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Management practices to control gastrointestinal parasites in dairy and beef goats in Minas Gerais; Brazil

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ABSTRACT

Parasitic infection is recognized worldwide as a limiting factor in the production of goats, and various control methods are used to reduce economic losses, often without considering the epidemiology of the parasites. This has led to the development of highly tolerant parasite populations and the presence of chemical residues in the beef and milk. The objective of this study was to determine the level of knowledge of goat farmers about parasitic diseases and to correlate this with the epidemiology of endoparasites and parasite control practices in goat farms in the state of Minas Gerais, Brazil. The analysis was based on a questionnaire applied by trained veterinarians. The sample was homogeneous throughout the state, covering 18.4% (157/853) of municipalities. Eighty-four dairy goat farms in 81 municipalities and 200 properties with beef goats in 76 municipalities were evaluated. The herd size per goat farm ranged from 4 to 57 (average 24) for beef herds and from 2 to 308 (average 63) for dairy farms. The majority of the beef herd production was extensive and semi-extensive (98.5%), while the dairy herds were maintained under intensive farming (98.8%). The mixed production of goats and sheep was reported by 36.5% of beef goat farmers and by 20.2% of dairy goat farmers. Among the beef goats farms on which the technological level was determined, 2.0% were categorized as having high technological level, 34.5% as medium, and 63.5% as low. Of the 84 dairy farms, 30% operated at a high, 47% at a medium, and 23% at a low technological level. The adoption of practices to reduce parasitism, such as the quarantine of animals, treatment of newly arrived animals, regular cleaning of the floor, and technical assistance, was significantly higher on dairy farms than on beef farms. Although 85.7% of dairy farmers and 83% of beef farmers medicate their animals, the treatments were performed without technical criteria, and deworming intervals ranged from 30 to 120 days or more. The average interval between treatments was significantly longer in dairy goat herds (4.8 months) than in the beef herds (3.6 months). The most commonly used drugs were macrocyclic lactones (37.7% in dairy and 39.5% in beef herds) and benzimidazoles (48.9% in dairy and 31.5% in beef herds). Goat production in Minas Gerais is still in its infancy, and even though using a control program associated with other health practices, producers still rely heavily on chemicals to get satisfactory results.

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1. Introduction

Helminthiasis represents a great impediment to the production of goats, causing damage in several ways depending on the intensity of the infection, an animal's category, nutritional status, cost of medication, and mortality rate (Kassai, 2002). However, infected animals may remain in good health status without the intense/suppressive use of antiparasitic drugs (Molento et al., 2009).

Chemical control of parasitic diseases is widely employed in Brazil (Depner et al., 2007), and drug resistance has been observed in goats (Veale, 2002), caused by the indiscriminate use of anthelmintics and the rapid alteration of chemical groups (Vieira and Cavalcante, 1999). Direct consequences of these malpractices are increased costs of production; chemical residues in milk and beef, and the environment; and increased animal mortality.

Minas Gerais has the largest goat population of the four states in the southwestern region of Brazil, mainly with dairy animals, traditionally producing colonial cheese and sausage. The dairy females are often transported and sold to farmers in the northeast of Brazil for the genetic improvement. The state has a growing beef population, with an intense introduction of animals from other regions since the year 2000 (IBGE, 2008; Guimarães et al., 2009).

In this context, the use of management practices in an integrated manner, by seeking to rationalize host–parasite contact and by the possible identification and selection of resistant animals, is essential for the effective control of parasitic diseases and the reduction in the spread of resistance to anthelmintics (Torres-Acosta and Hoste, 2008; Molento et al., 2009).

This study aimed to determine the level of epidemiological knowledge of goat farmers regarding endoparasites and parasite control used in dairy and beef goat farms in Minas Gerais, Brazil.

