

RESISTANCE OF SANTA INÊS AND ILE DE FRANCE SUCKLING LAMBS TO GASTROINTESTINAL NEMATODE INFECTIONS*

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ABSTRACT:- ROCHA, R.A.; AMARANTE, A.F.T.; BRICARELLO, P.A. **Resistance of Santa Ines and Ile de France suckling lambs to gastrointestinal nematode infections.** [Resistência de cordeiros lactentes Santa Inês e Ile de France às infecções por nematódeos gastrintestinais.] *Revista Brasileira de Parasitologia Veterinária*, vol. 14, n. 1, p. 17-20, 2005. Departamento de Parasitologia, Caixa Postal 510, IB-Unesp, 18618-000 Botucatu, SP, Brazil. E-mail: rradallah@hotmail.com

A trial was carried out to determine the resistance to natural infection by gastrointestinal nematodes in 12 Santa Ines and nine Ile de France lambs before weaning. Faecal samples were obtained for faecal nematode egg counts (FEC). Blood samples were collected to determine packed cell volume (PCV), total plasma protein levels and peripheral eosinophil counts. Most Ile de France lambs (77.8%) were treated with an anthelmintic at 43 days of age, while 50% off Santa Ines lambs were treated at weaning, 57 days of age. The mean PCV values were normal in Santa Ines lambs, while in Ile de France lambs showed lower values reaching 22.3% at 43 days of age. The lowest mean plasma protein values were observed in Ile de France lambs (4.13 g/dl) at 43 days of age and in Santa Ines lambs (5.0 g/dl) at 57 days of age. Before weaning, Santa Ines lambs were susceptible to natural infections by gastrointestinal nematodes but with a greater capacity to stand the adverse effects of parasitism compared to Ile de France lambs.

KEY WORDS: sheep, *Haemonchus contortus*, nematode, breed, resistance

RESUMO

Este experimento foi realizado com o objetivo de avaliar a resistência de 12 cordeiros das raças Santa Ines e nove Ile de France às infecções naturais por nematódeos gastrintestinais, antes da desmama. Amostras fecais e sanguíneas foram colhidas para a realização da contagem de ovos de nematódeos gastrintestinais por grama de fezes (OPG) e para a determinação do volume globular (VG), da proteína plasmática total e do número de eosinófilos. A maioria dos Ile de France (77,8%) teve que ser tratada com anti-helmíntico aos 43 dias de vida. Já os Santa Ines (50%) foram tratados apenas na desmama, 57 dias de vida. Os valores médios de VG dos cordeiros Santa Ines mantiveram-se dentro do normal, enquanto que nos Ile de France sofreram redução progressiva até os 43 dias de idade, quando a média foi de 22,3%. O valor mais baixo de proteína plasmática encontrado nos Ile de France foi de 4,13 g/dl, aos 43 dias de idade, enquanto que nos Santa Ines foi de 5,0 g/dl aos 57 dias. Antes da desmama, cordeiros Santa Ines mostraram-se susceptíveis às infec-

ções naturais por nematódeos gastrintestinais, porém com maior capacidade para suportarem os efeitos adversos das infecções do que cordeiros Ile de France.

PALAVRAS-CHAVE: ovinos, *Haemonchus contortus*, nematódeos, raça, resistência

INTRODUCTION

The lower resistance of young ruminants to helminthic infections seems to be mainly due to their weak immunological response against the parasites than simply to the lack of adequate exposure to the pathogens that induce the development of active immunity (COLDITZ et al., 1996).

The extent of gastrointestinal nematodes infection also varies as a function of management conditions, which greatly influence pasture contamination with infective larvae (L3). Young lambs are exposed to L3 mostly originating from the eggs of nematodes eliminated in the feces of their dams during the periparturient period (DONALD; WALLER, 1973). Lambs in a paddock with a low level of residual pasture contamination and not exposed to contamination from the periparturient rise had mean worm burden of 1,610 *Ostertagia* spp., whereas lambs which were exposed to the contamination from the periparturient

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rise and similar residual contamination were infected with 20,660 *Ostertagia* spp. (SALISBURY; ARUNDEL, 1970).

In Brazil, few studies are available addressing the occurrence of helminths in lambs before weaning. Lambs kept on pasture from birth to weaning in South Brazil, presented mild infection up to the sixth week of life, but high infection at 10 weeks and heavy infection at 14 weeks (MACEDO et al., 1986).

Amarante et al. (2004) observed that Santa Ines lambs, after weaning, presented a higher resistance to gastrointestinal nematodes than lambs of European breeds. The present experiment was conducted in order to continue the investigation of the resistance of lambs of different breeds by evaluating the parasitism of Santa Ines and Ile de France lambs before weaning.

