Relationship between CH_4 measured with sniffer method and dry matter intake in dairy cows

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The environmental impact of dairy cows largely comprises of the methane emissions from their digestion. Methane production is known to have a close relationship with feed/energy intake. Hence, it is important to investigate and understand how much variations in dry matter intake (DMI) could contribute to methane production. Several different methods are used to measure methane emissions from dairy cows. The objective of this study is to investigate the relationship between methane gas production measured with sniffer (infrared (IR)) method and dry matter intake in Swedish Red and Holsteins cows. Methane data from a total of 37 lactating cows from April 2017 – May 2018 was collected. The cows were fed with low starch concentrates restrictedly and grass-clover silage *ad libitum*. We performed a linear regression model with data aggregated in 3 different periods (weekly, fortnight, monthly) to compare the relationships. Pearson Correlation coefficient analysis was also calculated to determine the relationships between the methane production and the total corrected DMI for each period. The average methane production and total DMI were 409.26±57.25 g/day and 24.54±3.50 kg/day, respectively. While the milk yields each day averaged 33.41±6.96 kg. There were significant relationships ($P<0.05$) between the CH_4 production and the total DMI in all periods. However, the adjusted R-squared (R2) values from all analyses have fairly low prediction power, approximately 5-7% of the variation in the measure of methane (g/day) could be predicted by total DMI. The weekly, fortnight, and monthly correlation (R) between total corrected DMI and CH_4 production/day were 0.19, 0.25, and 0.23, respectively. While the relationships between total corrected DMI and CH_4/kg milk yield were -0.28, -0.28, and -0.31, respectively. The weak relationship between DMI and methane gas emission in this study could be due to the variation between cows, the accuracy of the IR measurements, and airflow systems. In conclusion, in the present study, there was a weak but significant correlation between methane production and DMI.

A new integrative mathematic approach to study metabolic trajectories of grazing dairy cows

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Mathematic approaches are needed to study integrated metabolic trajectories of dairy cows during lactation. This study aimed to assess the suitability of the perturbation vector (PERTv) for evaluating individual metabolic trajectories of multiparous cows belonging to two Holstein genetic strains (North American, NAH, n=20; New Zealand, NZH, n=20). At calving, cows were assigned to two feeding strategies differing on the inclusion of directly grazed pasture: 30% (P30, n=20) vs 60% (PMAX, n=20) of dry matter intake. The P30 cows were also fed with a total mixed ration (80:20, concentrate:forage ratio), while the PMAX cows were supplemented with concentrate at the milking parlour and conserved forage if needed. A plasma metabolic dataset corresponding to -45, 21, 100 and 180 days in milk (DIM) was used. It was assumed that the metabolic state at any given time could be described by plasma concentrations of several energy (glucose, non-esterified fatty acids, β-hydroxybutyrate, insulin), protein (3-methylhistidine, urea, total protein, albumin) and redox (thiobarbituric acid reactive substances, protein carbonyls) metabolites. Therefore, the PERTv was calculated as follow: $|PERTv| = \sqrt{(\sum xi^2)}$, in which xi denote the foldchange of each metabolite concentration after log-normalization over the median. It was assumed that $|PERTv| = 0$ reflected the non-perturbated states, while increasing values reflected states of greater perturbation. The results were analysed through ANOVA as repeated measures considering genetic strain, feeding strategy, DIM and its interactions as fixed effects, and the cow as random effect. The PERTv changed ($P=0.05$) through time in a genetic strain by feeding strategy dependent-manner, as it increased ($P<0.01$) between -45 DIM and 21 DIM and then decreased ($P<0.05$) at 100 DIM for all cows, except for NZH-PMAX in which the PERTv remained unchanged until 180 DIM. This determined that NZH-PMAX had the lowest ($P<0.01$) values at 21 DIM compared with the rest. Our results showed the PERTv was able to reflect the increased metabolic load at the onset of lactation and it seems to be useful to address the effect of genotype and feeding strategy on metabolic trajectory.