2. Materials and methods

2.1. Study area

This study was conducted in 12 regions of Minas Gerais, Brazil, the largest of the four states of southeastern Brazil (Fig. 1) with a total area of 588 383.6 km^2 and 853 municipalities, representing 15.5% of all municipalities in Brazil. The state was stratified into two regions based on climatic differences: the North region with four areas, and the Central–West–South region, with eight areas. The altitudes range from 100 to 1500 m. The predominant climate in Minas Gerais is mostly tropical and a mean annual temperature of 21.2 °C. Annual rainfall varies from 1000 to 2000 mm, with well-defined dry and wet seasons (SEA, 2008).

2.2. Questionnaire to farmers

The questionnaire, prepared by the Sheep and Goat Extension and Research Group, has been previously tested (Magalhães and Gouveia, 1985; Pinheiro et al., 2000). The questionnaire was applied by trained veterinarians in 2005. The information collected concerned mainly the production and herd management. A non-probability sampling was used to select the herd in each area of Minas Gerais that were also enrolled in the Minas Gerais official breeders from the Association of Sheep and Goat Farmers of the State of Minas Gerais (Associação dos Criadores de Caprinos e Ovinos de Minas Gerais/ACCOMIG).

2.3. Sample analysis—municipalities

We sampled 84 dairy goat farms located in 81 municipalities and 200 beef goat farms located in 76 municipalities (Fig. 1). The data were analyzed using the software Windows Excel 98 and Epi-Info (Dean et al., 1995) to establish the frequency of each variable in the samples collected. Comparison of frequencies was performed using the chi-square test.

2.4. Determination of the level of technology

To determine the level of technology on the properties, 13 variables were selected and scored, with the score values shown in parentheses below. The variables related to infrastructure were: the use of animal housing (1), technical assistance (2), and manure composting or elevated floors (2). Variables reflecting nutritional status were: the presence of high-quality pasture (1), the division of pastures (1), and the use of mineral supplements (1). Health care measurements such as exam of newborn animals (1), deworming schedule (1), some form of diagnosis of diseases (3), and the use of vaccination (2) were considered. Production variables were age of weaning (2), controlled breeding (3), and the use of breeding season (2). The technological level was obtained by dividing the points scored for each farm by the total possible points (22). The percentage obtained was used to classify the property according to the following cut-off points: low technological level—properties with a percentage between 0 and 33%, intermediate technological level—those with a percentage between 34 and 64%, and high technological level—those with a percentage above 65%.

3. Results

The number of animals per goat farm ranged between 4 and 57 (average 24) in the beef goat flocks and between 2 and 308 (average 63) for the dairy goat flocks. Table 1 shows the number of farms that employ various husbandry practices and illustrates the significant differences ($P < 0.05$) in the technological levels between dairy and beef goat farms.

Table 2 presents the number of goat farms practicing various management strategies that may directly or indirectly affect gastrointestinal parasitism. Some variables showed significant differences ($P < 0.05$) in frequency between beef and dairy farms.

The practice of treating the animals was predominant in both dairy and beef farms, but treatment intervals were shorter (one to four months) on beef farms than on dairy farms (Table 3). The average interval between treatments was significantly longer ($P < 0.05$) in dairy herds than in the beef herds.

