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Parasitic infection, reproductive and productive performance from Santa Inês and Morada Nova ewes

Juliano Issakowicz [a,*], Ana Clauidia Koki Sampaio Issakowicz [a], Mauro Sartori Bueno [b], Ricardo Lopes Dias da Costa [b], Luciana Morita Katiki [b], André Torres Geraldo [b], Adibe Luiz Abdalla [a], Concepta McManus [c], Helder Louvandini [a]

[a] Centro de Energia Nuclear na Agricultura, Universidade de São Paulo, NAPTISA, Piracicaba, SP, Brazil
[b] Instituto de Zootecnia/APTA/SAA-SP, Nova Odessa, SP, Brazil
[c] Faculdade de Agronomia e Medicina Veterinária, Universidade de Brasília, Brasília, Distrito Federal, Brazil

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ABSTRACT

Santa Inês (SI) and Morada Nova (MN) are hair breeds with potential for the production of lambs for early slaughter. However, they tend to show low carcass quality and meat production. On the other hand, this could be overcome by crossing these sheep with highly productive breeds. This study aimed to evaluate parasitic infection as well as reproductive and productive performance in 51 MN ewes with an average weight 33.1 ± 4.98 kg and 52 SI ewes averaging 51.8 ± 7.07 kg, mated with rams of their own breed or crossed with Dorper (D). The animals were raised on Aruana grass (*Panicum maximum* cv. Aruana) pasture and in the final third of gestation and lactation kept in collective pens receiving corn silage ad libitum and 400 g/animal/day of concentrate. During mating, gestation (every 28 days), at parturition and at 30 and 60 days postpartum the ewes were weighed, assessed for body condition score (BCS), Famacha© score, fecal egg counts (FEC), coproculture and hematological variables (packed cell volume, hemoglobin, total plasma protein and fibrinogen). β-Hydroxybutyrate levels were determined at 115 and 130 days of gestation, at parturition and 10, 20, 30, 45 and 60 days postpartum. Conception rates, prolificacy, multiple births, return to estrus, gestation length, litter weight at birth and at weaning and the ratio of theses relative to the weight of the dam in the same periods were calculated. In both breeds, FEC (*Haemonchus contortus*) increased ($P < 0.05$) pre and postpartum and Morada Nova ewes showed lower infection 30 days postpartum ($P < 0.05$). Both breeds showed good reproductive performance, with no differences ($P > 0.05$) in conception rate, return to estrus, multiple births and prolificacy. Crossing with Dorper rams produced heavier litter at birth in both maternal breeds ($P < 0.05$). At weaning the litter from Dorper × Santa Inês were heavier than the other groups ($P < 0.05$), with Morada Nova ewes crossed with Dorper rams showing similar weights to Santa Inês females ($P > 0.05$) and producing proportionally higher ($P < 0.05$) litter weight at weaning than the other groups, showing the potential of these animals for use in intensive meat production systems.

1. Introduction

Production capacity of sheep to meet market demands can be improved by using breeds that are more adapted to the production system. This can include the use of complementarity and heterosis, exploring desirable characteristics of each breed (Philipsson et al., 2011).

Due to large edaphoclimatic differences over the Brazilian territory, breeds vary according to region. In the South, there is predominance of wool breeds and in the Northeast and Midwest hair sheep suck as Santa Inês dominate. This breed has the largest flock in Brazil and has been the focus of various crossbreeding studies (McManus et al., 2010; McManus et al., 2013). This breed has been used for production of pure bred lambs, as well as crosses for early slaughter (McManus et al., 2010). However, recent studies have shown that although this breed has improved its production,

* Corresponding author at: Centro de Energia Nuclear na Agricultura, Universidade de São Paulo, NAPTISA, Av. Centenário, 303, 13400-970 Piracicaba, SP, Brazil.
E-mail addresses: issakowicz@zootecnista.com.br, julianozootecnia@hotmail.com (J. Issakowicz).

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some adaptability traits such as rusticity and heat tolerance were lost (McManus et al., 2013).

The Morada Nova may be an alternative breed, as it is hardy and has lower adult weight, which can lead to greater number of animals per area. Gomes et al. (2013) showed higher productivity from smaller dams since, smaller animals eat less and produced the same amount of lamb as larger animals. It shows maternal ability, prolificacy, nonexistent reproductive seasonality and good adaptation to the tropical environment (Facó et al., 2008), useful characteristics for a maternal breed. However, the poor performance of its pure bred lambs (Quesada et al., 2002) limits its use in intensive meat production systems. Crossbreeding of this breed with terminal sire breeds can improve performance characteristics in lambs. Thus, this breed may have the potential for the production of crossbred lambs for early slaughter.

The aim of this study was to evaluate parasitic infection, reproductive and productive performance from Morada Nova (MN) and Santa Inês (SI) ewes mated with their own breed or crossed with Dorper (D) rams for production of lambs.

2. Material and methods

The experiment was conducted at the Instituto de Zootecnia/APTA/SAA, located in São Paulo state, southeastern Brazil (22°42′S and 47°18′W). This study was approved by the Commission of Ethics for the Use of Animals in Experimentation at the Instituto de Zootecnia (Protocol n° 168/2013).

