., 2013) might have reduced the prevalence. Therefore, the prevalence of *Fasciola* spp. might be much higher in cattle raised by private and small holder farmers than observed in the institutional farms. Fascioliasis, the disease caused by *Fasciola* spp. or liver flukes, is one of the most important parasitic infections in many developing countries, infecting ruminants and humans (WHO, 2015). It does not only lead to poor growth and loss of animals but also high liver condemnation (Swai and Ulicky, 2009)**.**

In a study conducted by Agyei (1997), *Haemonchus contortus* was the most prevalent infection in coastal savannah regions of Ghana. Although *H. contortus* was not the most prevalent in this study, prevalence of 62.8% should be taken seriously. This rate is also similar to what have been reported in some countries in West Africa (Fritsche *et al*., 1993 & Nwosu *et al*., 1996). This indicates that *H. contortus* is a major and widespread infection in the sub-region. Resistance of the parasite to dewormers (Kaplan & Vidyashankar, 2012) further makes the situation scary. The prevalence of *Trichuris* sp. was 68.6%. This is higher than 12% reported in The Gambia, but comparable to 72.5% observed in Nigeria (Fritsche *et al*., 1993; Nwosu *et al*., 1996).

Schistosoma haematobium infection was the lowest (44.4%) in the goats examined. *Schistosoma* infection in cattle is well known (De Bont and Vercruysse, 1997) and has been reported as one of the main trematodes in goats and sheep in sub-Saharan Africa (Kusiluka and Kambarage, 1996). In a previous study, as high as 66.7% of grasscutters examined were infected with *S. haematobium* (Futagbi *et al.*, 2010), higher than what has been observed in goats in the current study. Squire *et al*. (2013) also recorded 21.7% prevalence for unidentified *Schistosoma* species in cattle in two institutional farms in Ghana. Since *S. haematobium* eggs are rarely seen in faeces of animals, especially with low parasitic infection, both the prevalence and the intensity of infection might be higher than reported in this study.

Though the Kato-Katz method is not good for identification of hookworms, *Bunostomum* sp was identified in 20% of the goats. This prevalence might, therefore, be an underestimation. Further work is required to ascertain the extent of hookworm infection in goats slaughtered in abattoirs and in farms.

The high prevalences of parasites and multiple infections in both local and imported animals for most parasites is an indication that the problem may be similar in the neighbouring countries. However, the percentage of animals infected with *H. contortus* was significantly higher in imported goats (75%) compared to locally-reared ones (46.7%). This is in agreement with reports of variations in prevalence of parasitic infections among countries and areas (Poulin, 2006).

The mean intensity of infection was low for all the parasites. However, about 80% of the goats had at least four parasite types.

This indicates that though the intensities of the individual parasite types were low, together they constitute a considerable parasite burden.

The high prevalence of parasitic infections is not surprising because keeping pastures and watering systems free of contamination with parasites and microbes remains a major problem for many farmers in the sub-region where poor farm management methods and general poor hygienic conditions of farms are the norm (ILRI, 2002). It is also a common place to see farmers keeping free range livestock that are exposed to parasitic infections. Parasitic infections in livestock are known to affect productivity which manifest in low fertility, reduction in food intake, low weight gain, high treatment cost and high mortality (Lebbie *et al*., 1994 & Teklye, 1991). Farmers should, therefore, be encouraged to adopt the use of broad spectrum anthelmintics to improve productivity.

Conclusion

In conclusion, the data show high prevalence and multiple infections in the goats brought to the slaughter house with majority of the animals having at least four parasites. The data suggest considerable helminthic parasitic problem for small ruminant farmers and the need to strengthen existing control measures and institute additional ones to curb the problem.

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References

Acharya R.M. and **Singh N. P.** (1992). The role of goats in conservation of ecology and livelihood security. Pre-conference proceedings, V International Conference on Goats. pp.81–99.

Adam H., Atengdem P. B. and **Al-hassan S.** (2010). Innovations adoption levels of small ruminant farmers in Tolon-Kumbungu district of Ghana. *GJDS*, **7**(2), 39–66.

Agyei A. D. (1997). Seasonal changes in the level of infective strongylate nematode larvae on pasture in the coastal savanna regions of Ghana. *Vet. Parasitol.* **70**: 175–182.

