



Dottorato di ricerca in Scienze Veterinarie XVII CICLO PON - Anno di corso: 2°

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Assessment of individual dairy cows *in vitro* rumen methane emissions

Objective Research in the last years has resulted in a better understanding of factors influencing methane (CH₄) emissions, the main greenhouse gas produced by ruminants. A large proportion of the variation in enteric CH₄ emissions from animals can be explained by diet composition and feed intake. Nevertheless, differences in CH₄ release might be ascribed to each individual cow. Aim of the study was to screen the CH₄ production in individual dairy cows using the Gas Endeavour® *in vitro* system (GE, Bioprocess Control, Svezia).

Materials and Methods For this purpose, 58 Italian Friesian dairy cows from the University of Bologna dairy research farm were enrolled. Animals had, on average, 3.5 years of age (± 1.36), 176.5 DIM (± 110.52), 40 l/day milk yield (± 11.79), 3.92% fat (± 0.43), 3.45% protein (± 0.23). Diet fed to all animals was mainly composed by alfalfa hay (35.1%DM), wheat hay (11.16%DM), and cereal mix (48%DM). Rumen fluid was sampled with an esophageal probe at 9.0 am after feeding. After collection, the rumen fluid was filtered with a sieve (1 mm diameter pores) to eliminate gross material, and then measured for its pH using a pH meter (PH20er, VWR). The rumen fluid was thus used as inoculum for *in vitro* TMR fermentation, according to the Tilley and Terry (1963) modified technique. CH₄ production was measured *in vitro* using the GE. CH₄ production was evaluated at 3 different time points: 8 (T1), 12 (T2) and 24 (T3) hours of incubation.

Results Data distributions were different per time point, as expected (170 ml in T1, 204.4 ml in T2, 228.8 ml in T3, on average). In addition, we observed a significant correlation between CH₄ production at T2 and T3 ($r^2=0.99$, $P<0.01$). Rumen fluid pH was 6.13 (± 0.38) on average, and positively correlated with CH₄ production ($r^2=0.3$, $P=0.28$). On the opposite, age ($r^2=-0.33$, $P=0.83$) and milk yield ($r^2=-0.12$, $P=0.79$) were negatively correlated.

Conclusions The result showed that cows with the same diet had different CH₄ productions also *in vitro*. Differences between the groups remained constant for all fermentation time points evaluated. Interestingly, a high correlation of CH₄ production was achieved between T2 and T3.

Future Proposal Developing a high-throughput *in vitro* system to measure individual dairy cows' rumen methane emissions, enabling precise identification of high emitters and targeted mitigation strategies for sustainable methane reduction in the dairy industry.

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