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Research Article

Diagnosis of Gastrointestinal Helminthiases Prevalent in Small Ruminants of Family Farm from Ceará-Brazil

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Abstract

This study aimed to perform a clinical and parasitological diagnosis of gastrointestinal Helminthiases and study some aspects of the parasitic dynamics in sheep and goat herds of family farming in Ceará-Brazil, aiming to contribute to the control of worms in these animals. For this, visits were made to family farms, and animals were evaluated, applied the Famacha exam, and examined the body condition score. In addition, fecal samples were collected directly from the rectal ampulla, always in the morning, from 10 goats and 36 sheep randomly within each category (young and adult). Subsequently, the samples were submitted to macroscopic examination and processing by routine methods in helminthology: EPG (number of eggs per gram of feces) and EOPG (number of eimeriid oocysts per grams of feces). The data were tabulated in a Microsoft Office Excel spreadsheet and expressed as arithmetic means and percentages. Of the total of 46 animals, 26 were positive for the presence of helminth, and 20 were negative for any gastrointestinal parasite. *Strongyloidea* and *Eimeria* were the most frequent, both in goats and sheep. In this study, it was observed that sheep had a higher frequency of animals positive for *Strongyloidea* eggs (58.3%) compared to goats (30%). In conclusion, the results showed that gastrointestinal Helminths are frequent in goat and sheep herds of the family farm of Ceará. The main gastrointestinal helminths that affect goats and sheep raised in these localities are *Strongyloidea*, as well as *Eimeria* oocysts.

Introduction

Goat and sheep breeding is an activity widely exploited in tropical countries, aiming at the production of meat, milk, and skins. In Brazil, the herds of sheep and goats are approximately 20.6 and 12.1 million heads, respectively, of which 70.6% and 95.0% are in the Northeast. The state of Ceará, holds about 2.4 and 1.1 million head of sheep and goats, respectively [1]. It is noteworthy that these animals are exploited in all five geographic regions of the country. Despite holding most sheep and goat herds, the Northeast region still uses inadequate management practices and technologies, which favors the increase of health problems, especially those related to eimeriosis and helminthiasis [2,3].

In this context, parasites caused by gastrointestinal nematodes in small ruminants represent the largest and most serious health problem in the production of these animals, since in the acute form they can quickly lead to death, or, in the chronic form, losses, such as weight loss, decrease in productive and reproductive performance, low immunity and lower body development [4].

The low efficiency of sheep production systems in the semi-arid climate of the Northeast region results from soil and climatic constraints and the use of rudimentary exploitation systems associated with deficiencies in the use of technologies and the management of the production unit, models of family farming in this region [5]. Thus, because they are such a frequent health disorder, it was necessary to conduct a more in-depth study of gastrointestinal parasites that affect the sheep and goat herd in the context of family farming, to contribute to a more efficient parasite control and promote a greater development of this productive segment. Thus, this study aimed to perform clinical and parasitological diagnosis of gastrointestinal helminthiases and study some aspects of the parasite dynamics in sheep and goat herds of family farming.

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Materials and methods

The study was carried out in communities and settlements, in production units of the family business, dedicated to animal production. In these farms, the animals were raised extensively in the caatinga. Initially, the objectives of the work were explained to each producer visited, requesting voluntary collaboration with them, and spontaneously, the family farmers owners of the animals whose samples were collected for this research signed the informed consent form.

This investigation was developed in family farms located in the municipalities of Umirim and Itapajé, Ceará, Brazil. These cities are inserted in the Curu Valley, which is in the northwest of the State of Ceará, and integrate eight municipalities: Apuiarés, General Sampaio, Irauçuba, Itapajé, Pentecost, São Luís do Curu, Tejuçuoca, and Umirim, being

Itapajé is the largest of them in population. Itapajé and Umirim are bordering municipalities and are characterized by a semiarid hot tropical climate, with rains from January to May. The average rainfall is 800.3 mm and 1,275 mm in Itapajé and Umirim, respectively [6].