MATERIALS AND METHODS

Animals. Twelve Santa Ines ewes were obtained from different families (four sheep per family) and ten Ile de France animals were of two different origins. Two rams, one of each breed, were used to mate with the ewes of the respective breed.

In November 2001, the dams were placed in a paddock where they grazed as a single flock. Starting 90 days after mating began, each ewe received daily 450 g of an 18% crude protein (CP) concentrate (Ração Noel® – Cafenoel). One month after the beginning of parturition, Tifton hay (12% CP) started to be offered *ad libitum* due to the reduced quality of pasture. The ewes and lambs had free access to mineralized salt (Nutrumin® - Nutrumin) throughout the experiment. The lambs had access to concentrate and hay, supplied to their dams.

Lambing occurred from 30 April to 19 June 2002, and 77% of the parturitions occurred in May. The lambs were left with the ewes until 60 days of age, when they were weaned.

To prevent mortality, anthelmintic treatments were administered individually to lambs with fecal egg count (FEC) higher than 4000 eggs per gram (EPG) and/or packed cell volume (PCV) lower than 21%. A combination of levamisole phosphate at the dose of 10 mg/kg (Ripercol® L 150 F, Fort Dodge) and albendazole at the dose of 10 mg/kg (Valbazen® 10 Cobalto, Pfizer) was used for treatment. The drugs were administered orally for three consecutive days and caused an overall reduction of 97% in FEC two weeks after treatment. This combination of anthelmintics showed efficacy against resistant nematodes, commonly occurring at the site of the study (AMARANTE et al., 2004).

Measurements. Faecal samples were taken from all animals weekly starting when the animals were 2 weeks old. FEC were determined using a modified McMaster technique (UENO; GONÇALVES, 1998). Composite cultures were performed separately for each group of sheep according to their breed at weaning. The larvae were identified according to the descriptions of Keith (1953).

Blood samples were taken when the lambs were approximately, 29, 43 and 57 days old. PCV was determined by the micro-hematocrit centrifugation method and total plasma protein levels were measured using an ocular refractometer

(Atago®). Blood eosinophils were counted with a Neubauer chamber after staining with Carpentier solution (DAWKINS et al., 1989). Counts are reported as number of cells/ml blood. Moreover, the animals were periodically weighed.

Statistical analysis. Due to dispersal of lambing, the data were grouped according to age of the lambs in days. Data were analysed using the Minitab Version 11 software and the results for the two breeds were compared by one-way analysis of variance. The data relative to FEC and eosinophils were transformed to $\log_{10}(x + 1)$. The results are expressed as arithmetic means, except for FEC and eosinophil means, which are geometric means backtransformed by taking their anti-logarithms.

RESULTS

All Ile de France lambs required anthelmintic treatment during the suckling phase. Most of them (77.8%) were treated at 43 days of age (Fig. 1). In contrast, among Santa Ines lambs the highest percentage of treated animals was observed at weaning (50%). Of 12 lambs of this breed, three did not reach the FEC or PCV values established for the administration of anthelmintic treatment until weaning. At 43 days of age, two Ile de France animals and one Santa Ines animal required anthelmintic treatment due to the fall in PCV. On that occasion, the Ile de France lambs presented zero and 600 EPG, respectively, and PCV = 14%, while the Santa Ines lamb presented 2000 EPG and PCV = 15%.

