Study of Ileal Amino Acid Digestibility of Soybean and Sunflower Meals in Growing Pigs Using *In Vivo* and *In Vitro* Methods

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Abstract

The objective of this study was to determine ileal crude protein and amino acid digestibility in growing pig using *in vivo* and *in vitro* methods. The *in vivo* ileal digestibility was studied in first experiment using four crossbred barrows (Large White x Landrace x Duroc) with initial average weight of 40 kg BW. The animals were surgically fitted with ileal simple T shape cannula and housed in individual metabolism cage. The experimental diets were 1) broken rice-soybean meal 2) corn-soybean meal 3) cassava starch-soybean meal and 4) cassava starch-sunflower-soybean meals. The experimental work was 4 x 4 latin square design. The *in vitro* ileal digestibility was studied with the same experimental diets as in the first experiment but using intestinal digesta collected from the same experimental animals. The average value of *in vivo* ileal digestibility for protein of all treatments (broken rice-soybean meal and corn-soybean meal, cassava starch-soybean meal and cassava starch-sunflower-soybean meals diets) and all feedstuffs (broken rice, corn, soybean meal and sunflower meal) were lower (p<0.05) than those of the *in vitro* methods. Meanwhile, *in vivo* ileal digestibility of amino acids for all treatments and all feedstuffs were higher (p<0.05) than those of the *in vitro* method. The correlation coefficients of ileal digestibility for lysine and crude protein between *in vivo* and *in vitro* methods were high (r=0.8000, 0.6682, respectively). The regression equations of lysine and crude protein were Y=71.6471+0.1445X and Y=70.4556+0.1296X, respectively. Meanwhile, the correlation coefficient of ileal digestibilitiy for DM and arginine between *in vivo* and *in vitro* methods were the lowest. There was no correlation coefficient of ileal digestibility for threonine, valine and isoleucine between *in vivo* and *in vitro* methods.

Key words: Amino acid, correlation coefficient, crude protein, *in vitro* digestibility, *in vivo* digestibility

Materials and methods

in vivo digestibility

Three crossbred (Duroc x Large White x Landrace) castrated male pigs, with initial average of 40 kg BW, were surgically fitted with ileal simple T shape cannula (Vearasilp and Apichartsarungkoon, 1988., Apichartsarungkoon and Vearasilp, 1989) and housed in individual metabolism cage. The experimental diets were 1) broken rice-soybean meal 2) corn-soybean meal 3) cassava starch-soybean meal 4) cassava starch-sunflower-soybean meal. The experimental work was 4 x 4 latin square design. The experimental pigs were fed twice daily at 06.00 h and 18.00 h. with 800 g of the experimental feeds, 0.5 g TiO_2 and mixed with water at 1:1 (w:v). After 7 days of adaptation period, faeces were totally collected for 3 days followed by totally collection

of ileal digesta for 2 days. The digesta and faeces samples were immediately stored at -20C.

***In Vitro* digestibility**

Three crossbred (Duroc x Large White x Landrace) castrated male pigs, with average 40 kg. liveweight, were surgically fitted with duodenum simple T shape cannula at approximately 50 cm. prior to jejunum and distal to the bile and pancreatic ducts (Furuya *et al*. 1979) and housed in individual metabolism cage. The pigs were fed 500 g daily of the basal diet at 08.30 h. The duodenal digesta were collected between 10.00 and 11.00 h. The procedure for digesta sampling and preparation for analysis was as outlined by Low (1982). The experimental diets were the same as in *in vivo* method.

Results and discussion

Table 1 shows that *in vivo* ileal digestibility of dry matter and crude protein in broken rice were lower (P<0.05) than those of the *in vitro* which was closely related to the results of Graham *et al*. (1989) Meanwhile, *in vivo* ileal digestibility of average amino acids was higher (P<0.05) than that of the *in vitro*. The comparison of *in vivo* and *in vitro* ileal digestibility in corn, soybean meal and sunflower meal are shown in Table 2-4. The *in vivo* ileal digestibility of dry matter, crude protein and average amino acids of the three feedstuffs were higher (P<0.05) than those of *in vitro*.

The correlation coefficients of digestibility in terms of lysine and protein between ileal digestibility from *in vivo* and *in vitro* methods were high (r=0.8000, 0.6682, respectively). The regression equations of lysine and protein were Y=71.6471+0.1445X and Y=70.4556+0.1296X, respectively. Meanwhile, the correlation coefficients of digestibility of DM and arginine between ileal digestibility from *in vivo* and *in vitro* methods were the lowest. There were no correlation of ileal digestibility of threonine, valine and isoleucine between *in vivo* and *in vitro* methods (Table 5).