For the study of some aspects of parasitic dynamics, data were collected from goats and sheep, which were separated by category - young male and female (12 months), adult male and female (> 12 months) – all mixed-breed. In the examined animals, the body condition score (BCS) was evaluated and the Famacha test was applied as a method of clinical diagnosis, which consists of the inspection of the color of the conjunctiva of the animals, the presence or absence of submandibular edema and/or diarrhea. Soon after, fecal samples were collected directly from the rectal ampulla, always in the morning, randomly within categories. Samples were obtained from at least 10% of the herd present in the fold on the day of the visit. In the case of breeders, samples were taken from all animals. Regarding the health history of the animals studied, they had not received vaccines and were only treated with IVOMEC®, an antiparasitic widely used in Brazil. Aiming to minimize the possible influence of anthelmintic use in counting the number of eggs per gram of feces, the harvests were performed only in vermifuged animals for more than 30 days.

After harvesting, the feces were stored in individually identified plastic bags, kept in an isothermal box with ice, and transported to the science laboratory of the Federal Institute of Education, Science and Technology of Ceará. Subsequently, the samples were processed by routine methods in helminthology: EPG (number of eggs per gram of feces) and EOPG (number of eimeriid oocysts per gram of feces). It used the McMaster technique described by Gordon and Whitlock [7], modified by Ueno and Gonçalves [8]. This technique consists of the use of 2 grams of feces and 58 mL of saturated sugar solution. After obtaining the suspension, a small sample was taken and the two areas of the McMaster chamber were filled. For microscopic observation, an increase of 50x was used. The total number of eggs observed in the left area plus the total number of eggs in the right area, multiplied by 100, determined the amount of eggs per gram of feces in the analyzed sample. The data were tabulated in a Microsoft Excel electronic spreadsheet and expressed as arithmetic and percentage means.

Results

This study presents data from 46 animals, divided into sheep (n = 36) and goats (n = 10) mixed-breed young and adult. According to the owners, the vermifugation was performed for more than 30 days, using Ivomec®. Fifteen of the 36 sheep and 5 of the 10 goats presented negative results in the OPG test.

Table 1 shows the overall number of animals used, source, frequency of positive animals, and mean OPG. Sheep showed a higher frequency of positive animals compared to goats.

Regarding the BCS, 50% of the goats presented BCS 1.5 and 50% presented BCS 2, sheep presented BCS between 1.5 and 3.5 (Figure 1). Concerning Famacha results, it was observed Famacha 2 in goats and Famacha 1, 2, 3, and 4 in examined sheep (Figure 2).

Table 1: Number and source of goats and sheep used for sampling, with frequency of positive animals and average number of eggs per grams of feces (EPG), by municipality.

Owner	Source	Specie	Number of animals	Positive animals (%)	Average EPG
A	Itapajé/CE	Goat	10	50.0	100
B	Umirim/CE	Sheep	10	80.0	450
C	Umirim/CE	Sheep	5	100.0	640
D	Umirim/CE	Sheep	7	42.8	167
E	Umirim/CE	Sheep	6	83.3	320
F	Umirim/CE	Sheep	8	0.0	

EPG: number of eggs per gram of feces.

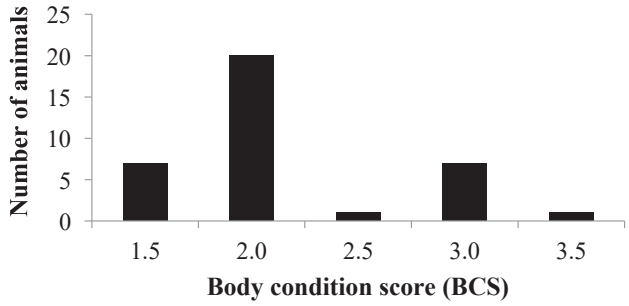

Figure 1: Number of sheep per body condition score (BCS), considering a scale of 1 to 5.

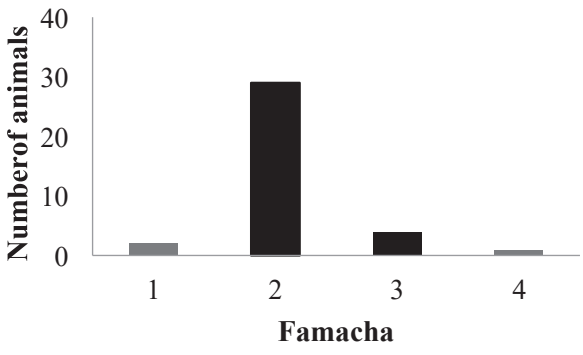

Figure 2: Grades of Famacha were observed in the studied sheep.

