Veterinary Parasitology: Regional Studies and Reports 13 (2018) 130–134

Contents lists available at ScienceDirect

Veterinary Parasitology: Regional Studies and Reports

journal homepage: www.elsevier.com/locate/vprsr

Gastrointestinal parasites in small ruminants from Grenada, West Indies: A coprological survey and a review of necropsy cases

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ARTICLE INFO

Keywords:
Gastrointestinal parasites
Small ruminants
Grenada

ABSTRACT

Gastrointestinal parasites are important in small ruminant farming because they can impact negatively on the productivity of animals. The objectives of the present study were to estimate the prevalence of gastrointestinal parasites and to assess mortality attributable to gastrointestinal parasite infection in sheep and goats. We collected fecal samples from 114 sheep and 292 goats from 34 farms for coprological examination. In addition, we evaluated necropsy records for sheep and goats that were submitted from 2002 to 2016 to the pathology diagnostic laboratory in the School of Veterinary Medicine at St. George's University, Grenada. Out of 406 small ruminant (292 goat and 114 sheep) fecal samples examined, 385 were positive for gastrointestinal parasites, giving an overall prevalence of 95% (95% confidence interval (CI) 92% to 97%). All the 34 farms visited were found to have positive animals to at least one type of gastrointestinal parasite; 100% herd prevalence (95% CI: 88% to 100%). Among the 292 goat fecal samples examined, 285 were positive for gastrointestinal parasites (98%; 95% CI: 95% to 99%) whereas the proportion of positive fecal samples in sheep was 88% (95% CI: 80% to 93%). There was a significant difference in prevalence of gastrointestinal parasites between sheep and goats (p = .0002). The proportion of infection with coccidia in goats and sheep was 76% and 75%, respectively. For helminthes, the proportions were as follows: *Moniezia* spp., 14% in goats and 4% in sheep; *Strongyloides* spp., 36% in goats and 21% in sheep; strongyle type eggs 89% in goats and 66% in sheep. Mixed infections in both sheep and goats were more common (92%) than single ones (8%). Out of 220 necropsy records evaluated, 29% of mortality was due to *Haemonchus contortus* infection. *Moniezia* spp and *Oesophagostomum* spp. were also commonly found.

1. Introduction

In small island countries where grazing land is limited, small ruminants provide a better option for livestock farming than cattle. In Grenada, small ruminants are an important aspect of agriculture. According to the 2009 technical report on agriculture in Grenada, the local demand for goat and sheep meat is still not met (http://www.grenadagov.info/egov/docs/report). Many residents in Grenada are involved in small scale sheep and goat production mainly for consumption in the form of meat, milk, and milk products. Occasionally, small ruminants are also used as a source of emergency income (Vokaty and Torres, 1997). Flock sizes of sheep and goats in Grenada are often small; comprising 5–20 animals; which are usually kept on free-range in an extensive system of management. Farms are usually of a mixed type, comprising both sheep and goats.

Gastrointestinal parasites can have a negative impact on small ruminant production due to both direct and indirect losses. Direct losses include, mortality, premature slaughter and condemnation of meat during inspection at the abattoir whereas indirect losses are through reduced productivity as a result of subclinical disease (Maichomo et al. 2004).

Studies on gastrointestinal parasites affecting small ruminants that have been conducted worldwide reveal differences and similarities in prevalence and types of gastrointestinal parasites. Risk factors for gastrointestinal parasites include climate, education level of farmers, age, and type of management (Kantzoura et al. 2012). One coprologic study in Trinidad, a neighboring island of Grenada revealed a prevalence of 55% in sheep and 85% in goats for gastrointestinal parasites. In this same study, *Hemonchus contortus*, *Eimeria* spp., *Moniezia* spp. and *Strongyloides* spp. were the prevalent gastrointestinal parasites

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https://doi.org/10.1016/j.vprsr.2018.05.004
Received 26 July 2017; Received in revised form 21 May 2018; Accepted 27 May 2018
Available online 28 May 2018

identified (Mohammed et al. 2010).

Despite most farmers reporting deworming of their animals on a regular basis, gastrointestinal parasites are still a major problem in small ruminant production in Grenada. To our knowledge, no study on gastrointestinal parasites has been done in small ruminants in Grenada. The aims of the present study were to estimate the prevalence of gastrointestinal parasites and to retrospectively assess mortality that could be attributed to gastrointestinal parasite infection in small ruminants in Grenada.

2. Materials and methods

2.1. Study area

Grenada is a small tri-island state located in the eastern Caribbean with an area of approximately 344 km^2. Grenada, the main island is divided into 6 parishes. The other sister islands which are part of Grenada are Carriacou and Petit Matinique. The average temperature of the tri-island state is 28 °C.

2.2. Ethical approval

Ethical approval to conduct this study was granted by the Institutional Animal Care and Use Committee (IACUC) at St. George's University.

