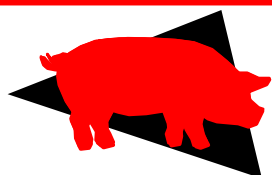


SWINE RESEARCH REPORT 14B



Ileal Digestibility and Availability Values of Lysine for Formulating Diets for Swine

B. Utilization of Ileal Digestible Amino Acids

Objective

To investigate whether ileal digestibility values are useful for formulating diets and to determine the utilization of ileal digestible amino acids.

Experimental Design

Animals

The ileal digestibility studies were conducted with pigs of approximately 50 kg live weight, which had T-piece cannulas inserted to allow the collection of ileal digesta. For collections were made per diet. The growth and retention studies were made with pigs between 20 to 45 kg live weight, using ten individually penned pigs per treatment. The pigs were fed restrictively.

Diets

Initially, the ileal digestibility of amino acids in three proteins was determined: cottonseed meal, representing a meal of low lysine availability (30-40%); meat and bone meal, representing a meal of medium availability (70%) and soybean meal, representing a meal of high availability (90%) (Table 1).

Table 1. Apparent ileal digestibility of the major essential amino acids in cottonseed, meat and bone and soybean meals

	Cotton- seed	Meat & Bone	SBM	SEM
Lysine	0.74	0.78	0.89	0.022
Threonine	0.76	0.72	0.85	0.024
Methionine	0.79	0.86	0.91	0.020
Tryptophan	0.81	0.65	0.90	0.018

Batterham et al (1990)

Diets were then formulated to similar levels of ileal digestible lysine, using the three protein sources as the only sources of lysine in sucrose-based diets. The diets were supplemented with free amino acids to ensure a surplus of 30%, relative to lysine. Three additional diets were supplemented with free lysine to verify that lysine was the limiting amino acid in the original diets. The diets were offered restrictively to swine between 20-45 kg live-weight. At the completion of the experiment, the swine were slaughtered; and the lysine content in the empty bodies determined.

Results

Growth, feed conversion and protein deposition were all superior in swine given the diets containing soybean meal (Table 2). The retention of ileal digestible lysine in swine given cottonseed meal was only 36% compared to 75% in swine given soybean meal.

Table 2. Growth and responses of ileal digestible lysine by growing swine given diets formulated to 0.36 g ileal digestible lysine/MJ DE

Response	Diets			
	1 Cot	2 Meat	3 Soy	4 SEM
Gain (g/d)	377	492	541	11.5
FCR	3.5	2.6	2.3	0.07
Protein (g/d)	38	66	77	1.60
Lysine retained: Ileal digestible				
Lysine intake	0.36	0.60	0.75	0.012

Batterham et al (1990)

These results indicate that a considerable portion the ileal digestible lysine in cottonseed meal was apparently absorbed in a form that was inefficiently utilized. As such, the ileal digestibility assay over-estimates lysine availability in heat-damaged meals.

Similar experiments have been conducted with the other essential amino acids. These results have confirmed that ileal digestible threonine and methionine are also apparently absorbed in a form(s) that is inefficiently utilized (Table 3 and 4).

Table 3. Growth and responses of ileal digestible threonine by growing swine given diets formulated to 0.22 g ileal digestible threonine/MJ DE

Response	Diets			
	1 Cot	2 Meat	3 Soy	4 SEM
Gain (g/d)	471	452	524	9.6
FCR	3.2	2.8	2.4	0.04
Protein (g/d)	47	62	75	2.3
Thr retained: Ileal digestible				
Thr intake	0.44	0.59	0.64	0.017

Beech et al (1991)

With tryptophan, it was not possible to supply all the tryptophan from meat & bone meal, as excessive calcium would have resulted. Thus, the tryptophan was supplied from a combination of meat & bone meal and free tryptophan. The results of this experiment were unusual, as the meat & bone meal plus free tryptophan diets stimulated the greatest swine response (Table 5). This suggests that the total values for tryptophan underestimated that amount of tryptophan in the meals.

Table 4. Growth and responses of ileal digestible methionine by growing swine given diets formulated to 0.09 g ileal digestible methionine /MJ DE

Response	Diets			
	1 Cot	2 Meat	3 Soy	4 SEM
Gain (g/d)	411	441	496	17.4
Protein (g/d)	47	57	61	2.3
Meth retained: Ileal digestible Meth intake	0.38	0.45	0.45	0.013

Batterham et al (1993)

Table 5. Growth and responses of ileal digestible tryptophan by growing swine given diets formulated to 0.065 g ileal digestible tryptophan /MJ DE

Response	Diets			
	1 Cot	2 Meat	3 Soy	4 SEM
Gain (g/d)	393	531	437	27.7
Protein (g/d)	54	75	63	3.5
Trp retained: Ileal digestible Trp intake	0.51	0.49	0.41	

Batterham et al (1994)

New samples of cottonseed and soybean meals were used for the utilization studied with the remaining essential amino acids. Similar values were obtained with phenylalanine; with growth response and retention of ileal digestible phenylalanine lower with pigs given cottonseed meal compared to those given soybean meal.

Surprisingly, with isoleucine, there were no differences in the growth performance and little difference in the retention of ileal digestible isoleucine (Table 6).

This indicates that ileal digestible isoleucine is useful formulating diets. Similar results were recorded with leucine and valine.

Table 6. Growth and responses of ileal digestible isoleucine by growing swine given diets formulated to 0.23 g ileal digestible isoleucine /MJ DE

Response	Diets		
	1 Cot	3 Soy	4 SEM
Gain (g/d)	590	594	13.0
Protein (g/d)	84	91	2.9
Isoleucine retained: Ileal digestible Isoleucine intake	0.65	0.73	0.014

Batterham and Andersen (1994)

Conclusion

These results indicate that the branched-chain amino acids (valine, isoleucine and leucine), which are metabolized predominantly in the muscles rather than the liver, are less sensitive to processing damage; and the ileal digestibility assay for these amino acids reflects availability.

For lysine, threonine, methionine, tryptophan and phenylalanine, which are metabolized in the liver, heat damage during processing apparently causes changes to occur which have little effect on ileal digestibility. However, these changes result in a considerable portion of the se amino acids apparently being absorbed in a form that is inefficiently utilized. Availability values are, therefore, needed for these amino acids in heat-damaged proteins

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