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van Gastelen, Sanne, Dijkstra, Jan, Bannink, André 2019 Are dietary strategies to mitigate enteric methane emission equally effective across dairy cattle, beef cattle, and sheep? JOURNAL OF DAIRY SCIENCE, 102(7), 6109-6130. 10.3168/jds.2018-15785

Background and objective

Although all types of ruminant animals (e.g., cattle, goats, sheep) might have similar CH₄-forming pathways in the rumen, they differ considerably in their level of feed intake, rumen morphology, and rumen physiology. Consequently, the effectiveness of dietary strategies to mitigate CH₄ emission might also differ across different types of ruminants. 1) to provide a brief overview of differences in rumen physiology between dairy cattle, beef cattle, and sheep that are related to CH₄ emission; 2) to evaluate whether dietary strategies to mitigate CH₄ emission with various modes of action are equally effective in dairy cattle, beef cattle, and sheep.

Search strategy and selection criteria

The authors performed a literature search to evaluate the effectiveness of CH₄ mitigation strategies, using Web of Science and Scopus, with a focus on forage quality, forage type and forage replacement, forage to concentrate ratio, and feed additives that have been tested in multiple ruminant types. 1) an in vivo experiment was conducted; 2) the CH₄ emissions were measured directly (i.e., not estimated); 3) the composition of the basal diet was described; 4) the results were available on DMI, and on CH₄ production (g/d) or CH₄ yield [g/kg of DMI or % of gross energy intake (GEI)]; and 5) a statistical analysis was performed. Although preferred, the studies did not have to involve the testing of dietary strategies in multiple types of ruminants.

Data and analysis

The effect size of the dietary strategies was determined for each individual study, expressed as a proportion (%) of the CH₄ emission for the control treatment and based on the reported treatment means (percentage increase or decrease relative to the value established with the "baseline" or control treatment).

Number of papers	Population	Intervention	Comparator	Outcome	Quality score
94	Ruminants (dairy cattle, beef cattle, sheep)	Forage with higher digestibility, maize silage, dietary legumes, Tannin-rich forages, increased concentrate level in diet	Forage with lower digestibility, grass pasture/grass silage/alfalfa silage, grass pasture/silage, no tannin-rich forages, lower concentrate level in diet	Metric: Dry matter intake; Effect size: not applicable	50

Results

- Improved digestibility of grass herbage or grass silage (on average 25%) for dairy cattle increased DMI (on average 14%).
- In dairy cattle, increased levels of corn silage resulted in increased DMI, while DMI generally decreased 5% with increased levels of corn silage in beef cattle.
- Increased levels of legumes at the expense of grass pasture or grass silage for dairy cattle resulted in increased DMI (16%) while DMI generally decreased in sheep (5%).
- In dairy cattle, increased levels of tannin-rich forages increased DMI 20%, while DMI increased 34% for sheep.
- Increased levels of concentrates increased DMI in cattle (19% for dairy and 23% for beef) but not in sheep.

Factors influencing effect sizes

- No factors influencing effect sizes to report

Conclusion

The effects reported are generally positive or no effect, but the uncertainty is high due to the limits of the methodology implemented.