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Characterization of the diurnal pattern of the breath metabolome and enteric methane emissions in dairy cows

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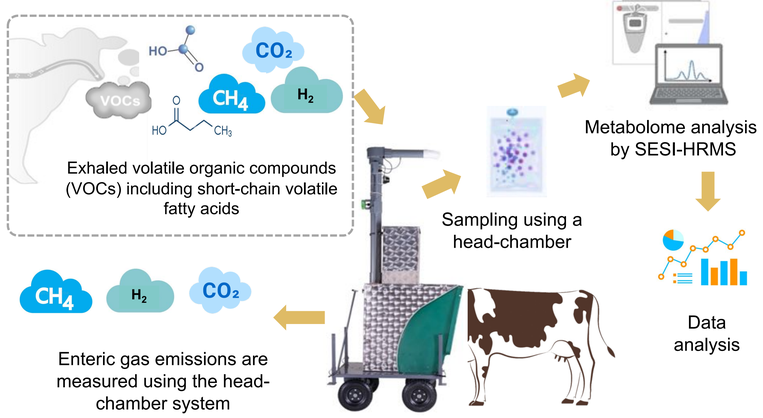
1. Motivation & Method

Context

- The exhalome (= all exhaled volatiles) contains volatile organic compounds that can reflect animal physiological processes.
- The commonly used methods to assess rumen functions are invasive.

Objective

- To explore the breath metabolome of dairy cows as a non-invasive technique, and to characterize the diurnal patterns of rumen fermentation.



- 7 lactating cows were fed the same basal diet once per day.
- Enteric CH_4 was measured using a head-chamber system (GreenFeed) 8 times over 2 days to represent every 3 h of a day, simultaneously breath samples were collected in Tedlar gas sampling bags.
- Short chain volatile fatty acids (VFAs) were annotated using their exact *m/z* ratios.

2. Research Facilities Used

3. Results

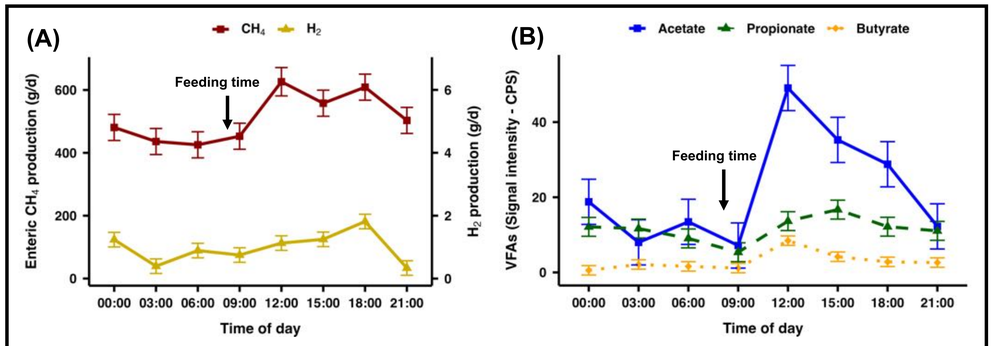


Fig 1. (A) Methane and hydrogen emission (g/d), and (B) exhaled short-chain VFAs of dairy cows measured in 3-h intervals.

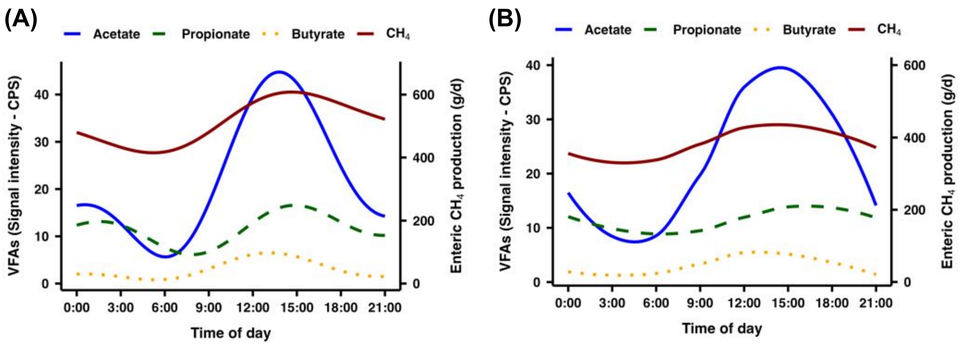


Fig 2. Fitted daily patterns of exhaled short-chain VFAs, and enteric CH_4 emission of cows using (A) cosine functions with a linear mixed model, and (B) a generalized additive model.

4. Conclusions

- The present study revealed a great potential for using breath metabolomics as a proxy for the assessment of rumen fermentation and its daily pattern.
- Further research is needed to validate the method and its establishment as a non-invasive tool for the assessment of the rumen and metabolic health of dairy cows.

5. Contribution to Sustainable Food Systems

Sustainable animal agriculture demands better feed efficiency and reduced environmental impact. This study provides a novel non-invasive approach based on breath metabolome to better understand ruminal fermentation in animal studies.

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