

FACTORS AFFECTING AMINO ACID  
AVAILABILITIES FOR CEREAL GRAINS  
AND THEIR COMPONENTS FOR GROWING  
MONOGASTRIC ANIMALS

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WILLEM CORNELIS SAUER

A dissertation submitted to the Faculty of Graduate Studies of  
the University of Manitoba in partial fulfillment of the requirements  
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DEDICATED TO MY DAUGHTER,  
MARGRIET VALENTINA

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## ABSTRACT

The apparent ileal and faecal amino acid availabilities from corn, wheat and barley were determined with barrows ranging in weight from 45 to 75 kg, that were fitted with ileocaecal re-entrant cannulae. The average ileal versus (vs) faecal availabilities were 85.6 vs 89.9, 83.3 vs 89.1 and 77.7 vs 85% for corn, wheat and barley respectively. For the indispensable amino acids, ARG, HIS and THR disappeared to the greatest extent in the large intestine ( $P < .05$ ). For the dispensable amino acids, GLY and PRO disappeared to the largest extent in the large intestine ( $P < .05$ ).

Of the indispensable amino acids, LYS and THR were approximately equal in being least available at the end of the ileum. The ileal LYS vs THR availabilities decreased significantly ( $P < .05$ ) from corn to wheat to barley and were 82.0 vs 78.9, 75.7 vs 76.5 and 73.3 vs 71.2% respectively. Lysine was the least available amino acid when determined by the faecal analysis method. Its availability decreased significantly ( $P < .05$ ) from corn to wheat and to barley and was 83.0, 80.7 and 77.5% respectively.

Faecal amino acid availabilities obtained from rats compared reasonably well with those obtained from pigs for cereal grains of approximately the same protein content of the same variety.

Similarly, apparent ileal and faecal amino acid availabilities from wheat, flour and a diet consisting of

45% bran, 45% shorts and 10% middlings (B+S+M) were determined in pigs. The average ileal vs faecal availabilities were 90.0 vs 94.1, 85.4 vs 92.3 and 72.1 vs 80.4% for flour, wheat and B+S+M respectively. Generally speaking, ARG, HIS THR, GLY and PRO disappeared to the largest extent in the large intestine.

Of the indispensable amino acids, LYS and THR were equal in being least available from flour and wheat. The ileal LYS vs THR availabilities were 84.2 vs 85.4 and 79.5 vs 78.4% from flour and wheat respectively. Lysine was the least available amino acid when determined by the faecal analysis method, namely 86.1 and 86.0% for flour and wheat respectively. Ileal and faecal availabilities of THR in B+S+M were lowest with values of 54.0 and 71.3% respectively.

The apparent ileal and faecal amino acid availabilities from finely ground and cracked wheat were determined with barrows that weighed approximately 75 kg. The average ileal vs faecal availabilities were 87.7 vs 91.6 and 82.8 vs 90.8% for finely ground and cracked wheat respectively. The ileal availabilities of most amino acids were significantly higher ( $P < .05$ ) for finely ground than for cracked wheat, but were not significantly different when determined by the faecal analysis method.

Ileal amino acid availabilities are more biologically meaningful than faecal availabilities. Caecally infused LYS (as free LYS or as part of isolated soy protein) did not significantly



improve the protein retention of barrows, ranging in weight from 25 to 40 kg, that were fed diets low in LYS.

Metabolic ileal and faecal amino acid levels were determined with barrows, ranging in weight from 45 to 75 kg, that were fed 3 protein-free diets containing 5, 10 and 15% Alphafloc respectively. As the level of Alphafloc was increased from 5 to 10 and to 15%, the average ileal vs faecal amino acid levels, expressed as grams per 100 grams of dry matter intake, increased from .072 vs .032 to .091 vs .046 and to .093 vs .050. The average ileal vs faecal nitrogen levels increased from .205 vs .101 to .256 vs .139 and to .271 vs .161. The dispensable amino acids made up 75 to 80% of the total amount of metabolic ileal amino acids, of which PRO and GLY made up 55 and 16% respectively. Arginine, THR, GLY and PRO (especially the last 2 amino acids) disappeared extensively in the large intestine. The levels of ILE, LEU, LYS, MET and ASP increased between the end of the ileum and the anus of pigs fed the protein-free diets.

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