Bannerman-Williams E. (2013). Gastrointestinal Parasites in Ruminants at Selected Abattoirs in the Greater Accra Region, Ghana. A Master of Philosophy Thesis, University of Ghana, Legon, Accra, Ghana.

Blackie S. (2014). A Review of the Epidemiology of Gastrointestinal Nematode Infections in Sheep and Goats. *Ghana J. Agric. Sci*. **6**(4)…

Dacombe R. J., Crampin A. C., Floyd S., Randall A., Ndhlovu R., Bickle Q. and **Fine P. E.** (2007). Time delays between patient and laboratory selectively affect accuracy of helminth diagnosis. *Trans. R. Soc. Trop. Med. Hyg.* **101**:140–145.

De Bont J. and **Vercruysse J.** (1997).The epidemiology and control of cattle schistosomiasis, *Parasitol. Today* **13**(7): 255–262.

Dossa L.H., Rischkowsky B., Birner R. and **Wollny C.** (2008). Socioeconomic determinants of keeping goats and sheep by rural people in southern Benin. *Agr. Hum. Values* **25**(4): 581–592.

Duku S., Price L.L., Tobi H. and **Zijpp A.** (2011). Influence of male or female headship on the keeping and care of small ruminants: the case of the transitional zone of Ghana. Livestock Research for Rural Development 23(1). Available at: http://www.lrrd.org/lrrd23/1/duku23009.htm. Accessed June, 2015.

Faye D., Leak S., Nouala S., Fall A., Losson B. and **Geerts S.** (2003). Effects of gastrointestinal helminth infections and plane of nutrition on the health and productivity of F1 (West African Dwarf × Sahelian) goat crosses in The Gambia. *Small Rumin. Res.* **50**(1–2): 153–161.

Fritsche T., Kaufmann J. and **Pfister K.** (1993). Parasite spectrum and seasonal epidemiology of gastrointestinal nematodes of small ruminants in The Gambia. *Vet. Parasitol.* **49**: 271–283.

Futagbi G., Agyei D. O., Aboagye I. F., Yirenya-Tawiah D. R. and **Edoh D. A.** (2010). Intestinal Parasites of the Grasscutter (*Thryonomys swinderianus*, Temminck 1827) from Kwaebibirem District in the Eastern Region of Ghana. *W. Afr. J. of App. Ecol.* **17**: 81–86.

International Livestock Research Institute (ILRI). (2002). *Mapping Poverty and Livestock in the Developing World*. A report commissioned by the UK Department for International Development, on behalf of the Inter-Agency Group of Donors Supporting Research on Livestock Production and Health in the Developing World (P. K. Thornton, R. L. Kruska, N. Henninger, P. M. Kristjanson, R. S. Reid, F. Atieno, A. N. Odero and T. Ndegwa, ed). Available at: https://www.ilri.org/InfoServ/Webpub/fulldocs/investinginAnimal/Book1/media/PDF_chapters/B1_5.pdf

Kaplan R. M. and **Vidyashankar A. N.** (2012). *An* inconvenient truth: global warming and anthelmintic resistance. *Vet. Parasitol.* **186**(1–2): 70–78.

Katz N., Chaves A. and **Pellegrino J.** (1972). A simple device for quantitative stool thick-smear technique in *Schistosomiasis mansoni*. *Rev. Inst. Med. Trop. Sao Paulo*: 397–400.

Kumar S. and **Roy,M. M.** (2013). Small Ruminant's Role in Sustaining Rural Livelihoods in Arid and Semiarid Regions and their Potential for Commercialization. In *New Paradigms in livestock production from traditional to commercial farming and beyond*. Agrotech publishing academy, Udaipur, pp. 57–80.

Kumar S. Vaid R. K. and **Sagar R. L.** (2006). Contribution of goats to livelihood security of small ruminant farmers in semiarid region. *IJSR* **12** (1): 61–66.

Kusiluka L. and **Kambarage D.** (1996). Common diseases of sheep and goats in sub-saharan Africa. In: *Diseases of Small Ruminants: A Handbook*. Vetaid publishers, Scotland. 68 pp.

Kumsa B. and **Wossene A.** (2006). Abomasal nematodes of small ruminants of Ogaden region, eastern Ethiopia: prevalence, worm burden and species composition. *Rev. Med. Vet*., 157:27–32.

