Letter to the Editors

Marker methods for measuring digesta flow

There appears to be an increasing number of workers who are reporting 'measurements' of the flow of digesta to the duodenum of ruminants by reference to a single marker in samples taken from a simple, or 'T-piece', cannula. Thus Aldrich *et al.* (1993) used ytterbium acetate and Zinn and co-workers (4 reports in *Journal of Animal Science*, (1993) vol. 71 no. 1) used Cr_2O_3 despite the fact that single markers, especially Cr_2O_3 (Faichney, 1972; Beever *et al.*, 1978), cannot be relied upon to give accurate results (Faichney, 1980).

The double-marker method (Faichney, 1975) was developed to overcome the sampling errors that render otherwise suitable single markers unreliable. As with all methods, problems can arise in its use but their solution does not lie in returning to a demonstrably unreliable method. There appear to be three main problems with the double-marker method: first, the accurate determination of the particle-associated marker in the particle-depleted fluid phase sample; second, the need for multiple analyses to enable true digesta composition to be calculated; third, the unreliable reconstitution values obtained with some diets. The first two have been resolved by further development of the method (Faichney, 1992). The third relates to the basic assumption of the method that digesta can be considered to consist of two phases (Hogan & Weston, 1967; Faichney, 1975). This assumption has been found to be reasonable for forage and many mixed diets. However, with diets containing whole or cracked grain, e.g., maize and sorghum, including those based on maize silage, the digesta may be so heterogeneous that the assumption may not hold. Consequently, the double-marker method would fail and valid corrections for sampling errors could not be made. The use of a single marker in this situation does not solve the problem, it merely masks it. If a solution such as the extension of the double-marker method to multiple markers (France & Siddons, 1986) cannot be implemented, the only alternative is to measure digesta flow by total collection using re-entrant cannulas (MacRae, 1975).

It is incumbent upon every research worker to be as rigorous as possible in his/her choice and implementation of methods. I think that the retreat from rigour exemplified by the use of a single marker to 'measure' duodenal digesta flow is totally unacceptable because it confounds the literature with unreliable data and questionable interpretations.

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REFERENCES

Aldrich, J. M., Muller, L. D. & Varga, G. A. (1993). Effect of somatotropin administration and duodenal infusion of methionine and lysine on lactational performance and nutrient flow to the small intestine. *British Journal of Nutrition* **69**, 49–58.

Beever, D. E., Kellaway, R. C., Thomson, D. J., MacRae, J. C., Evans, C. C. & Wallace, A. S. (1978). A comparison of two non-radioactive digesta marker systems for the measurement of nutrient flow at the proximal duodenum of calves. *Journal of Agricultural Science, Cambridge* **90**, 157–163.

Faichney, G. J. (1972). An assessment of chromic oxide as an indigestible marker for digestion studies in sheep. *Journal of Agricultural Science, Cambridge* **79**, 494–499.

Faichney, G. J. (1975). The use of markers to partition digestion within the gastro-intestinal tract of ruminants. In *Digestion and Metabolism in the Ruminant*, pp. 277–291 [A. C. I. Warner and I. W. McDonald, editors]. Armidale, NSW: University of New England Publishing Unit.

Faichney, G. J. (1980). The use of markers to measure digesta from the stomach of sheep fed once daily. *Journal of Agricultural Science, Cambridge* **94**, 313–318.

Faichney, G. J. (1992). Application of the double-marker method for measuring digesta kinetics to rumen sampling in sheep following a dose of the markers or the end of their continuous infusion. *Australian Journal of Agricultural Research* **43**, 277–284.

France, J. & Siddons, R. C. (1986). Determination of digesta flow by continuous marker infusion. *Journal of Theoretical Biology* **121**, 105–119.

Hogan, J. P. & Weston, R. H. (1967). The digestion of chopped and ground roughages by sheep. 2. The digestion of nitrogen and some carbohydrate fractions in the stomach and intestines. *Australian Journal of Agricultural Research* **18**, 803–819.

MacRae, J. C. (1975). The use of re-entrant cannulae to partition digestive function within the gastro-intestinal tract of ruminants. In *Digestion and Metabolism in the Ruminant*, pp. 261–276 [A. C. I. Warner and I. W. McDonald, editors]. Armidale, NSW: University of New England Publishing Unit.

Preliminary announcement

The European Nutrition Leadership Programme

- This programme is formulated for advanced PhD students and postdoctoral fellows in human nutritional sciences in Europe.
- The programme proposed consists of a one-week advanced training seminar to be held from 12 to 19 March 1994 in Luxembourg. The programme will give specific attention to topics such as communication of nutrition science, future strategies and new frontiers in nutrition research, nutrition science and nutritional health in Europe and nutrition within European health policies.
- The programme will be organized by a group of leading European nutritionists in close collaboration with or under the patronage of European nutrition organizations and societies.
- Candidates upon application will be selected by an international selection committee. Altogether 30–35 candidates will be able to participate.
- The programme is supported by an EC grant and food companies in Europe. Selected candidates are requested to make a modest financial contribution.

- *Administrative information*

A map with information is available from 1 October 1993 onwards.

Applications can be made till 1 December 1993. In January 1994 the decision will be taken about the participants who are invited.

The map with information can be obtained from:

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