The Rostock Energetic Feed Evaluation on the Base of Net Energy

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Introduction Feed evaluation was an emphasis of research from the foundation of the "Oskar-Kellner-Institute of Animal Nutrition" in 1953 at Rostock by Prof. Kurt Nehring. The aim of the research work was the elaboration of a feed evaluation system containing reference numbers of feed values and requirements of farm animals. The approach and the present system are outlined in this paper.

Materials and methods By means of indirect calorimetry using respiration chambers for cattle (4), sheep (2), pigs (4) and fowl (6) many metabolic experiments were carried out at different levels of nutrition measuring digestibility of energy (DE) and nutrients, metabolisable energy (ME) and net energy (NE) of 110 and 92 cattle and pig rations respectively (Schiemann *et al*., 1971). On the basis of the experimental results, equations for the estimation of energy reference numbers of feedstuffs were calculated by multiple regression analysis (Table 1).

Results Net Energy Retention (NER) was taken as a uniform measure for energetic feed evaluation and characterisation of energy requirement of farm animals. The NER is an experimentally measurable and universal measure of the biologically utilisable feed energy and correlates closely with ATP potential of nutrients and feedstuffs as well as with energetic potential for all energy consuming reactions of the animal body and reflects the energy requirement for different levels of performance (Schiemann *et al*., 1971).

Table 1 Equations for estimation of Net Energy Retention (NER) in kJ for cattle (NERc) (1) and pig (NERp) (2) (Collective of authors, 2003)

(1) NERc=(7.2dCP+20.0dCF+10.1dST +8.3dSU+8.2dNFR)(-0.5574+0.0405DE-0.0002633DE^2)	± 4.5 %
(2) NERp=11.0dCP+27.0dCF+12.7dST +11.6dSU+(12.0- 0.14(80-DE)) dNFR	± 4.0 %

(d=digestible, C=crude, P=protein, F=fat, ST=starch, SU=sugar, NFR=N-free residue, DE=energy digestibility)

Net energy retention is dependent on animal species (Table 1), but results in sheep were similar to those in cattle, so that energetic values of feedstuffs are subdivided into three tables: cattle in NERc, pigs in NERp and fowl in NERf (equation not shown). The energy requirements are tabulated for different species groups (Collective of authors, 2003): Cattle, sheep, goat and horse in NERc, Pig, rabbit, and fur-bearing animals in NERp, Fowl, all species of poultry and fish in NERf.

Energetic feed values at the maintenance level for examples of feedstuffs in NERc, ME, and Net Energy Lactation (NEL) and relative feed values are given in Table 2.

Table 2 Comparison of feed values for cattle, relations and utilisation of ME between different systems

Feedstuff	Feed value			Relative feed value			Utilisation of ME	
	NERc MJ	ME MJ	NEL MJ	NERc Barley (= 100)	ME Barley (= 100)	NEL Barley (= 100)	NERc/ ME %	NEL/ME %
Barley, corn	7.84	12.54	8.44	100	100	100	63	67
Maize silage, milk-wax ripeness	5.89	10.25	6.62	75	82	78	58	65
Meadow hay, full bloom	3.77	7.87	4.79	48	63	57	48	61
Oats straw	2.42	6.01	3.61	31	48	43	40	60

Conclusions Feed evaluation on the basis of NER is superior to NEL and ME because it provides greater differentiation between feedstuffs in their energetic values. The system was tested in farms specialised in milk production, cattle breeding, sheep breeding and fattening. The system has been used with high success in feed production, feeding, economic evaluation and feed planning in many farms.

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