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Of the total of 46 animals, 26 were positive for the presence of helminth, and 20 were negative for any gastrointestinal parasite. All had been treated with Ivomec® for more than 30 days and even then, a portion of the herd presented gastrointestinal worms in fecal samples (Figure 3).

In the goat herd, *Strongyloidea* eggs and *Eimeria* oocysts were found in small quantities. Of the 10 animals examined, 5 were positive for the presence of gastrointestinal parasites: 2 had *Strongyloid* spp eggs; 2 had *Eimeria* spp. oocysts and 1 had both parasites.

Strongyloidea, *Oxyuris*, and *Trichuris* eggs, and *Eimeria* oocysts were found in sheep. Of the 36 animals studied, 21 found the presence of gastrointestinal parasites: 9 presented only *Strongyloidea*; 8 presented *Strongyloidea* and *Eimeria*; 1 presented only *Oxyuris*; 2 presented *Trichuris* and *Eimeria*; 1 presented *Eimeria* and *Oxyuris*.

Relating the category of animals to the number of eggs detected in the 36 fecal samples (Table 2), 72.2% and 8.34% of endoparasites were recorded for the adult female and young female categories. It was observed a higher infestation rate in sheep females, with a high frequency of *Strongyloidea.*

Sheep had a more severe level of infection by *Strongyloidea* eggs than goats, with 8.34% of sheep presenting heavy infection and 27.77% with moderate infection, while 100% of goats presented moderate infection (Table 3).

Discussion

In the present work, we investigate Famacha and parasitological diagnosis of gastrointestinal helminthiases and study some aspects of the parasite dynamics in sheep and goat herds of family farming from Ceará, Brazil. Family farming has distinct dynamics and characteristics compared to non-family farming. In it, property management is shared by the family and agricultural productive activity is the main source of income. In addition, the family farmer has a particular relationship with the land, his place of work, and housing. Productive diversity is also a striking feature of this sector. Family farming is a model with emphasis on the conservation of natural resources, use of inputs from the property itself (legumes and grasses), job generation and income with low investment cost. In addition, it can ensure the development of the municipality and at the same time, the growth of the entire socioeconomic environment, keeping the population in its locality, and avoiding displacement to large urban centers, with rural exodus.

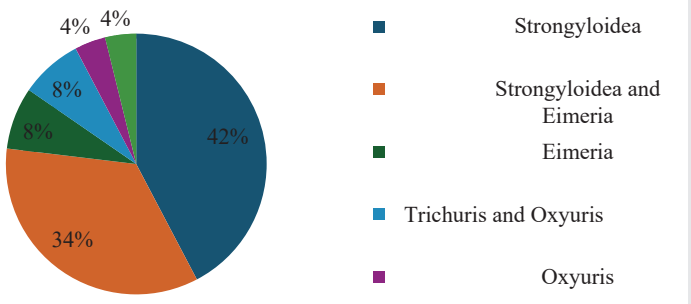

Figure 3: Graph representing the percentage of infection for each helminth in the two studied animal species (sheep and goat).

Table 2: Number and percentage of sheep containing eggs of gastrointestinal helminths and egg oocysts, per animal category.

Category	Number of animals (%)	Helminth positive animals (%)	Eimeriid positive animals (%)
AM	4 (11.12)	1 (2.77)	1 (2.77)
AF	26 (72.2)	17 (47.22)	9 (25.00)
YF	3 (8.34)	3 (8.33)	1 (2.77)
YM	3 (8.34)	0.00 (0.00)	0.00 (0.00)
Total	36 (100.00)	21 (58.32)	11 (30.54)

AM: Adult Male; AF: Adult Female; YM: Young Male; YF: Young Female; EPG: Number of Eggs per Gram of Feces; EOPG: Number of Eimerid Oocysts per Gram of Feces.

Table 3: Frequency of positive sheep in copro parasitological analysis according to the level of *Strongyloidea* egg infection.

Infection level	EPG	Frequency (%)
Light	< 500	10 (27.77%)
Moderate	500-1500	3(8.34%)
Heavy	1501 - 3000	3 (8.34%)
Fatal	> 3000	
Total		44.45%

EPG: Number of Eggs per Gram of Feces.

