



## Evaluation of mathematical models to predict methane emissions from ruminants under different dietary mitigation strategies

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## 1. Title

# **Evaluation of mathematical models to predict methane emissions from ruminants under different dietary mitigation strategies <sup>(1)</sup>**

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Nutrition Network” (<http://animalscience.psu.edu/fnn>) of the Livestock Research Group within the Global Research Alliance for Agricultural Greenhouse Gases ([www.globalresearchalliance.org](http://www.globalresearchalliance.org)).

### 3. Abstract

This study evaluated the ability of published models to predict enteric methane (CH<sub>4</sub>) emissions from dairy cattle, beef cattle, sheep and dairy goat, using a large database (3183 individual animal data). Models for each animal subcategory and CH<sub>4</sub> dietary mitigating strategies of lipid or starch supplementation and of diet quality (described by organic matter digestibility and neutral-detergent fiber digestibility) were assessed. Models were ranked according to root mean square prediction error (RMSPE; % of observed mean) to standard deviation of observed values ratio (RSR) and RMSPE, using all data within each animal subcategory. For dairy cattle, CH<sub>4</sub> emissions (g/day) were predicted with the smallest RSR using the model based on feeding level [dry matter intake (DMI)/body weight (BW)], digestibility of feed gross energy (dGE) and dietary ether extract (EE) content (RSR=0.66, RMSPE=15.6%). For beef cattle, the smallest RSR was obtained using GE intake, BW, forage and EE content (RSR=0.83, RMSPE=27.2%). For sheep and goat, there were limited published models; the smallest RSR was observed for a sheep model based on digestible energy intake (RSR = 0.61, RMSPE = 19.2%). IPCC Tier 2 models (1997; 2006) had low predictive ability for variation in dietary EE content, neutral detergent fiber content and organic matter digestibility (RMSPE 14.3-30.5% and 23.0-40.5% for dairy and beef cattle, respectively). No model predicted CH<sub>4</sub> emissions accurately under all dietary mitigation strategies. Some models gave satisfactory predictions and for improved prediction, models should include feed intake, digestibility and information on dietary chemical composition.

### 4. Index terms:

Prediction equation, enteric methane, livestock, nutritional practices.