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***In-vitro* and *in-vivo* Methane Production from Improved and Traditional Rations of Dairy Cows in India**

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Abstract

Enteric methane (CH₄) emissions arise from carbohydrate fermentation in the forestomachs of ruminants. Feeding dairy cows a balanced diet aims at increasing their productivity; however, it is less clear whether it may also reduce the CH₄ emissions per kg of ingested feed dry matter (DM). This study analysed differences in CH₄ emissions by cows fed traditional Indian dairy rations before (BRB) and after ration balancing (ARB) using both *in-vivo*- and *in-vitro*-techniques.

The CH₄ emitted by Holstein–Friesian crossbred cows (n=35) that first received a BRB and then a ARB diet in two subsequent experimental periods was measured by the sulphur hexafluoride tracer technique at the National Dairy Development Board (NDDB) in India. Additionally, 35 samples each of the two diet types were analysed using the Hohenheim gas test at NDDB and the University of Hohenheim (UHOH). The parameters measured in these *in-vitro*-trials were gas production (GP) (ml/mg truly degraded DM), CH₄ production (ml/g DM), partitioning factor (mg/ml), and short chain fatty acid (SCFA) concentrations (μmol/ml) in rumen fluid. Mean values were compared statistically using SAS 9.4.

Although only GP was lower in ARB than in BRB diets in *in-vitro*-trials at NDDB ($p < 0.01$), at UHOH GP ($p < 0.01$) and total SCFA concentrations ($p = 0.04$) were lower in ARB and the partitioning factor ($p = 0.02$) was higher in ARB than in BRB diets. Thus, the ARB diet improved feed DM degradability without adversely affecting rumen fermentation. Neither diet was associated with significant differences in *in-vitro*- and *in-vivo*-CH₄ production (ml/g DM), suggesting that CH₄ emissions per unit of feed intake are not reduced when animals are fed balanced diets. However, lower CH₄ emissions per kg of milk yield can be expected due to an increase in performance of animals fed more balanced diets. The correlation between *in-vitro*- and *in-vivo*-CH₄ production (ml/g DM) was weak. Thus, although the Hohenheim gas test is useful for screening many samples in a short time, it is of limited value for predicting CH₄ emissions from ruminants *in vivo*.

Keywords: Balanced diet, dairy cows, Hohenheim gas test, *in vivo* technique, methane