

Reference 28

Ungerfeld, EM; Forster, RJ 2011 A meta-analysis of malate effects on methanogenesis in ruminal batch cultures ANIMAL FEED SCIENCE AND TECHNOLOGY, 166-167, 282-290. 10.1016/j.anifeedsci.2011.04.018

Background and objective

Addition of malate and other dicarboxylic acids to decrease methane (CH₄) production has been evaluated both in vitro and in vivo but there are few studies in which the response of CH₄ production by ruminants to malate supplementation has been measured, and results have been variable. To quantitatively summarize and understand effects of malate addition on CH₄ and volatile fatty acid (VFA) production in ruminal batch cultures in order to help explain animal responses to malate supplementation. Here, results on CH₄ production are reported.

Search strategy and selection criteria

The database used for the meta-analysis comprised 6 batch in vitro studies of malate effects on CH₄ production and VFA production or concentration, including a total of 76 treatment means. 1) Studies not reporting VFA production or concentration could not be included because of lack of information of VFA standard error of the means, which are necessary to calculate the treatment means weighting factor.

Data and analysis

Responses of CH₄ and VFA production to malate addition were regressed. The relationship between changes in CH₄ and propionate production was also assessed, and linear and quadratic effects of independent variables were evaluated. All regressions included the random effect of study and, initially, its random linear and quadratic interactions with the independent variable. Influences of amount of substrate and duration of the incubation on responses were also explored by including them in the model as main terms and as their interactions with the linear term of the independent variables. A second regression model which included the proportion of concentrate in the substrate was evaluated for each response variable only for those treatment means in which feed substrate was incubated. The REML algorithm of JMP 8.0.2 (SAS, 2008) with unbounded variance components was used to fit regressions.

Number of papers	Population	Intervention	Comparator	Outcome	Quality score
6	Ruminal (beef steers and sheep) batch cultures	Malate supplementation	No malate supplementation	Metric: Methane (CH ₄) production; Effect size: Difference of of the considered metrics between intervention and control	56.25

Results

- There was no effect of malate addition on CH₄ production.
- NULL
- NULL
- NULL
- NULL

Factors influencing effect sizes

- No factors influencing effect sizes to report

Conclusion

There was no consistent decrease in methanogenesis by adding malate to in vitro batch cultures.