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108. Evaluation of the German NE system for dairy cows on the basis of an extensive data set from feeding trials (Bewertung des deutschen NE systems für Milchkühe auf der Basis umfangreicher Daten aus Fütterungsversuchen) – Irdning / Kiel / Freising / Iden / Bonn / Stuttgart / Braunschweig / Posieux / Aulendorf / Poing

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Material and methods: A comprehensive data set (n = 24,583; means of two lactation weeks of individual cow measurements) obtained from long term feeding experiments with lactating dairy cows carried out in 9 research institutes of Germany, Austria and Switzerland (Gruber et al. 2005) was used to evaluate the current German feeding standards (GfE 2001). The experiments were carried out with Simmental, Brown Swiss, and Holstein Friesian cows and the data showed a wide variation both in animal parameters [(mean, SD, range; days of lactation (138 ± 78, 2 – 459), milk yield (24.3 ± 8.1, 2.2 – 60.6 kg/d), DM intake (18.5 ± 3.5, 5.4 – 31.6 kg DM/d)] as well as nutritional factors [NE content (5.9 ± 0.5, 4.1 – 7.4 MJ/kg DM), proportion of concentrate in the diet (25.6 ± 17.9, 0.0 – 81.1 % of DMI)]. The NE system was validated by regressing the NE requirements calculated on the basis of its assumptions [0.293 MJ NEL/kg $LW^{0.75}$ for maintenance, NE in milk = 0.38 × fat + 0.21 × protein + 0.95 (Tyrrell & Reid 1965), 25.5 MJ NEL for gain and 20.5 MJ NEL for loss of 1 kg LW, NEL pregnancy = (0.044 × exp(0.0165 × day of gestation/0.175 × 0.6)] on the actual NE intakes (MJ). The NEL content of the ration components was calculated using equations of GfE (2001) based on *in vivo* digestibility trials with sheep in the respective institutes parallel to the feeding experiments.

Results and conclusion: The following equation was derived:

NE requirement calculated = 24.1 + 0.83 × NE intake

R^2 = 0.660, MSPE = 316, MPE = 17.8 MJ NEL, MPE = 14.7 %
Components of MSPE: Bias = 3.7 %, Line = 10.9 %, Random = 85.4 %

This regression equation shows a bias of 3.7 % of MSPE (mean NE requirement = 124.5 MJ, mean NE intake = 121.1 MJ) and an even higher error caused by a systematic deviation of the regression line from 1 (x = y), intercept = 24.1 and the slope = 0.83, despite a high prediction error (MPE = 17.8 MJ NEL or 14.7 % of NE intake). In order to find reasons for the relatively low correlation, a multiple regression analysis was carried out relating ME intake (MJ) on metabolic live weight ($LW^{0.75}$, kg), milk energy output (LE, MJ/d) and live weight change (LWC, kg/d). Requirement for pregnancy was fixed as specified by GfE (2001) and substracted from total ME intake (MJ ME/d):

ME intake = 0.652 × $LW^{0.75}$ + 1.41 × LE + 16.6 × LWC

R^2 = 0.717, RSD = 24.1 MJ

The results reveal a considerable higher maintenance energy requirement than used in current energy systems (INRA 1989, AFRC 1993, GfE 2001, NRC 2001), but are in line with recent observations in experiments carried out in Northern Ireland (0.600 – 0.660 MJ ME/kg $LW^{0.75}$; Agnew & Yan 2000, Agnew et al. 2003, FiM 2004). The coefficient of energetic efficiency for lactation is higher than in current systems (k_l = 1/1.41 = 0.71) as well. Agnew & Yan (2000) and Agnew et al. (2003) reported values of k_l = 0.64 – 0.69. The equation gives a much lower energy content for mobilisation/retention of body reserves than usually expected. It is concluded that recent data from feeding trials provide evidence that the German NE system for lactating dairy cows underestimates both the energy requirement for maintenance and the efficiency of ME utilization for lactation leading to difficulties in formulating diets for high yielding animals.

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