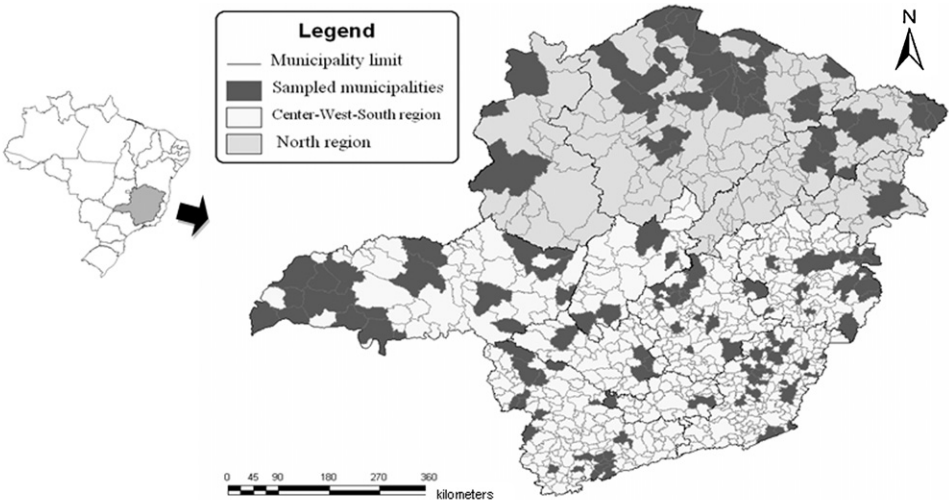

Fig. 1. Map of Brazil, with the state of Minas Gerais in detail, showing the location of the municipalities with goat farms where questionnaires were applied (dark patches).

Table 1
Frequency of husbandry practices and technological level in 84 dairy goat and 200 beef goat farms in Minas Gerais, Brazil.

Practiceor management adopted	Dairy goats n^a (%)	Beef goats n^a (%)
Extensive farming	0 a(0)	99 b(49.5)
Semi-extensive farming	1 a(1.2)	98 b(49.0)
Intensive farming	83 a(98.8)	3 b(1.5)
Individual identification and herd records	62 a(73.8)	15 b(7.5)
Mixed of goats and sheep farms	17 a(20.2)	73 b(36.5)
High level of technology	25 a(30.0)	4 b(2.0)
Medium level of technology	39 a(47.0)	68 b(34.5)
Low level of technology	19 a(23.0)	125 b(63.5)

[a] Different letters between columns indicate significant differences ($P < 0.05$), dairy vs. beef.

Table 2
Frequency of practices adopted that may affect endoparasitism in 84 properties with dairy goats and 200 properties with beef goats sampled in Minas Gerais, Brazil.

Practiceor management adopted	Dairy goats n^a (%)	Beef goats n^a (%)
Separation of young and adult animals	49 a(58.3)	19 b(9.5)
Use quarantine for new animals	13 a(15.5)	8 b(4.0)
Use of anthelmintics in new animals	40 a(47.6)	53 b(26.5)
Yearly rotation of anthelmintic	32 a(38.1)	24 b(12.0)
Pasture change after deworming	1 a(1.2)	22 a(11.0)
Free-range grazing	1 a(1.2)	47 a(23.5)
Manure composting	30 a(35.7)	9 b(4.5)
Housing with elevated floors	49 a(58.3)	7 b(3.5)
Presence of technical assistance – regular	44 a(52.4)	66 b(33.0)
Not answered	14 a(16.7)	101 b(50.5)

[a] Different letters between columns indicate significant differences ($P < 0.05$), dairy vs. beef.

The state was stratified into two regions, North and Central–West–South and despite marked differences in rainfall and temperature, no significant differences ($P < 0.05$) between these two regions were found in the use of medication or treatment intervals. The North region had 80.5% (161/200) of the beef goat farms while 98.8% of the dairy goat herds (83/84) were located in the Central–West–South region.

The chemical groups most frequently used are summarized in Table 4. Only the use of fenbendazole was significantly different ($P < 0.05$) between dairy and beef raising systems.

4. Discussion

The farming systems showed different features in Minas Gerais. The predominant intensive production in goat dairy farms is explained by the small size of the farms, which is due to high land prices, higher than those in the North of the State where the extensive system of beef goat production predominates. These findings are in accordance with the studies of Guimarães et al. (2009) and Pinheiro

Table 3
Frequency of anthelmintic treatments in 284 farms of dairy and beef goats in Minas Gerais, Brazil.