The predominant nematode in the fecal cultures performed

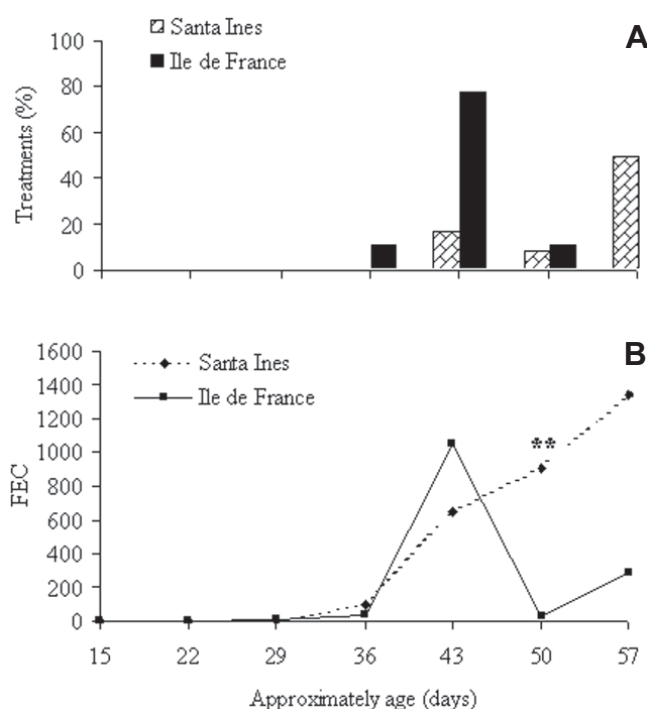


Fig. 1. (A) Percentage of the animals treated with anthelmintic and (B) mean fecal egg counts (FEC-backtransformed means) of the Santa Inês and Ile de France suckling lambs naturally infected by gastrointestinal nematodes (** $P < 0.001$).

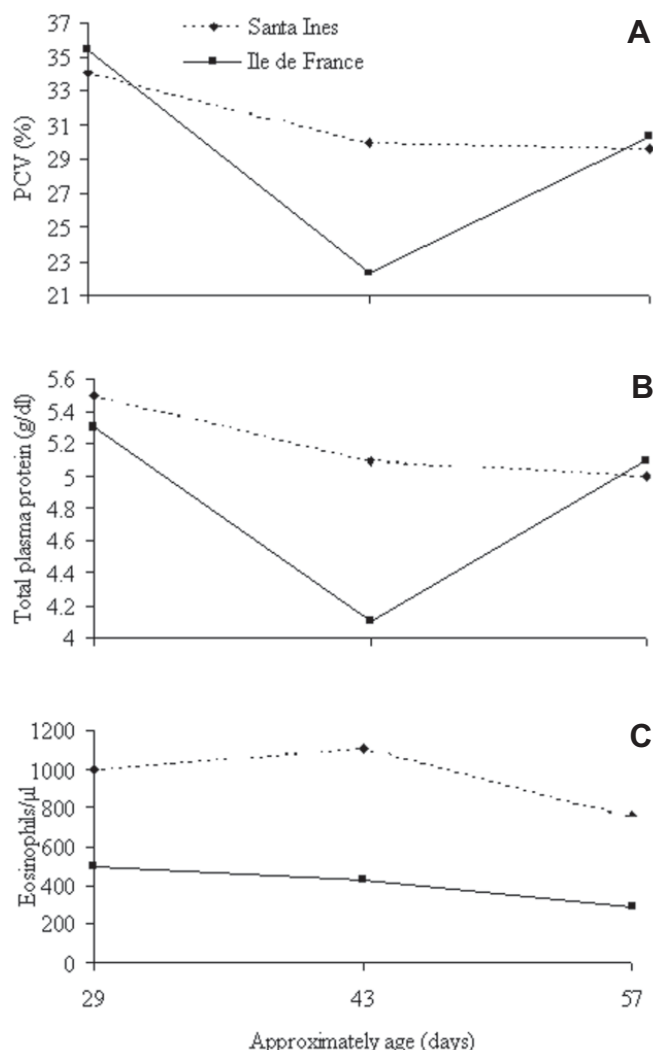


Fig. 2. Arithmetic means of packed cell volume (A), total plasma protein (B) and (C) eosinophils (backtransformed means) of the Santa Inês and Ile de France suckling lambs naturally infected by gastrointestinal nematodes (* $P < 0.05$; ** $P < 0.01$).

at weaning was *Haemonchus* spp. (96%), followed by *Trichostrongylus* spp. (3%) and *Oesophagostomum* spp. (1%).

The mean FEC for the lambs of both breeds was low during the first 36 days of age (Fig. 1), with an elevation in the mean values for the two breeds occurring thereafter and being more marked among Ile de France animals at 43 days of age. Since most Ile de France lambs were treated at 43 days of age, this breed presented a lower mean FEC than Santa Ines lambs in the exams performed one week later at 50 days of age ($P < 0.01$).

PCV values decreased in both breeds between 29 and 43 days of age (Fig. 2), with this reduction being more marked in Ile de France (PCV = 22.3%) than in Santa Ines (PCV = 30.4%) animals ($P < 0.05$). At 57 days of age, the PCV of Ile de France animals was close to that of Santa Ines animals (29.9% and 30.1%, respectively, $P > 0.05$).

