Prediction of methane production from dairy and beef cattle

Ellis JL, Kebreab E, Odongo NE, McBride BW, Okine EK, France J.

Centre for Nutrition Modelling, Department of Animal and Poultry Science, University of Guelph, Guelph, Ontario, N1G 2W1, Canada

Abstract
Methane (CH₄) is one of the major greenhouse gases being targeted for reduction by the Kyoto protocol. The focus of recent research in animal science has thus been to develop or improve existing CH₄ prediction models to evaluate mitigation strategies to reduce overall CH₄ emissions. Eighty-three beef and 89 dairy data sets were collected and used to develop statistical models of CH₄ production using dietary variables. Dry matter intake (DMI), metabolizable energy intake, neutral detergent fiber, acid detergent fiber, ether extract, lignin, and forage proportion were considered in the development of models to predict CH₄ emissions. Extant models relevant to the study were also evaluated. For the beef database, the equation CH₄ (MJ/d) = 2.94 (± 1.16) + 0.059 (± 0.0201) x metabolizable energy intake (MJ/d) + 1.44 (± 0.331) x acid detergent fiber (kg/d) - 4.16 (± 1.93) x lignin (kg/d) resulted in the lowest root mean square prediction error (RMSPE) value (14.4%), 88% of which was random error. For the dairy database, the equation CH₄ (MJ/d) = 8.56 (± 2.63) + 0.14 (± 0.056) x forage (%) resulted in the lowest RMSPE value (20.6%) and 57% of error from random sources. An equation based on DMI also performed well for the dairy database: CH₄ (MJ/d) = 3.23 (± 1.12) + 0.81 (± 0.086) x DMI (kg/d), with a RMSPE of 25.6% and 91% of error from random sources. When the dairy and beef databases were combined, the equation CH₄ (MJ/d) = 3.27 (± 0.79) + 0.74 (± 0.074) x DMI (kg/d) resulted in the lowest RMSPE value (28.2%) and 83% of error from random sources. Two of the 9 extant equations evaluated predicted CH4 production adequately. However, the new models based on more commonly determined values showed an improvement in predictions over extant equations.


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