Tropentag, September 17-19, 2014, Prague, Czech Republic

"Bridging the gap between increasing knowledge and decreasing resources"

Milk Fatty Acids Relationships with Methane Emissions from Dairy Cattle: A Step Beyond Predictions Models

Joaquín Castro-Montoya[1], Veerle Fievez[2], Nico Peiren[3], Bernard De Baets[4], Sam De Campeneere[5]

[1] *University of Hohenheim, Animal Nutrition and Rangeland Management in the Tropics and Subtropics, Germany*

[2] *Gent University, Dept. of Animal Production (Lanupro), Belgium*

[3] *Institute for Agriculture and Fisheries Research, Belgium*

[4] *Gent University, Dept. of Applied Mathematics, Biometrics and Process Control, Belgium*

[5] *Institute for Agriculture and Fisheries Reserach, ILVO, Belgium*

Abstract

Around the world, growing demand for dairy products is changing milk production towards increased intensity and its concomitant changes in greenhouse gases emissions, which should be quantified and managed accordingly. Particularly for methane (CH_4), several approaches have been used to quantify/estimate emissions from cattle. Milk fatty acids (MFA) have been previously used to develop predictive models for CH_4 from dairy cows. However, small data sets and low variability prevent these models from accurately predicting CH_4 under more general conditions. In this study, a data set containing 145 observations from 9 experiments with dairy cows was used to develop models to predict CH_4 expressed in four functional units (g/d, g/kg DMI, g/kg milk and g/kg BW0.75/d) and to explore the ability of MFA to differentiate high from low CH_4-emitter animals. A generalised linear mixed model was fitted to the data, and the variance explained by fixed (marginal R^2(m)) and random (conditional R^2(c)) effects were calculated for model evaluation. Variance explained by MFA (R^2(m)) ranged from 0.19 (g CH_4/kg BW0.75/d) to 0.55 (g CH_4/kg DMI). Standardized coefficients showed that C17:0 and cis-9 C17:1 are highly relevant for CH_4 prediction. Furthermore, the Gini coefficient and Lorenz curve, parameters normally applied in economics, were used to represent the distribution of MFA and its relationship with CH_4. Gini coefficients for daily CH_4 and CH_4 relative to DMI were calculated for subsets of the data according to their cumulative abundance (below 0.625 g/100 g MFA (Group 0.625); between 0.625 and 2.5 g/100 g MFA (Group 2.5); between 2.5 and 10 g/100 g MFA (Group 10); above 10 g/100 g MFA (Group 100)). Methane measurements were divided into HIGH, MEDIUM and LOW. For daily CH_4, Gini coefficients of MFA profiles in the category HIGH were different from the other categories for Group 10 and Group 0.625. For CH_4 relative to DMI, category HIGH had a higher Gini coefficient for every group, with greater differences than those found for daily CH_4. Milk FA hold a modest potential to predict amounts of CH_4 emitted by dairy cows, but they might have potential to identify high from low emitter animals.

Keywords: Dairy, methane, milk fatty acids, prediction

Contact Address: Joaquín Castro-Montoya, University of Hohenheim, Animal Nutrition and Rangeland Management in the Tropics and Subtropics, Fruwirthstrasse 31, 70599 Stuttgart, Germany, e-mail: jcm@uni-hohenheim.de