The lowest total plasma protein mean was observed at 43 days of age in the Ile de France breed (4.13 g/dl), which was lower than the Santa Ines mean (5.07 g/dl) ($P < 0.01$). The

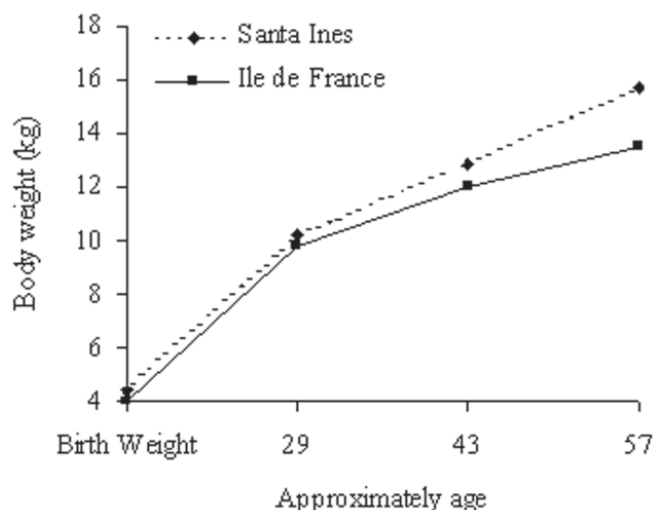


Fig. 3. Mean body weight of Santa Inês and Ile de France suckling lambs naturally infected by gastrointestinal nematodes.

reduction in plasma protein coincided with the reduction in PCV in both breeds (Fig. 2). However, there was a recovery in PCV and plasma protein values in Ile de France lambs after anthelmintic treatment, administered to most of them at 43 days of age.

Santa Ines lambs had a higher mean number of eosinophils than Ile de France lambs at all ages (Fig. 2) although the differences between breeds were nonsignificant ($P > 0.05$). The lowest eosinophil mean coincided with the highest FEC values in the Santa Ines breed.

The lambs of both breeds gained weight during the experiment (Fig. 3). At weaning the mean weight of Santa Ines and Ile de France lambs were 15.7 kg and 13.5 kg, respectively ($P > 0.05$).

DISCUSSION

Haemonchus contortus is the major nematode parasite of sheep at the site of the study (AMARANTE et al., 2004). In acute infections, *H. contortus* can cause hypoalbuminaemia and marked anemia. The mean PCV values of Santa Ines lambs were within normal limits throughout the study period, whereas the Ile de France lambs presented a marked reduction in mean PCV (22.3%) at 43 days of age. A marked reduction similar to the present one was detected in Suffolk lambs before weaning, whereas the same was not observed in Gulf Coast Native lambs kept under the same management conditions in the USA (BAHIRATHAN et al., 1996).

At 43 days of age, most Ile de France lambs needed anthelmintic treatment. Two of them did not have a high FEC (0 and 600 EPG), but had a reduced PCV (14%). In these lambs, anemia occurred during the pre-patent period of infection, probably due to the action of *H. contortus* larvae. As described by Dargie e Allonby (1975) in sheep experimentally infected with *H. contortus*, anemia starts to develop between the seventh and the 25th day post-infection and is characterized

by a progressive and regular fall in PCV due to blood consumption by immature worms.

Eosinophils are important defense cells which can destroy the infective larvae of gastrointestinal nematodes (MEEUSEN; BALIC, 2000). Amarante (2002) observed that eosinophilia was more pronounced and occurred earlier in Santa Ines lambs than in Suffolk and Ile de France lambs. In the present experiment, Santa Ines lambs also presented a higher mean number of eosinophils than Ile de France lambs at all ages considered but the differences between breeds were not significant.

Amarante et al. (2004) detected a marked difference in the number of *H. contortus* among Santa Ines, Suffolk and Ile de France sheep tested up to 12-14 months of age, when the Santa Ines had higher resistance than the other two. The differences in FEC observed in the present experiment were not as marked. Since the suckling animals were being exposed to the nematodes for the first time, they probably had not had enough time to establish an adequate immunologic response and to express resistance to the nematodes. Similar results were reported for Crioula Lanada and Corriedale lambs in Rio Grande do Sul (BRICARELLO et al., 2002). The degree of infection was similar after artificial primary infection with *H. contortus* (BRICARELLO et al., 2002), but marked differences were observed in weaned lambs naturally infected with *H. contortus* when Crioula Lanada lambs proved to be more resistant than Corriedale lambs (BRICARELLO et al., 2004). These results demonstrate that at least in the case of the Crioula Lanada and Santa Ines breeds there is the need of previous infection for the animals to express effective resistance to *H. contortus*. In contrast, Bahirathan et al. (1996) detected an effective response by Gulf Coast Native lambs to *H. contortus* infection even before weaning.

From birth to weaning, Santa Ines lambs were found to be susceptible to natural infections with gastrointestinal nematodes, but showed a greater capacity to withstand the adverse effects of the infection than did Ile de France lambs.

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