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The Impact of Garlic and Citrus Extracts on Energy Retention and Methane Production in Ruminants in vitro

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Abstract : Research on feed supplementation with natural compounds is currently being intensively pursued with a view to improving energy utilisation in ruminants and mitigating the production of methane by these animals. Towards this end, a novel combination of extracts from garlic and bitter orange was therefore selected for trials on the basis of their previously published in vitro anti-methanogenic potential. Three separate in vitro experiments were conducted to determine energy utilisation and greenhouse gas production. These included use of rumen fluid from fistulated cows and sheep in batch culture, the Hohenheim gas test, and the Rusitec technique. Experimental and control arms were utilised, with 5g extracts per kilogram of total dietary dry matter (0.05g/kg active compounds) being used to supplement or not supplement the in vitro systems. Respiratory measurements were conducted on experimental day 1 for the batch culture and Hohenheim gas test and on day 14-21 for the Rusitec Technique (in a 21-day trial). Measurements included methane (CH4) production, total volatile fatty acid (VFA) concentration, molar proportions of acetate, propionate and butyrate and degradation of organic matter (Rusitec). CH4 production was reduced by 82% (±16%), 68% (±11%) and 37% (±4%) in the batch culture, Hohenheim gas test and Rusitec, respectively. Total VFA production was reduced by 13% (±2%) and 2% (±0.1%) in the batch culture and Hohenheim gas test whilst it was increased by 8% (±2%) in the Rusitec. Total VFA production was reduced in all tests between 2 and 10%, whilst acetate production was reduced between 10% and 29%. Propionate production which is an indicator of weight gain was increased in all cases between 16% and 30%. Butyrate production which is considered an indicator of potential milk yield was increased by between 6 and 11%. Degradation of organic matter in the Rusitec experiments was improved by 10% (±0.1%). In conclusion, the study demonstrated the potential of the combination of garlic and citrus extracts to improve digestion, enhance body energy retention and limit CH4 formation in relation to feed intake.

Keywords : citrus, garlic, methane, ruminants
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