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Enteric Methane Emission and Nitrate Toxicity in Sheep Fed Encapsulated Nitrate

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Abstract

Nitrate administration in diets for ruminants decreased methanogenesis and reduced methane intensity. However, it is well known the toxic effect of nitrate by nitrite accumulation, but a feeding adaptation strategy can reduce the nitrate poisoning. The purpose this study was to assess the effect of nitrate supplementation in ruminants on its toxicity and extent of methane mitigation. Six rumen cannulated lambs were distributed in a 6×6 Latin square, 2×3 factorial arrangement experiment. Factors were type of diet (20:80 and 80:20 concentrate : forage ratio) and inclusion of encapsulated nitrate (PNE; 0, 1.5, 3.0, and 4.5 % in dietary DM). Doses of nitrate corresponded to 0; 11.7 and 24.2 g NO_3 in dietary DM. Encapsulated nitrate replaced soybean meal to achieve isonitrogenous diets. The animals were acclimated gradually to nitrate stepped up from 0.5 % in the ration every 3 day until it reach 1.5 % and 3 % in the finisher ration respectively. We evaluated the toxicity of diets by following blood methemoglobin and measuring methane (CH_4) emission by open chamber technique. Treatment means were compared by Tukey test. Dry matter intake (DMI, $p = 0.48$) and methemoglobin ($p = 0.32$) were not affected by addition of PNE. Very low blood methemoglobin levels were observed 3 h after feeding, (3.21, 4.1 and 4.4) with increasing of nitrate level in diets. A 29 % reduction in estimated daily methane production ($p = 0.06$) was observed on diets with 80 % of concentrate with nitrate (27.5, 19.6 and 19.3 L CH_4 / day respectively for 0, 1.5 and 3 % PNE,) when compared with diets without nitrate. It is suggested that supplementary nitrate can be used to mitigate enteric methane emission with low risk by nitrite poisoning , if animals have a gradual acclimation of nitrate.

Keywords: Hydrogen sinks, methanogenesis, nitrite poisoning

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