Before the start of the study, all animals were examined clinically for absence of mastitis by palpating of the udder and had the eye mucous color evaluated by Famacha© method. Fifty-one Morada Nova ewes (weight of 33.1 ± 4.98 kg), and 52 Santa Inês ewes (weight of 51.8 ± 7.07 kg), all multiparous (2–4 years old) were used. Over a 45 day period (08:00 and 16:00 h) a teaser ram was used for estrus detection for 60 minutes and subsequent exposure to one of the available rams (4 Morada Nova, 4 Santa Inês and 4 Dorper), which remained with the ewes in collective stalls for approximately 48 h for mating.

Ewes were raised on Aruana grass (*Panicum maximum* cv. Aruana) pasture, with free access to water and mineral mixture. In the last third of gestation and postpartum (lactation) they were kept in collective stalls, with free access to water and fed twice a day (08:00 and 16:00 h) with ad libitum corn silage and concentrate (400 g/animal/day). The chemical composition of corn silage and concentrate are presented in Table 1.

Data were obtained at mating and every 28 days during the gestation, at parturition and postpartum (30 and 60 days). The animals were weighed and blood and feces samples collected for hematological evaluation (Packed cell volume—PCV, Hemoglobin—Hb, Total plasma protein—TPP and Fibrinogen—FIB) and parasitological evaluation (fecal egg counting (FEC) and coproculture). Color score of the ocular mucosa were scored by Famacha© Chart method by the same experienced person on a 1–5 scale using the Famacha© Chart. The score of each animal was classified into five categories according to the Famacha© Chart; 1 = red, non-anemic; 2 = red-pink, non-anemic; 3 = pink, mildly anemic; 4 = pink-white, anemic; 5 = white, severely anemic (Molento et al., 2004). The body condition score (BCS) were performed according to Russel et al. (1969).

The packed cell volume determination in blood was carried out by centrifugation in capillary tubes (Schalm and Carrol, 1986). The same capillary tube used for TPP determination by refractometry and FIB determination by heat precipitation (Fan and Oliveira, 1980). The hemoglobin was determined using the cyanmethemoglobin method by spectrophotometry at 540 nm in a semi-automatic biochemical Bio device 200L (Bioplus®, Barueri—SP).

Table 1
Ingredients of concentrate and chemical composition of corn silage and concentrate fed to fattening lambs.

Ingredients	Concentrate Ingredient proportion (%)	Corn Silage
Corn	71.4	–
Soybean	25.0	–
Mineral mixture[a]	1.3	–
Sodium chloride	0.7	–
Limestone	1.6	–
Chemical composition (%)[b]		
Dry matter	84.4	22.1
Crude protein	22.3	7.9
Neutral detergent fiber	20.3	62.6
Acid detergent fiber	3.82	31.9
Hemicellulose	16.5	30.7
Ether extract	2.60	3.2
Mineral matter	6.20	5.8

[a] Composition of product: calcium 120 g/kg, phosphorus 87 g/kg, sodium 147 g/kg; sulfur 18 g/kg, copper 590 mg/kg; cobalt 40 mg/kg, chromium 20 mg/kg, iron 1800 mg/kg, iodine 80 mg/kg, manganese 1300 mg/kg, selenium 15 mg/kg, zinc 3800 mg/kg; molybdenum 300 mg/kg; and fluorine (max.) 870 mg/kg.
[b] Percentage at 100% dry matter.

The fecal egg counting was performed by a technique modified from Whitlock (1948) and coproculture carried out on animals with FEC greater than 500 eggs, according to Robert and O'sullivan (1950). The identification of third-stage larvae (L3) was as in Ueno and Gonçalves, (1998).

The β-hydroxybutyrate (βHB) concentration was performed at mating, during gestation (115 and 130 days), at parturition and 10, 20, 30, 45 and 60 days postpartum. For this, blood samples were collected by jugular vein puncture and measurements made immediately after collection with the use of the portable Optium Xceed sensor (Abbott Diabetes Care Ltd., Witney, UK) according to Raimondo et al. (2011).

The lambs were kept with their dams until weaning (about 60 days old) and weighed at birth, 30 and 60 days of age. They had free access to a concentrate diet in private troughs (*creep feeding*) and water. The chemical composition of the concentrate is shown in Table 1.

Prolificacy was calculated by the number of lambs born per ewe lambed, multiple births rate as the relationship between the number of twin births and the total births, conception rate by the relationship between the number of ewes in gestation and the number of ewes put to the ram, the return to estrus rate as the relationship between the number of ewes that returned to estrus relative to the total ewes and gestation length. Dam weight at birth (DWB) and at weaning (DWW) as well as lamb weight at birth and at weaning were registered. The litter weight at birth (LWB) and the litter weight at weaning (LWW) were obtained by sum of the weight of lambs from each ewe in these periods. The LWB/DWB and LWW/DWW ratio was calculated.

The animals were distributed in a completely randomized design with two treatments (Santa Inês and Morada Nova breed). The data were submitted to variance analysis by PROC MIXED (SAS v. 9.2® Cary, NC) with repeated measures. The multiple comparisons betewen crossing group (MM—Morada Nova ewe mated with reproducers own genetic group; DM—Morada Nova ewe crossed with Dorper reproducers; SS—Santa Inês ewe mated with reproducers own genetic group and DS—Santa Inês ewe crossed with Dorper reproducers) for gestation length, litter weight at birth (LWB), litter weight at weaning (LWW), LWB/DWB ratio, and LWB/DWB ratio were compared by Tukey test at 5% probability. Logarithmic transformation (log $x+10$) was used to FEC data, however, the data are presented in original scale. Conception rate, prolifi-