2.3. Sampling and testing of fecal samples

From May to July 2011 we collected fecal samples from randomly selected sheep and goat farms from all the 6 parishes of the main island Grenada and also from Carriacou. Carriacou. Fecal samples were collected in plastic bottles and transported to the Parasitology laboratory at the School of Veterinary Medicine, St. George's University. All fecal samples were kept at 2 °C and were examined the following day; approximately 24 h from the time of collection. A fecal flotation test as recommended by Foreyt (2001) and Bowman (1999) was conducted as follows: Five grams of feces were mixed with water in a paper cup and strained into a second paper cup. The contents from the second paper cup were put in a 15 ml tube and centrifuged at 1500 rpm for 10 min. The supernatant was decanted. The sediment was re-suspended in a flotation solution (sodium chloride; specific gravity = 1.18–1.2) and centrifuged at 1500 rpm for 10 min. The centrifuge tube was then filled to the brim with more sodium chloride and a cover slip placed on top of the tube. After 10 min, the cover slip was removed from the centrifuge tube and placed on a glass slide for microscopic examination. For the McMaster method, 3 g of feces were mixed in 15 ml of water. Strained material was poured into a 15 ml tube and centrifuged at 1500 rpm for 2 min. The sediment was mixed in 10 ml of sodium chloride and poured into a beaker and 32 ml of additional sodium chloride solution was added. With a pipette, the suspension was transferred into a McMaster counting chamber. The total number of eggs or oocysts counted in both chambers was multiplied by 50 for the total number of either eggs or oocysts per gram of feces. The number of animals, age, deworming history and any disease history on each farm visited were also recorded.

2.4. Review of necropsy records

In addition, necropsy records of sheep and goats submitted to the Pathology laboratory in the School of Veterinary Medicine, St. George's University from 2002 to 2016 were evaluated for evidence of gastrointestinal parasites and for the cause of death. Since a total worm count was not undertaken, it is possible that other trichostrongyles were not seen on gross examination. Therefore, they could not be diagnosed. This was a limitation for the present study.

2.5. Statistical analysis

Descriptive statistics of mean and range were used for data pertaining to small ruminant fecal samples. We calculated prevalence by dividing the number of positive fecal samples by the total number of samples examined. A Chi-square test to assess whether there was a significant difference in the prevalence obtained between caprine and ovine species was employed. A p-value < .05 was interpreted as statistically significant.

3. Results

Out of 292 goat and 114 sheep fecal samples examined, 385 were positive for gastrointestinal parasites on simple flotation test, giving an overall prevalence of 95% (95% confidence interval (CI) 92% to 97%). For determination of prevalence, we did not use the McMaster results because in 7 animals in which strongyle eggs and coccidia were seen on simple flotation, only coccidia were detected by the McMaster test. This was most likely due to the larger amount of feces used in flotation test and the lower detection limit of the McMaster test. The other explanation for this could possibly be attributed to the uneven distribution of eggs in the fecal samples. There was a significant difference in prevalence of gastrointestinal parasites between sheep and goats (p = .0002). Mixed infections in both sheep and goats were more common (92%) than single ones (8%). Prevalence of gastrointestinal parasites in sheep and goats is as shown in Table 1. Young animals < 1 year and between 1 and 2 years were generally more infected with gastrointestinal parasites than the older ones (> 3 years) in both sheep and goats (Table 2).

The proportion and types of gastrointestinal parasite egg/oocyst according to parish is as shown in Table 3. There was widespread infection with gastrointestinal parasites in all the 6 parishes of Grenada, including on the island of Carriaocou. All the 34 farms (100%) where found to have positive animals to at least one type of gastrointestinal parasite; giving a flock prevalence of 100%. Table 4 shows the proportion of infection with gastrointestinal parasites on the 34 farms.

Fecal egg and oocyst counts were high in both species. Table 5 shows fecal egg and oocyst counts in eggs/oocyst per gram (epg/opg) for gastrointestinal helminthes and coccidia in both sheep and goats. Strongylid eggs as a group were identified using the guide by Forety (2001) and Bowman (1999) for the morphology of eggs. Fecal cultures were not undertaken.

Out of the 220 small ruminant necropsy records evaluated, 29% of the deaths were attributed to *Haemonchus contortus* infection. Lesions due to *Hemonchus contortus* noted at necropsy were, generalized pallor

Table 1
Prevalence and types of sheep and goat gastrointestinal parasite eggs/oocysts in fecal samples from Grenada, West Indies.

Species no.	Examined	% positive	Types of parasite egg/oocyst observed			
			strongyle type	Strongyloides spp	Moniezia spp	Coccidia
Sheep	114	100 (88%)	75 (66%) (75%)	24 (21%)	5 (4%)	85 (75%)
Goat	292	285 (98%)	260 (89%)	106 (36%)	40 (14%)	223 (76%)
Total	406 (76%)	385 (95%)	335 (82%)	130 (32%)	64 (16%)	308 (76%)
P-value		0.0002	0.001	0.0031	0.0710	0.7003