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LETTER TO THE EDITOR
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Simplified estimation of forage degradability in the rumen assuming zero-order degradation kinetics by M. S. Dhanoa, S. Lopez, R. Sanderson & J. France, *Journal of Agricultural Science, Cambridge* **147**, 225–240

Dhanoa *et al*. (2009) described an elegant and novel approach to estimate effective rumen degradability (*E*) assuming zero-order kinetics, which would increase the capacity to process samples using the *in situ* nylon bag method. The degradation and passage kinetic model for estimating *E* was basically the same as the original Ørskov & McDonald (1979) model. Although the described method is mathematically sound, the authors ignored two erroneous assumptions of the basic kinetic model. First, the model assumes that the 'wash fraction' is instantly degraded. Part of the immediately 'degraded' fraction can be physical loss of small particles from the bags. Although the effect of particle loss may be corrected mathematically, the assumption of infinite degradation rate for the truly soluble fraction is not correct. There is ample experimental evidence based on different *in vitro* and *in vivo* techniques (Chen *et al*. 1987; Hristov & Broderick 1996; Peltekova & Broderick 1996; Choi *et al*. 2002; Volden *et al*. 2002; Ahvenjärvi *et al*. 2007; Reynal *et al*. 2007) demonstrating that a quantitatively significant proportion of soluble non-ammonia N escapes from the rumen in the liquid phase. Another false assumption is the first-order one-compartment passage model. Marker kinetic studies based on duodenal sampling have clearly demonstrated that passage kinetics of ruminal digesta are not well described by a single exponential model (for references see Huhtanen *et al*. 2006), not even for concentrate feeds. These two false model assumptions would exaggerate differences in ruminal protein degradability between feeds. The insignificant effects of increasing rumen undegraded protein (RUP) supply on milk production (Ipharraguerre & Clark 2005) support this statement. In a recent meta-analysis (Huhtanen & Hristov 2009) based on 1800 treatment means, ruminal protein degradability only marginally improved predictions of milk protein yield or milk N efficiency when used as a third independent variable in regression models with energy and crude protein intake. The experimental evidence strongly suggests that RUP is overvalued in current protein feeding systems, at least partly because of the above mentioned two false assumptions of the Ørskov & McDonald (1979) model. Unless more correct models are used to derive *E* from kinetic parameters, simplified *in situ* procedures are of little value in feed evaluation despite increased labour effectiveness.

REFERENCES

Ahvenjärvi, S., Vanhatalo, A., Huhtanen, P. & Hristov, A. (2007) Ruminal metabolism of ^{15}N labeled ammonium-N and grass silage soluble non-ammonia N. *Journal of Dairy Science* **90** (Supplement 1), 232.

Chen, G., Sniffen, C. J. & Russel, J. B. (1987). Concentration and estimated flow of peptides from the rumen of dairy cattle: effect of protein quantity, protein solubility and feeding frequency. *Journal of Dairy Science* **70**, 983–992.

Choi, C. W., Ahvenjärvi, S., Vanhatalo, A., Toivonen, V. & Huhtanen, P. (2002). Quantitation of the flow of soluble non-ammonia nitrogen entering the omasal canal of dairy cows fed grass silage based diets. *Animal Feed Science and Technology* **96**, 203–220.

Dhanoa, M. S., Lopez, S., Sanderson, R. & France, J. (2009). Simplified estimation of forage degradability in the rumen assuming zero-order degradation kinetics, *Journal of Agricultural Science, Cambridge* **147**, 225–240.

Hristov, A. N. & Broderick, G. A. (1996). Synthesis of microbial protein in ruminally cannulated cows fed alfalfa silage, alfalfa hay, or corn silage. *Journal of Dairy Science* **79**, 1627–1637.

Huhtanen, P. & Hristov, A. (2009). A meta-analysis of the effects of dietary protein concentration and degradability on milk protein yield and milk N efficiency in dairy cows. *Journal of Dairy Science* **92**, 3222–3232.

Huhtanen, P., Ahvenjärvi, S., Weisbjerg, M. & Norgaard, P. (2006). Digestion and passage of fibre in ruminant. In *Ruminant Physiology* (Eds K. Sejrsen, T. Hvelplund & M. O. Nielsen), pp. 83–135. Wageningen, The Netherlands: Wageningen Academic Publishers.

Ipharraguerre, I. R. & Clark, J. H. (2005). Impacts of the source and amount of crude protein on the intestinal

supply of nitrogen fractions and performance of dairy cows. *Journal of Dairy Science* **88** (E. Supplement), E22–E37.

ØRSKOV, E. R. & MCDONALD, I. (1979). The estimation of protein degradability in the rumen from incubation measurements weighted according to rates of passage. *Journal of Agricultural Science, Cambridge* **92**, 449–503.

PELTEKOVA, V. D. & BRODERICK, G.A (1996). *In vitro* ruminal degradation and synthesis of protein on fractions extracted from alfalfa hay and silage. *Journal of Dairy Science* **79**, 612–619.

REYNAL, S. M., IPHARRAGUERRE, I. R., LINEIRO, M., BRITO, A. F., BRODERICK, G. A. & CLARK, J. H. (2007). Omasal flow of soluble proteins, peptides, and free amino acids in dairy cows fed diets supplemented with proteins of varying ruminal degradabilities. *Journal of Dairy Science* **90**, 1887–1903.

VOLDEN, H., MYDLAND, L. T. & OLAISEN, V. (2002). Apparent ruminal degradation and rumen escape of soluble nitrogen fractions in grass and grass silage administered intraruminally to lactating dairy cows. *Journal of Animal Science* **80**, 2704–2716.

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