According to Brazilian Law 11,326/2006, the family farmer and rural family entrepreneur is considered the one who practices activities in rural areas, has an area of up to four tax modules (whose size varies according to the municipality where the property is located) family labor, family income linked to the establishment itself and management of the establishment or enterprise by the family itself. Are also considered family farmers: foresters, aquaculturists, extractivists, fishermen, indigenous, quilombolas, and settlers of the agrarian reform [9].

Many techniques have been developed to diagnose endoparasite infections. Accurate diagnosis is dependent on the sample and method of evaluation. Fecal floats concentrate ova and oocysts into a drop of solution to be examined under a microscope. Common methods of fecal flotation include the McMaster method and the Wisconsin method. Both methods are used with various modifications. The McMaster method involves mixing a known volume of fecal material with a flotation solution and straining the sample to remove large debris before evaluation [10]. According to Dunn & Keymer [11], factors detracting from the reliability of fecal egg counts based on the McMaster technique include variation in flotation time (interval between loading chamber and counting eggs) and sample dilution (ratio of fecal material to salt solution).

The high prevalence of *Strongyloidea* infection levels found in the counting of eggs per gram of feces suggests that this family of parasites is the most common in these cities, presenting higher occurrence and intensity of infection. Productivity in animal rearing is affected by management and diseases. Gastrointestinal parasitism has been one of the major problems in the small ruminant rearing system.

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Gastrointestinal parasites mostly found in small ruminants are *Trichostrongylus colubriformis*, *Teladorsagia (Ostertagia) circumcincta*, *Cooperia* spp., *Oesophagostomum* spp., *Strongloides* spp., *Bunostomum* spp. and *Haemonchus contortus*. Among these, *Haemonchus* spp. (or the Barber's pole worm) is probably the most important parasite of sheep and goats. *Haemonchus contortus* is a blood-sucking parasite and is the major reason for morbidity and production losses in the goat-farming system, especially in the developing world [12].

In this study, it was observed that sheep had a higher frequency of sheep positive for *Strongyloidea* eggs (58.32%) compared to goats (30%). Ahid, et al. (2008) showed similar results, also in the semi-arid region of the Rio Grande do Norte state. The authors also found higher frequency in sheep, observing 60.5% and 49.5% of sheep and goats positive, respectively. According to Costa, et al. (2011), the frequency of parasitosis in small ruminants depends, among other factors, on the feeding habits of the species. When reared extensively, in native areas of the semi-arid region, for example, sheep tend to be more susceptible than goats, and when in the intensive system or cultivated pastures, goats are more susceptible to parasitosis, due to their low ability to create an immune response against nematodes.

The Famacha method developed, tested, and validated in South Africa, allows to identification of animals in severe conditions with a greater chance of not resisting anemia caused by haemonchosis. This method evaluates the coloration of the host eye conjunctiva and its scale ranges from red (grade 1) to pale white (grade 5). According to Chagas, et al. [13], the use of EPG in conjunction with FAMACHA allows to distinguish resistant, resilient, and sensitive animals to gastrointestinal parasites within the herd and also excludes cases of low EPG and high anemia, as gastrointestinal parasites being the main cause, thus eliminating the unnecessary use of dewormers. There are several other causes of anemia in small ruminants (nutritional deficiencies, babesiosis, anaplasmosis, bleeding abomasal ulcers, fascioliasis, injuries severing blood vessels or rupturing the liver or spleen) that should be investigated when there is clinical suspicion because the FAMACHA method cannot help in these situations. In these cases, the veterinarian should be consulted.

In this research, the adult females were most affected by eimeriid oocysts. Coccidiosis (Eimeriosis *sensu stricto*) of small ruminants is a protozoan infection caused by coccidia parasites of the genus *Eimeria* which develop in the small and the large intestine and affect young animals. Several species of *Eimeria* are involved in different ruminant hosts (bovine, ovine, caprine) but there is no cross-infection due to the strict host specificity. Coccidiosis is of great economic importance because of the losses due to clinical disease (diarrhea) and subclinical infections as well (poor weight gain in particular) [14].

In conclusion, the results showed that gastrointestinal helminthiases are frequent in the goat and sheep family farm herds of Ceará. The main gastrointestinal parasites that affect goats and sheep raised in this state are *Strongyloidea*, as well as *Eimeria* oocysts.

With the Famacha examination it is possible to help the producer to decide whether to do the worming because not all animals need to be wormed in a certain time, causing the small producer to decrease spending, and avoiding the faster development of resistance to anthelmintics.

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