21. Combining measurements of enteric CH_4 emissions from two non-invasive sensors for genetic evaluations

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In animal breeding, there is a large interest in mitigating enteric methane (CH_4) emissions from dairy cows to reduce the environmental impact of dairy. Breeding techniques provide farmers with a mitigation strategy that is cumulative, permanent, and cost-effective. However, to apply breeding techniques, enteric CH_4 emissions have to be recorded on thousands of individual dairy cows. Our aim was to study if records from two breath analysers, "sniffers" and GreenFeed units can be used collectively in a genetic evaluation for lower enteric CH_4 emissions, by investigating if records by the two devices are genetically correlated. Methane and carbon dioxide emissions were recorded on 25 farms, of which four farms were equipped with both devices at the same time. Sniffers recorded concentrations (ppm) from the feed bin of milking robots, and GreenFeed units recorded concentrations and the airflow rate elsewhere in the barn, which were used to estimate CH_4 production in grams/cow/day. In total, 31,579 weekly averages from 1,744 cows were recorded for sniffers, and 4,345 weekly averages from 724 cows for GreenFeed, of which 333 records from 73 cows overlapped with records for both devices. All 2,292 cows had pedigree information and the full pedigree with recorded cows and their ancestors included 40,367 animals. Furthermore, 1,817 animals, of which 1,626 had CH_4 records, were genotyped with 76,438 SNPs. The genetic correlation between measurements of the two devices was estimated from bivariate mixed models using a restricted maximum likelihood approach. The model included fixed effects for: herd*year*week, parity, and 3rd order Legendre polynomials for days in milk, and random effects for the genetic cow effect and the repeated measurements for each cow. The genetic correlation between enteric CH_4 emissions recorded by sniffers and GreenFeed was high (0.77 ± 0.14). This suggests that, regardless of phenotypic differences, based on the genetic background of the cow the two devices ranked cows similarly from low to high emitting. Furthermore, it shows that there is promise in using measurements from the two devices collectively in genetic evaluations. In practice, the sniffers can collect CH_4 records relatively cheap on a large number of cows, and the GreenFeed records on CH_4 production in grams/cow/day can be used when required for the breeding goal.