Impacts of protozoal population on methanogenesis: A quantitative review

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(0, 3.125, 6.25, 12.5, 25 and 50mg/L) of Rubus extracts were treated to in vitro rumen digestion system and incubated for 24 hrs. After incubation, gas production, methane production, pH, dry matter (DM) digestibility and volatile fatty acid (VFA) concentrations were measured. The culture supernatant pH was not affected by concentration of Rubus extract ($P < 0.05$). Whereas, DM digestibility and culture head gas production were decreased with increased extract concentration. The extract concentrations over 12.5mg/L caused decrease in gas production per digested DM ($P < 0.05$). The comparative concentration of methane among total produced gas in treatment group was lower than that of control with significance ($P < 0.05$). Methane productions in 12.5mg/L and 25mg/L of extract treatment groups were lower than that of control group by 22% and 23% respectively. There were no significant differences among treatment in ammonia concentration, total VFA production, and the molar ratio of acetate and propionate ($P > 0.05$). The change in rumen microbial population in in vitro system using quantitative PCR is under analysis.

R05. Impacts of protozoal population on methanogenesis: A quantitative review

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Starch-rich concentrates, lipids and plant extracts added to the ration are among the most common nutritional strategies explored to reduce enteric methane (CH_4) emission from ruminants. In addition to reducing methane emissions, a frequently observed effect of the addition of these feeds and supplements is a decrease in the number of ruminal protozoa. In order to evaluate the role of protozoa in these mitigation strategies, we propose to explore the relationship between CH_4 production and ruminal protozoa concentration using a meta-analysis statistical approach. A quantitative review of all available data that reported measurements of dry matter intake (DMI), CH_4 emissions and ruminal protozoa on the same animal was performed. The compiled database had a total of 18 studies obtained from both the literature and unpublished trials from our laboratory and contained 65 diets: 22 considered as controls and 5, 23 and 16 diets that were supplemented with concentrates, lipids and plant extracts, respectively. Cattle and small ruminants represented 47 and 53% of data, respectively. The DMI ranged from 0.7 to 22 kg d^{-1} (mean ± SD, 7 ± 7.4), CH_4 production ranged from 0.4 to 27 MJ d^{-1} (7 ± 7.5) and protozoa concentration ranged from 0.3 to 32 105 ml^{-1} (7 ± 6.1). Methane production was measured in open or respiratory calorimeter chambers or with the SF_6 tracer method. Data were analysed using GLM procedure (Minitab Version 14), accounting for study effect as a fixed effect. The dietary contents (g kg^{-1} DM) of crude protein varied from 9 to 22 (15 ± 2.4), neutral detergent fibre from 26 to 61 (39 ± 7.7), non-fibrous carbohydrate from 28 to 43 (37 ± 4.4), ether extract from 2.5 to 10.4 (4.4 ± 2.55), and gross energy from 10.7 to 20.6 MJ kg^{-1} DM (18.1 ± 2.68). Preliminary relationships from this database show that protozoa numbers influenced positively and substantially methanogenesis: CH_4/DMI (MJ kg^{-1}) = -1.6 (± 0.5) + 0.47 (± 0.09) protozoa (log10 ml^{-1}); ($n = 65$; $r^2 = 0.64$). The effect of the mitigation strategy, chemical composition of the diet and fermentative parameters (VFA, pH) will be tested in order to better explain some of the variations in the relationship observed.