Lebbie S. H. B., Rey B. and **Irungu E. K.** (1994). Small ruminant research and Development in Africa. Proceedings of the Second Biennial Conference of the African Small Ruminant Research Network. ILCA. 1994:1–5.

Mahama C. (2012). Farm Animals are Vital to Ghana's Food Secure Future, Modern Ghana Multimedia Group. Modern Ghana. Available at http://www.modernghana.com/news/404595/1/farmanimals-are-vital-to-ghanas-food-secure-futur.html. Accessed June 2015.

Ngategize P. K., Tekelye G. and **Getachew T.** (1993): Financial losses caused by ovine fasciolosis in Ethiopian highlands. *J. Trop. Anim. Hlth. Prod*., **25**:155–161.

Ntonifor H. N., Shei S. J., Ndaleh N. W. and **Mbunkur, G. N.** (2013). Epidemiological studies of gastrointestinal parasitic infections in ruminants in Jakiri, Bui Division, North West Region of Cameroon. *J. Vet. Med. Anim. Hlth.* **5**(12): 344–352.

Nwosu C. O., Ogunrinade A. F. and **Fagbemi B. O. (**1996). Prevalence and seasonal changes in the gastro-intestinal helminths of Nigerian goats. *J. Helminthol*. **70**: 329–333.

Otchere E. O. (1986). Small Ruminant Production in Tropic Africa. FAO Animal Production and Health, Paper 58. Food and Agriculture Organisation (FAO), Sofia, Bulgaria.

Peacock C. (2005). Goats -A pathway out of poverty. *Small Rumin. Res.,* **60**: 179–186.

Poulin R. (2006**).** Variation in infection parameters among populations within parasite species: intrinsic properties versus local factors. *Int. J. Parasitol*. **36**: 877–885.

Sharkhuu T. (2001). Helminths of goats in Mongolia. *Vet Parasitol*. **101**(2): 161–169.

Stromberg B. E. (1997). Environmental factors influencing transmission. *Vet. Parasitol.* **72**: 247–264.

Squire S. A., Amafu-Dey H. and **Beyuo J.** (2013). Epidemiology of gastrointestinal parasites of cattle from selected locations in Southern Ghana. *LRRD, 25 (117).* Retrieved July 24, 2015, from http://www.lrrd.org/lrrd25/7/squi25117.htm

Soulsby E. J. L. (1982*). Helminths, Arthropods and Protozoa of Domesticated Animals*. Lea and Febiger, Philadelphia, 292 pp.

Swai E. S. and **Ulicky E.** (2009). An evaluation of the economic losses resulting from condemnation of cattle livers and loss of carcass weight due to Fasciolosis: a case study from Hai town abattoir, Kilimanjaro region, Tanzania. *LRRD, 21 (186).* Retrieved August 17, 2015, from http://www.lrrd.org/lrrd21/11/swai21186.htm.

Tarafder M., Carabin H., Joseph L., Balolong E., Olveda R. and **McGarvey S.** (2010). Estimating the sensitivity and specificity of Kato-Katz stool examination technique for detection of hookworms, *Ascaris lumbricoides* and *Trichuris trichiura* infections in humans in the absence of a "gold standard." *Int. J. Parasitol.* **40**(4): 399–404. doi:10.1016/j.ijpara.2009.09.003.

Teklye B. (1991). Epidemiology of endoparasites of small ruminants in sub-Saharan Africa. *Proceedings of Fourth National Livestock Improvement Conference. Addis Ababa, Ethiopia; 13–15 November 1991: 7–11.*

Tibbo M,, Aragaw K, and **Deressa A**. (2004). Effects of anthelmintics and supplementation on productivity of Menz and Menz- Awassi crossbred sheep with sub-clinical helminthosis. *Ethiop. Vet. J.* **8 (2)**: 1–22.

Wanyangu S. W. and **Bain R. K.** (1994). The impact of helminth infection on small ruminant production in tropical Africa. *The Kenya Veterinarian* **18** (2): 104–106.

World Health Organization (2015). *Fascioliasis: infection with the "neglected" neglected worms* .World Health Organization, Geneva. Available at: http://www.who.int/neglected_diseases/integrated_media/integrated_media_fascioliasis/en/ Accessed on 24th August, 2015.

Zeryehun T. (2012). Helminthosis of sheep and goats in and around Haramaya, Southeastern Ethiopia. *J. Vet. Med. Anim. Hlth*. **4**(3): 48–55.