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CONSTRUINDO SABERES, FORMANDO PESSOAS E TRANSFORMANDO A PRODUÇÃO ANIMAL

METHANE EMISSIONS OF SHEEP FED DIETS CONTAINING AMAZONIAN CO-PRODUCT

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Abstract: A suplementação lipídica utilizando co-produtos de oleaginosas é uma estratégia que mitiga a produção entérica de metano (CH_4) em ruminantes. O objetivo deste trabalho foi estimar as emissões de metano em ovinos alimentados com dietas contendo tortas de cupuaçú (*Theobroma grandiflorum*) e tucumã (*Astrocaryum aculeatum*). Vinte e oito ovinos foram distribuídos em gaiolas metabólicas individuais, em delineamento em blocos ao acaso com quatro tratamentos, sete repetições e dois períodos de coleta. Cada animal recebeu silagem de milho e um dos seguintes concentrados: reduzido teor de óleo (ROC), contendo torta de cupuaçú (CUP), contendo torta de tucumã (TUC) e elevado teor de óleo (HIOC). As emissões de metano (g d^{-1} e L d^{-1}) foram reduzidas ($P<0,05$) quando os animais receberam dietas contendo cupuaçú e tucumã. No entanto, nenhum efeito ($P>0,05$) nas emissões de CH4 (g kg^{-1} DMI^{-1}) entre as dietas testadas foi observado. A inclusão de co-produtos amazônicos na dieta reduz a emissão de CH_4 em ovinos, mas não exerce efeito mitigador.

Keyword: greenhouse gases, lipids, ruminants, sulfur hexafluoride

Introduction

Methane emissions by ruminants contribute to increase the concentration of this gas in the atmosphere. According to the Intergovernmental Panel on Climate Change (IPCC, 2006), in developing countries such as Brazil, CH_4 production is approximately 5 g kg^{-1} of dry matter intake in sheep weighing around 45 kg. However, further studies in Amazonia are necessary to generate data that contribute to global estimates.

Lipid supplementation ruminant nutrition is one of the strategies used to mitigate enteric methane. Thus, oilseed co-products, such as pies, which contain from 10 to 12% oil content, may be an alternative to traditional resources.

In the Amazon region, species such as cupuaçú, which produce an average of 9 million fruits per year (IDAM, 2013) and tucumã, with 50 kilos of fruits per tree per year (Figliulo and Silva, 2009), generate significant amounts of residues after the extraction of the pulp from the fruit and the oil of the almond.

In this way, the pies, because they are available in large quantities and have potential use in sheep feed, have been the focus of the research on alternative feed sources in the northern region.

The objective was to estimate the methane emissions of sheep fed diets containing cupuaçú and tucumã pies.

Materials and Methods

The protocol used in this experiment was approved by the Ethics Committee on Animal Use, Federal University of Pará, Faculty of Veterinary Medicine/Campus Castanhal (protocol number 8694141217).

Twenty-eight castrated lambs of crossbreeding, Dorper x Santa Inês, with an average body weight of 35 ± 2 kg and 9 ± 2 months were used. They were housed in metabolic cages 0,75 m², equipped with trough and waterer. Experimental diets were formulated to contain 7% ethereal extract in dry matter (DM) and to be isonitrogenous. The roughage feed was maize silage (400 g kg^{-1} on a DM basis) plus

concentrate (600 g kg^{-1} on a DM basis). Diets were supplied daily at 08h00 and 17h00, to allow 20% as leftovers (fresh matter); the weights of feed supplied, and leftovers were recorded to estimate the dry matter intake (DMI). At the onset of the experiment, lambs were identified, dewormed, vaccinated against clostridioses and distributed at random into the following treatments: reduced oil content (ROC), containing cupuaçu pie (CUP), containing tucumã pie (TUC) and high oil content (HIOC) (Table 1). The experimental period lasted 50 days; the first 14 days were for adaptation to the facilities and diet and the last 36 days were data collection defined as two experimental periods, with 18 d in each one. The experimental period consisted of 13 days of adaptation and 5 days to evaluate dry matter intake. Pre-dried and contents of DM were estimated according methods ICNT-CA G-001/1 INCT-CA G-003/1, respectively (National Institute of Science and Technology in Animal Science INCT-CA; DETMANN et al., 2012).

Methane collection occurred through sulfur hexafluoride (SF_6) technique (Johnson et al., 1994), with SF_6 capsules administered 72 hours before data collection to allow constant gas emission. The gas collection halters were replaced, always in the same order, at 10h00. CH_4 and SH_6 gas concentrations were determined at Embrapa Amazônia Oriental, at the Laboratory of Sustainable Systems Analysis, located in Belém, Pará, by means of gas chromatography, with an apparatus equipped with a flame ionization detector. The methane emission rate was calculated according to the formula: QCH4 = QSF6 × [CH4] / [SF6].