Table 1. The *in vivo* and *in vitro* ileal digestibility of crude protein and essential amino acids in broken rice (%).

Items	***In Vivo***	***In Vitro***	**SEM**[1/]
Dry matter	71.64[a]	81.06[b]	1.27
Crude protein	78.66[a]	83.78[b]	1.14
Essential amino acids			
Arginine	82.39	76.60	2.63
Isoleucine	73.13[a]	49.59[b]	7.26
Leucine	84.84[a]	60.32[b]	2.02
Lysine	86.85	90.23	2.54
Phenylalanine	78.04[a]	52.73[b]	5.36
Threonine	73.01	56.44	12.50
Valine	81.12[a]	51.34[b]	4.90
Average	**79.91[a]**	**62.46[b]**	**4.56**

[a, b] means in the same row superscripts differ significantly (P<0.05)

[1/] standard error of the mean

Table 2. The *in vivo* and *in vitro* ileal digestibility of crude protein and essential amino acids in corn(%).

Items	***In Vivo***	***In Vitro***	**SEM**[1/]
Dry matter	72.67[a]	55.44[b]	2.84
Crude protein	78.05[a]	66.59[b]	2.35
Essential amino acids			
Arginine	67.69	72.90	8.97
Isoleucine	79.30	56.93	15.54
Leucine	84.95[a]	60.99[b]	6.87
Lysine	81.19	68.60	6.83
Phenylalanine	84.80	53.88	13.84
Threonine	79.24[a]	49.96[b]	2.08
Valine	76.29	50.96	9.34
Average	**79.07[a]**	**59.17[b]**	**4.74**

[a, b] means in the same row superscripts differ significantly (P<0.05)

[1/] standard error of the mean

Table 3. The *in vivo* and *in vitro* ileal digestibility of crude protein and essential amino acids in soybean meal (%).

Items	***In Vivo***	***In Vitro***	**SEM**[1/]
Dry matter	80.82[a]	51.61[b]	1.41
Crude protein	85.76	87.74	2.03
Essential amino acids			
Arginine	91.41	83.93	8.13
Isoleucine	80.82	62.07	7.30
Leucine	86.59[a]	53.21[b]	5.72
Lysine	81.61	87.35	16.77
Phenylalanine	84.33	65.26	11.94
Threonine	75.52	64.85	9.38
Valine	77.52	60.62	6.83
Average	82.54[a]	68.18[b]	4.56

[a, b] means in the same row superscripts differ significantly (P<0.05)

[1/] standard error of the mean

Table 4. The *in vivo* and *in vitro* ileal digestibility of crude protein and essential amino acids in sunflower meal (%).

Items	***In Vivo***	***In Vitro***	**SEM**[1/]
Dry matter	66.94[a]	47.41[b]	6.08
Crude protein	76.36[a]	39.59[b]	3.56
Essential amino acids			
Arginine	88.64[a]	57.80[b]	3.27
Isoleucine	85.14[a]	45.77[b]	3.67
Leucine	82.77[a]	39.39[b]	2.44
Lysine	72.26[a]	33.40[b]	7.18
Phenylalanine	82.23[a]	61.35[b]	5.43
Threonine	83.68[a]	53.58[b]	5.95
Valine	86.36[a]	38.14[b]	2.93
Average	83.01[a]	47.06[b]	3.50

[a, b] means in the same row superscripts differ significantly (P<0.05)

[1/] standard error of the mean

Table 5. Correlation coefficient (r) between the *in vivo* and *in vitro* ileal digestibility.

Items	r	regression equation
Dry matter	0.0435	Y = 72.5026 + 0.0173X
Crude protein	0.6682	Y = 70.4556 + 0.1296X
Essential amino acids		
Arginine	0.2089	Y = 64.5910 + 0.2414X
Isoleucine	-0.3188	Y = 91.1244 – 0.2092X
Leucine	0.3556	Y = 82.6883 + 0.0519X
Lysine	0.800	Y = 71.6471 + 0.1445X
Phenylalanine	0.3188	Y = 63.7870 + 0.2939X
Threonine	-0.0268	Y = 79.3018 – 0.0114X
Valine	-0.0549	Y = 82.8075 – 0.0327X

Y = *in vivo* ileal digestibility,
X = *in vitro* digestibility incubated with duodenal digesta

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