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Addition of propolis or monensin in the diet: Behavior and productivity of lambs in feedlot

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ABSTRACT

This study assessed the behavior and the productive performance of lambs finished in feedlot receiving diets added with green propolis, brown propolis or monensin sodium. The experiment used a randomized block design that compared weight gain of 32 male lambs aged four months among four dietary treatments: (1) control, non-enriched diet; (2) with green propolis; (3) with brown propolis; and (4) with monensin sodium. The basic diet provided to all the groups was a total mixed ration (TMR) with a forage:concentrate ratio of 50:50, in which Tifton 85 (*Cynodon* spp.) grass was used as roughage feed and the concentrate was based on soybean meal, corn meal and minerals. The green propolis diet decreased rumination and increased resting time. The diets provided similar feeding rate (g/min). DM and aNDF intake (g/kg of body weight and g/kg of metabolic weight) were higher in the control treatment. Although the control group had the highest weight gain, the highest feed conversion and feed efficiency were found in lambs fed brown propolis and monensin sodium. Technically, brown propolis can substitute monensin sodium as a dietary additive for feedlot lambs. However, complementary studies are needed to identify the best levels of brown propolis to add to these diets.

1. Introduction

Ionophores are antibiotics that mediate reductions in ATP and in K^+ render the organism, *gram*-positive bacteria principally, incapable of sustaining a rate of cell division sufficient to maintain normal metabolic significance. To *gram*-negative bacteria, they enhance net energy (McGuffey et al., 2001) by changing the final products of fermentation, *i.e.*, increasing propionate levels and decreasing acetate, butyrate and methane levels by 30% (Yang and Russell, 1993; Guan et al., 2006). Earlier studies show that, although ionophore monensin increases propionate production and decreases butyrate levels in sheep (García et al., 2000), it does not affect total nutrient digestibility. The effects of monensin on feed intake are controversial; some studies indicate that it decreases consumption (Oliveira et al., 2007), whereas others have found no consumption changes (Rodrigues et al., 2001).

Abbreviations: BW, body weight; DM, dry matter; TMR, total mixed ration; aNDF, aneutral detergent fiber.

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Table 1
Chemical composition (g/kg and MJ/kg, on dry matter, DM basis) of the total mixed ration.

Chemical composition	Ground Tifton 85 grass	Concentrate[a]	Total mixed ration
Dry matter (g/kg)	889.5	907.5	898.5
Organic matter (g/kg DM)	923.8	940.7	932.2
[b]Crude protein (g/kg DM)	110.2	215.8	163.0
aneutral detergent fiber (g/kg DM)	591.6	123.8	357.7
Ether extract (g/kg DM)	18.3	27.1	22.7
Total carbohydrates (g/kg DM)	795.3	697.8	746.6
[c]Non-fibrous carbohydrates (g/kg DM)	203.8	574.0	388.9
Digestible energy (MJ/kg DM)	10.9	15.1	13.0
[d]Metabolizable energy (MJ/kg DM)	8.8	12.4	10.6

[a] Ingredients (517 g/kg corn meal; 472 g/kg soybean meal; 1 g/kg premix mineral);
[b] Crude protein = Ntotal × 6.25;
[c] Non-fibrous carbohydrates = 100 − (crude protein + ether extract + aneutral detergent fiber + ash)[3].
[d] Estimated as Sniffen et al. (1992).

Evidence indicates that the use of antibiotics in livestock production increases prevalence of resistant bacteria (Mathew et al., 2001). Accordingly, many countries prohibit the use of antibiotics in raising livestock and restrict the importation of products derived from antibiotic-treated animals.

Propolis is an alternative to the use of dietary antibiotics. According to Mirzoeva et al. (1997), propolis has bacteriostatic activity against *gram*-positive and some *gram*-negative bacteria. The action mechanism of propolis is likely related to changes in the bioenergetic status of the bacterial membrane, which inhibits bacterial motility. This is similar to the action of ionophores.

Propolis is the product of resinous, gummy and balsamic substances that are collected by bees from buds, flowers and plant exudates and mixed with their salivary secretions, wax and pollen. This serves to seal and protect the honeycomb against insect and microorganism attack as well as to maintain internal temperature and humidity. The chemical composition of propolis is complex and variable because it is intrinsically related to the floristic and ecological composition of the environment visited by the bees (Ghisalberti, 1979). The combination of these factors affects the pharmacological properties of propolis, which is in fact classified into different types such as brown, green and red propolis.

Earlier studies report the use of propolis in animal production. For instance, dietary addition of propolis was shown to enhance the performance and carcass quality of chickens subjected to heat stress (Tatli Seven et al., 2008). Moreover, the ethanol extract of propolis affects fermentation and methanogenesis of continuous microbial culture in ruminants; it decreases protozoa population and increases propionate levels by 10.3% (Brodiscou et al., 2000).

Considering the abovementioned facts, this study evaluated the effects of the dietary addition of green propolis, brown propolis and monensin sodium on the behavior and production performance of lambs finished in feedlot.

2. Materials and methods

The experiment was carried out at the Universidade Federal de Mato Grosso do Sul, Campo Grande, MS, Brazil. This work has been approved by Ethical Committee for use of animal in experiments.

2.1. Animals and diets

Thirty two male lambs aged four months, undefined breed, castrated and weaned were used. The average weight was 20.4 kg at the beginning of the experiment.

The lambs were vaccinated against clostridiosis and throughout the experiment received anthelmintic treatment according to regular FEC analyses (fecal egg counts per gram).

The lambs were housed in individual 3 m^2 pens with wood lath floor, feeder and waterer. Water and mineral salt were offered *ad libitum*. Ground Tifton 85 (*Cynodon* spp.) grass, chopped to 5 mm length, was used as roughage feed at a forage:concentrate ratio of 50:50 on a dry matter basis. The concentrate, based on soybean meal, corn meal and minerals, was formulated to meet the nutritional needs of lambs (NRC, 1985) for a 250 g daily weight gain. The chemical composition of the isoprotein and isoenergetic diets used is shown in Table 1.

The experiment used a randomized block design. The lambs were previously divided into four weight classes (blocks) that were randomly divided into four dietary treatments: (1) control, without supplementation; (2) with green propolis; (3) with brown propolis; and (4) with monensin sodium (30 mg/animal/day).

2.2. Propolis characterization

The crude propolis was obtained from the beekeeping company "Companhia da Abelha" in Contagem, MG, Brazil. The green propolis derived from "alecrim-do-campo" (*Baccharis dracunculifolia*), with oxidation level similar or lower than