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Effects of some organic acids and salts on microbial
fermentation in the digestive tract of piglets estimated using an
in vitro gas production technique

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Abstract

An in vitro gas production technique was used to screen different organic acids (formic, propionic, lactic, citric, and fumaric acid), organic salts (calcium formate, potassium sorbate, and sodium benzoate), and inorganic phosphoric acid for their ability to modulate microbial fermentation in the digestive tract of piglets. For the incubation, 40 ml of culture medium (53% buffer, 45% frozen ileal digesta, and 2% fresh faeces) was dispensed in vessels containing 5 ml of buffer, 0.5 g of feed, and 20 μ l of liquid or 20 mg of solid acidifiers. Gas production was measured every 15 min during the 24 h incubation at 39°C, and a Gompertz bacterial growth model was applied to the gas production data. Formic acid was the only acid that reduced the maximum rate of gas production (i_m) compared to that in the control treatment ($P < 0.05$). The i_m was slower in vessels with formic acid than in those with calcium formate, citric acid, and potassium sorbate ($P < 0.05$). Calcium formate increased the i_m compared to the control treatment ($P < 0.05$). The maximum volume of gas produced and the lag time did not differ between different acidifiers ($P > 0.05$). When investigating formic-acid-based mixtures that contained 1–5% of potassium sorbate and/or sodium benzoate, the estimated parameters for the Gompertz growth model did not differ from those for treatments with plain formic acid ($P > 0.05$). However, concentrations of total volatile fatty acids, acetic acid, propionic acid, and n-butyric acid were reduced by all the mixtures ($P < 0.05$), but not by plain formic acid ($P > 0.05$). In conclusion, organic acids and salts were found to differ in their ability to modulate microbial fermentation in the digestive tract of piglets. Mixing formic acid with potassium sorbate or sodium benzoate changed fermentation patterns, and the possibility to use them to enhance the antimicrobial effect of formic acid should be investigated further in vivo.

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