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MEASUREMENT OF PROPIONIC ACID AND GLUCOSE METABOLISM USING A MODELLING APPROACH

J.B. ROWE*, J.V. NOLAN* and R.A. LENG*

A modelling approach provides a powerful means of measuring and assessing the complex changes in rumen fermentation and body metabolism of ruminants which occur during various experimental manipulations.

A sheep was fed 100 g/day of oaten chaff and one of two levels of molasses (and 3% urea) at either 1000 g or 500 g/day. At each level of intake, 4 separate continuous infusions of ^{14}C-labelled tracer were made, one into each of the 4 compartments of interest, *viz.* rumen propionate and bicarbonate, blood glucose and bicarbonate. The specific radioactivity of carbon at "plateau" in each of these 4 compartments was estimated in each experiment. Two general, 4 compartment models were calculated, one for each level of feed intake, by a method similar to that used by Nolan, Norton and Leng (1976) (see Figure 1).

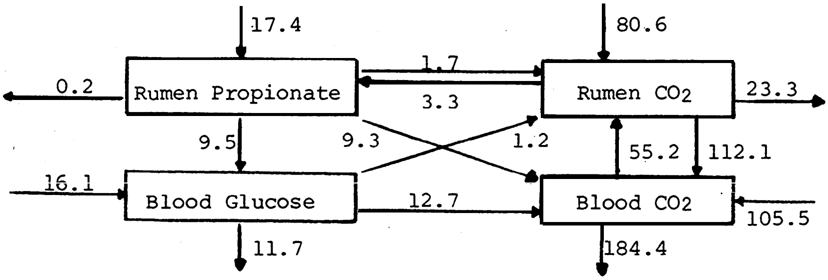

Figure 1. Example of one 4 compartment model for a sheep (36 kg) on the high molasses intake (carbon flows in g/d)

From both models a considerable amount of information is available; however several of the results are of particular importance:

1. The models indicate the relative utilisation of propionate and other precursors for glucose synthesis and show that, as rumen propionate availability increases, the proportion of glucose derived from propionate also increases.

2. The rate of irreversible loss of C from the system, other than through CO_2, provides an estimate of the C deposited during synthesis of body tissues, Viz. 30 g/day glucose (12 g C/day) for both levels of feed intake which is about 50% of the total glucose utilisation. This indicates the extent of use of glucose during the synthesis and replacement of tissues, even in mature sheep.

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* Department of Biochemistry and Nutrition, University of New England, Armidale, N.S.W. 2351.