Chirca Leaves Minimizes Sheep Methane Emissions

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Introduction

A reduction in ruminant animal methane emission is of interest in terms of greenhouse gas production as well as for increase in the efficiency of dietary energy. Methane formation generates losses of 2 to 12% of consumed gross energy (Johnson and Johnson, 1995). Several strategies are being studied to mitigate this emission, and most have focused on the use of additives in the diet. The use of plants containing secondary compounds such as essential oils, tannins and/or saponins are natural alternatives to chemical additives that may be perceived negatively by consumers.

Tannin-containing plants are under study for their anti methanogenic activity, which is attributed mainly to a group of condensed tannins (CT). The CT can act on the methanogenic bacteria and reduce methane output (Martin et al., 2010).

The Pampa biome has a well diversified flora, however, little known as its physical and chemical functions. This area contains chirca, which grows as a weed in fields. It's a native plant that has in its composition secondary compounds. However, there are no studies evaluating the use of this plant because cattle and sheep eat in small quantities. Thus, this study aimed to evaluate the effect of increasing levels of Chirca leaves (*Eupatorium buniifolium*) on the individual intake and methane emission adult sheep.

Material and Methods

The experiment was conducted at Embrapa South Livestock (CPPSUL), Bagé, RS, in two evaluation periods: 09/15/2015 to 09/28/2015 and 10/05/2015 to 10/17/2015. Were used 20 adult sheep barrows, five animals per treatment, with an average initial weight was 43 ± 7 kg. The basic diet for all treatments was composed of chopped alfalfa hay plus 300 grams of a commercial concentrate with 14% crude protein (CP). The amount of feed was calculated to allow 10% of leftovers daily. The treatments consisted of four levels of inclusion of chirca leaves (*Eupatorium buniifolium;* Asteraceae family). It is a shrub native of the Pampa biome. It was included at 0, 50, 100 and 150 grams. The chirca leaves were collected manually in the experimental fields of CPPSUL and subsequently dried in an oven with forced ventilation at 40°C. These were homogenized and milled and offered in different treatments. The feed supply was made in the morning and chirca leaves were mixed with the concentrate. Every day the leftovers were weighed for subsequent calculation of individual intake. The animals were kept in metabolic cages. The adjustment period was eight days followed by five days of collection.

On the ninth day, the animals were prepared with equipment and materials for collection of enteric methane. To measure methane, we used the technique described by Johnson et al., (1994) and adapted by Gere and Gratton (2010) employing sulfur hexafluoride (SF_6) tracer. Stainless steel collection tubes were used for storage of gases, which was sampled for five consecutive days. We used control tubes (n = 3) to control for ambient methane, and all samples were measured with gas chromatography.

The leaves of chirca were analyzed for total phenolic content (TF) and total tannins (TT) expressed as equivalent gram acid tannic.kg of dry matter^{-1} (DM) and condensed tannins (CT) expressed in equivalent gram of leucocyanidin.kg of DM^{-1}.

Daily individual intake and the emission of enteric methane.animals^{-1}. day^{-1} for different periods were subjected to regression analysis by the statistical program JMP (JMP version 9.0.0, 2010). There was no significant interaction effect between the periods, and the data are presented in relation to the treatment.

Results and Conclusions

There was no significant effect for the inclusion levels on the daily individual intake (Figure 1). The literature found divergent results on the influence of condensed tannins on individual intake. This is due mainly to the tannin content in the diet (%) and the different forms of ruminal activities of tannins, which may reduce the digestibility of DM and nitrogen and affect fiber digestion (Batta et al., 2002). When these effects are small, there is no influence on individual intake.

There was a linear significant effect decreasing for the inclusion levels on the reduction in the emission of enteric methane.animals^{-1}.day^{-1}. The performance of condensed tannins on the effect on mitigation of methane emissions, intake and digestibility of food is related to its composition—especially with respect to molecular weight and degree of polymerization in addition to the quantity supplied. A similar result was found by Paengkoum et al. (2015) where it has been tested the effect of five different inclusion levels of peel of the fruits of *Garcinia mangostana.* They found a linear and significant decrease in methane as a function of dose.

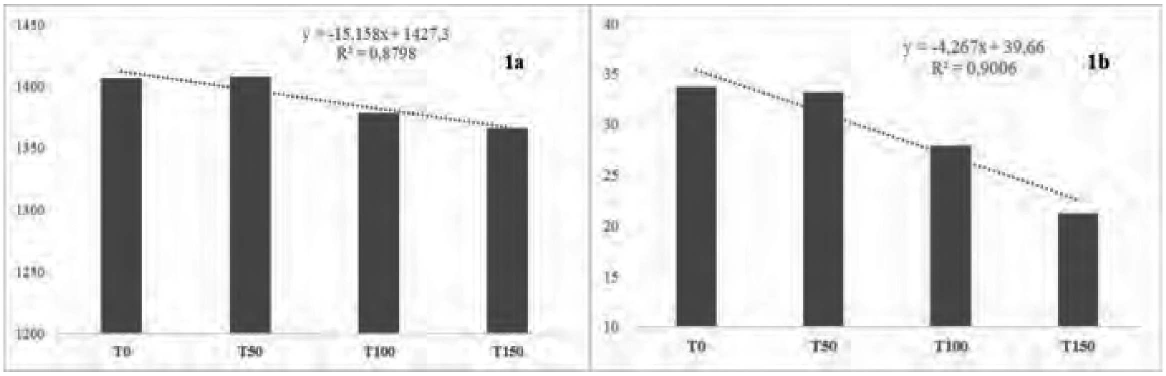

Figure 1. Daily individual intake (grams of the DM) (1a) and emission of enteric methane.animals^{-1}.day^{-1} (1b) from sheep receiving increasing doses of chirca leaves.

The chirca leaves have 95.2 g/kg DM of total tannin (TT), 115.3 g/kg DM of total phenols and 11.4 g/kg DM of condensed tannins (CT). However, the quantities of secondary compounds present in the leaves of chirca used here had no adverse effects on dry matter intake.

The addition of 150 grams of chirca in the diet did not affect daily individual intake, however, there was a possible reduction in the emission of enteric methane.animals^{-1}.day^{-1} for adult sheep.

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