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Empirical predictions of splanchnic released energetic nutrients in ruminants*

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For feeding systems to monitor new production targets, they have to be renovated to be more nutrient based. Our objective is to describe the aggregated energy values of diets for ruminants in terms of quantity and quality of nutrients made available to tissues. Recent INRA results showed that it is possible to move from aggregated energy values of diets to the amount of energetic nutrients (volatile fatty acids, glucose ..) appearing in the portal vein (Loncke, 2009; Nozière et al., 2010; Ortigues-Marty et al., 2010) using dietary and animal characteristics as defined by INRA. The present paper focuses on the empirical equations that have been established to predict the transfer of the major energetic nutrients (acetate, propionate, butyrate, glucose, lactate and β -hydroxybutyrate) across the liver. All results were based on the analysis of all the relevant published knowledge gathered into the Flora database (Vernet and Ortigues-Marty, 2006; on net splanchnic nutrient fluxes in multi-catheterised ruminants) by an empirical meta-analysis modelling approach compatible with the INRA energy values, also constructed by empirical modelling. Prediction criteria were identified from current knowledge on hepatic and other tissue metabolism. Models were established for intakes up to 30 g dry matter per kg body weight per day and diets containing less than 70 g concentrate per 100 g dry matter. The transfer of nutrients across the liver was predicted assuming mass action laws alone (butyrate, propionate and α -amino-nitrogen) or combined with homeorhetic regulations (β -hydroxybutyrate, glucose and L-lactate). For mass action laws, predictors included the net portal appearance of nutrient or its dietary precursor. For other response equations (e.g. β -hydroxybutyrate and L-lactate), the energy balance of the animals proved to be a valuable predictor reflecting the ratio between nutrient supply and requirements. The net hepatic release of glucose was predicted according to a sigmoid curve with a general linear increase of glucose emission with precursor availability except at low and high precursor availability where conversion rates were greatly altered. Our work showed that it is possible to accurately predict the amount and nature of ketogenic and glucogenic nutrients released by splanchnic tissues towards peripheral tissues in both sheep and cattle at different physiological status using simple predictors.

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