Table 1. Composition of the experimental diets (%)

Ingredient	Diets			
	ROC	CUP	TUC	HIOC
Corn silage	40.0	40.0	40.0	40.0
Ground corn	43.2	6.2	13.2	40.7
Soybean meal	14.8	6.8	13.9	1.3
Ground soybean	-	-	-	14.5
Soybean oil	-	-	-	1.5
Cupuaçú pie	-	45.0	-	-
Tucumã pie	-	-	30.9	-

Mineral and vitamin supplement[1]	1.5	1.5	1.5	1.5
Limestone	0.5	0.5	0.5	0.5

[1]calcium, 140 g; phosphorus, 65 g; magnesium, 10 g; sulfur, 12 g; sodium, 130 g; cobalt, 80 mg; iron, 1000 mg; iodine, 60 mg; manganese, 3.000 mg; selenium, 10 mg; zinc, 5.000 mg; fluorine (maximum), 650 mg; vitamin A, 50.000 U.I.; vitamin E, 312 U.I.

Results and Discussion

The dry matter intake was lower in the animals receiving the TUC diet. Animals that received diets containing Amazonian pies reduced CH_4 emission ($P < 0.05$) in grams day^{-1} and liters day^{-1}. However, they did not present a mitigating effect when considering CH_4 emission in grams $kilo^{-1}$ of dry matter intake ($P = 0.06$). There was no effect of diets on CMS and CH_4 emissions between the two collection periods ($P>0.05$) (Table 2).

The DMI of animals that were fed with the TUC diet (0.650 g) was lower than expected to meet the animals' nutritional requirements (Table 2). An animal weighing 35kg, consuming 3% of this value, is expected to consume 1.05 kg MS^{-1} day^{-1}. The lower CMS in this treatment decreased the total CH_4 production emitted by sheep in this experimental group.

Table 2. Effects of experimental diet on intake and CH_4 emission in sheep

Variable	Diet				P-value
	ROC	CUP	TUC	HIOC	
DMI	1.00^{a}	0.99^{a}	0.65^{b}	1.09^{a}	<0.001
CH_4, g d^{-1}	25.04^{a}	20.06^{b}	14.55^{c}	20.52^{b}	<0.001
CH_4, L d^{-1}	34.97^{a}	28.01^{b}	20.32^{c}	30.25^{ab}	<0.001
CH_4, g kg^{-1} MSI^{-1}	28.54	20.77	26.45	21.72	0.06

Means followed by the same letters on the lines do not differ significantly by the Tukey test ($P<0.05$).

Although the animals fed ROC, CUP and HOIC showed similar intakes, those who received the diet with reduced oil content (ROC) emitted a greater amount of the CH_4 gas.

A possible explanation for this is that lipids, present in the diets, may have exerted on the microorganisms and, consequently, the ruminal fermentation, as for example, the coating of the fiber, the toxic effect to the cellulolytic bacteria and reduction of the methanogenic activity (Machado et al., 2011).

Conclusion

Diets containing Amazonian co-products caused a reduction in the emission of enteric CH_4 (g day^{-1} and l day^{-1}); however, they do not exert a mitigating effect (g kg^{-1} DMI^{-1}).

Reference

DETMANN, E.; SOUSA, M.A.; VALADARES FILHO, SC.; QUEIROZ, A.C.; BERCHIELLI, T.T.; SALIBA, E.O.S.; CABRAL, L.S; PINA, D.S,; LADEIRA, M.M. and AZEVEDO, J.A.G. 2012. Métodos para análise de alimentos. 1 ed. Visconde do Rio Branco, Suprema.

FIGLIUOLO, R. and SILVA, J.D. 2009. Cadeia produtiva sustentável e integral do tucumã do Amazonas: do lixo à produção de cosméticos e biodiesel. In: Anais da 32ª REUNIÃO ANUAL DA SOCIEDADE BRASILEIRA DE QUÍMICA. Sociedade Brasileira de Química, Fortaleza.

IDAM – Instituto de Desenvolvimento Agropecuário e Florestal Sustentável do Estado do Amazonas. Produção de cupuaçú no Amazonas. Available at: <http://www.idam.am.gov.br/produção-de-cupuacu-no-amazonas/> accessed on: Abr. 21, 2018.

IPCC - Painel intergovernamental sobre mudança do clima. 2007. Mudança do Clima. Available at: < http://www.mct.gov.br/upd_blob/0015/15130.pdf>. Acessed on: abril de 2018.

JOHNSON, K.; HUYLER, M.; WESTBERG, H.; LAMB, B. and ZIMMERMAN, P.1994. Measurement of methane emissions from ruminant livestock using a SF6 tracer technique. Environment Science Technology, 28:359–362.

MACHADO, F. S.; PEREIRA, L.G.R.; JÚNIOR, R.G.; LOPES, F.C.F.; CHAVES, A.V.; CAMPOS, M.M. and MORENZ, M.J.F. Emissões de metano na pecuária: conceitos, métodos de avaliação e estratégias de mitigação. Embrapa Gado de Leite, p. 1–92, 2011.