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Gut endogenous protein flows and postprandial
metabolic utilization of dietary amino acids in
simple-stomached animals and humans

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ABSTRACT

Dietary protein quality depends on two key measures: true ileal protein digestibility and the metabolic utilization of absorbed amino acids (AA). The objectives of this study were to determine the influence of two dietary factors (antinutritional factors and peptides) on ileal endogenous protein flows; to validate the intubation technique used in humans for ileal digesta sampling; to determine the postprandial metabolic utilization of dietary AA depending on their delivery form and to assess the validity of the growing pig for predicting true ileal protein digestibility in the adult human. Investigations were undertaken in the growing rat, growing pig and adult human. Ileal digesta were collected from euthanised rats, post valve T-caecum cannulated pigs, and naso-ileal intubated conscious adult humans. Ileal endogenous nitrogen (N) and AA were measured using a protein-free (PF) diet, diets containing ^{15}N -labelled casein in the intact (C) or hydrolysed (HC) form, or a diet based on free AA (diet A), for which some dispensable AA were omitted to allow a direct determination of their endogenous flows. Digesta centrifugation and ultrafiltration (diet HC) allowed for the determination of ileal endogenous protein flows and the extent of tracer (^{15}N) recycling.

Antinutritional factors from a crude extract of kidney beans (*Phaseolus vulgaris*), when given at amounts commonly ingested in practice, enhanced ileal endogenous protein flows (rats, PF diet). After adaptation to the diet, body N balance *per se* did not influence ileal endogenous protein flows (rats, diets PF and A) but dietary peptides led to greater ileal endogenous AA and N flows compared with a protein-free diet. Dietary peptides (HC), compared with peptides naturally released in the gut during protein digestion (C), did not enhance ileal endogenous protein flows (rats, pigs, and humans). The extent of tracer recycling, however, was maximal in frequently-fed rats, lower in meal-fed pigs and minimal in meal-fed humans (65, 21, and 11% of ^{15}N -labelled ileal endogenous proteins, respectively). Naso-ileal intubation for ileal digesta sampling in humans was shown to be an accurate method and evidence was obtained supporting the growing pig as a valid model for predicting true ileal protein digestibility in the adult human. Finally, the form of delivery of dietary AA (from HC or C) influenced the postprandial metabolic fate of dietary AA, especially in terms of AA catabolism kinetics. However, the overall nutritional value of C and HC were similar.

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