Variable	Answer	Dairy goats n^a (%)	Beef goats n^a (%)
Treatment	Yes	72 a(85.7)	166 a(83.0)
	No	6 a(7.1)	29 a(14.5)
	Not informed	6 a(7.1)	5 a(2.5)
	Total	84(100.0)	200(100.0)
Interval	1–2 months	29 a(40.3)	81 a(48.8)
	2.1–4 months	21 a(29.2)	53 a(31.9)
	>4.1 months	18 a(25.0)	4 b(2.4)
	When needed	4 a(5.5)	11 a(6.6)
	Not informed	6 a(8.3)	17 a(10.2)
	Total[b]	78(100.0)	166(100.0)

[a] Different letters between columns indicate significant differences ($P < 0.05$), dairy vs. beef.
[b] Total herds which the treatment was cited as being used.

Table 4
Distribution of the main chemical classes used for parasite control in 284 farms in the state of Minas Gerais, Brazil.

Chemical base	Dairy goats n^a (%)	Beef goats n^a (%)
Macrocyclic lactones	32 a (37.7)	79 a (39.5)
Albendazole	27 a (32.2)	48 a (24.0)
Fenbendazole	14 a (16.7)	15 b (7.5)
Levamisole	6 a (7.1)	12 a (6.0)
Piperazine	7 a (8.3)	27 a (13.5)
Others	8 a (9.5)	4 b (2.0)
All	1 a (1.2)	16 a (8.0)
Not informed	13 a (15.5)	26 a (13.0)

[a] Different letters between columns indicate significant differences ($P < 0.05$), dairy vs. beef.

et al. (2000). The small beef goat herd size suggests family based agriculture, where the simultaneous raising of sheep and goats is practiced under a more extensive system that has high mortality rates and low levels of technological assistance. Ninety-eight percent of the farms with beef goats in this study presented intermediate or low technological levels. The dairy goat production, with an average size of 63 goats/farm, showed higher levels of technology determined by the adoption of appropriate management practices and integrated control of parasites (Table 1).

In the extensive/semi-extensive system, predominantly for beef flocks (98.1%), the use of free-range pasture predisposes the animals to helminth infections, which makes parasite control difficult due to the greater contamination during grazing, exacerbated by cohabitation of young and adult animals in the same area. The intensive system, predominant in the dairy farms (98.8%), and the existence of housing with suspended ripped floors (58.3%) allow little contact between the animals and their faeces and reduce the possibility of reinfection. This strategy permit the fermentation of excrement, like a manure compost, mentioned in 35.7% of these farms.

Only 7.5% of the beef goat farmers sampled identifies their animals individually and kept records of the herds, thus important production indices, such as mortality rate, were not registered accurately. In technologically similar conditions, Pinheiro et al. (2000) and Molento and Almeida (2004) found mortality rates of up to 50% in different Brazilian states. In contrast, 73.8% of dairy goat farmers in this study kept production records. However, the mortality rate of young animals was not recorded. Under the same conditions of intensive farming, but with the retention of young males and females, Magalhães and Gouveia (1985) showed a low (2–5%) mortality of kids in southeastern Brazil.

The separation of young and adult animals was more frequent on the dairy farms than the beef farms (Table 2). This practice may show some effect because young animals are more susceptible to helminths, mainly against *Haemonchus contortus* than adult animals (Amarante et al., 2004).

The use of quarantine is fundamental to protect the flock against the introduction of different agents such as helminth infections, and the likelihood of acquiring resistant parasites would increase proportionately to the amount of newly introduced animals (Coles and Roush, 1992). The extensive interregional and interstate transit of goats facilitates the exchange of parasites from distant flocks (Guimarães et al., 2009) and we think that this situation is aggravated by the limited use of quarantine in the dairy and beef flocks (Table 2).

Few dairy or beef goat farmers transfer their animals to new pastures after treatment. Even though the treat-and-move recommendation is popular among producers, assuming that the animals would be transferred to an area with low larval contamination, resistance to anthelmintics of multiple chemical groups (imidothiazoles, benzimidazoles and macrocyclic lactones) have been described in Brazil (Thomaz–Soccol et al., 2004). Molento et al. (2004b) suggested that when farmers use this strategy they may impose a stronger selection pressure on the parasite population indicating that animals should be treated only after some time the allocation to the new area.

Maingi et al. (1996) conducted 92 interviews with goat producers to evaluate practices of parasite control in Denmark. Pesticides were used by 80% of the owners: of these, 51% did not follow any predetermined program. The animals were treated between one and three times per year. Benzimidazoles were more used without annual rotation, and 21% of the producers treated the animals before moving them to a new area. Hoste et al. (2000) applied a questionnaire in France and assessed how the recommendations adopted by producers for three years were able to avoid the development of anthelmintic resistance in 73 rearing farms of dairy goats. The average treatment frequency was 2.7 times per month, a practice adopted by 69% of farmers. An annual rotation of anthelmintics was not adopted. Benzimidazoles were used in 80% of treatments on 71 properties. Levamisole and ivermectin were used in 15% and 27% of treatments, respectively. The routine use of higher doses than those used for sheep was practiced by 55% of producers. The data indicate that even in countries where the goat is traditional, strategies for the control of parasites are often not used, contributing to the spread of resistant populations.

The presence of regular technical assistance is essential to the success of goat farming. The technical education of farm workers in sanitation and other husbandry practices, and the close monitoring of parasite prevention and control programs for each farm, are necessary. The frequency of technical assistance on dairy and beef farms was very low, but was statistically higher on dairy farms (Table 2).

Most of the goat farmers claimed to deworm their animals but had no standard interval between treatments (Table 3). The frequency of anthelmintic use was high and treatment intervals were short, allowing the rapid development of anthelmintic resistance due to high parasite selection pressure. The intensive use of anthelmintics also increases the presence of residues in meat, milk and the costs of production. The intensive system of dairy farming has better sanitary conditions than beef herds and justifies the range of treatment interval over two months for most of properties, the suppressive treatment from 1 to 2 months are done for the lactating animals in dairy and beef herds. Even in extensive farming systems, the animals are treated at least once a year. Host resistance to the helminths, however, has a genetic inheritance close to that of weight gain

(Barger, 1989) and we believe that the interval used by goat producers in Minas Gerais is beyond the necessity of the animals' need and do not reflect an improvement on production.

Worm control based on the exclusive use of anthelmintics is doomed to failure, therefore monitoring the presence of resistance to anthelmintics in the herd should be based on the use of faecal egg counts at yearly intervals. The rapid rotation of chemical groups accelerates the process of resistance and the sustained use of drugs of a single chemical group, with constant monitoring by faecal egg counts and the FAMACHA method, is advocated (Van Wyk et al., 2001; Molento et al., 2004a). The anthelmintic chemical group should only be changed if a reduction in its effectiveness is verified. This practice is justified by the fact that selection by an anthelmintic can occur within several generations in the parasite, and a strategic change in anthelmintic can reduce the frequency of alleles resistant to the active chemical (Molento, 2004).

Macrocyclic lactones are commonly used on goat farms (Table 4). It is important to note that this group is not recommended in lactating animals because of the residues in milk but in spite of this the indiscriminate use of this class of anthelmintic was noted. Benzimidazoles (albendazole and fenbendazole) were the second most commonly used group. The high percentage of farmers that responded that they did not know which product they use is of great concern reflecting the insufficient amount of technical information available and the lack of extension services that are prepared to deal with such recommendations (Table 4).

5. Conclusion

The technological level and the adoption of management practices in dairy goat farms were significantly better than those found on properties with beef goats in Minas Gerais. The goat farmers worry about worms, but use long intervals between deworming and rotate drugs without any epidemiological or technical support. There is an urgent need for the adoption of new management practices in order to minimize the development of anthelmintic resistance.

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