

Protein concentrations in basal diets affect metabolizable energy of feed ingredients determined by difference procedure in pigs

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Introduction

- The difference procedure is widely used to determine energy concentrations in feed ingredients (Kong and Adeola, 2014).
- The assumption of the difference procedure is that there is no interaction between energy values in a test ingredient and a basal diet.
- However, this assumption may be violated if urinary energy excretion is very large due to a high protein concentration in the basal diet, and subsequently, affects metabolizable energy (ME) of a test ingredient.
- The objective was to determine ME of feed ingredients using a low-protein basal diet (LPBD) and a high-protein basal diet (HPBD) based on the difference procedure.

Materials and Methods

- Twelve barrows (73.7 ± 5.5 kg BW) were used.
- A replicated 6 × 3 Latin square with 6 diets (Table 1) and 3 periods and one additional replication was employed (n = 7).

Table 1. Ingredient and analyzed composition of diets¹

Item	LPBD group			HPBD group		
	LPBD	FFSB	SPI	HPBD	FFSB	SPI
Ingredient, %						
Ground corn	97.50	77.50	77.50	77.97	62.02	62.02
Soybean meal	-	-	-	19.64	15.62	15.62
FFSB	-	20.00	-	-	20.00	-
SPI	-	-	20.00	-	-	20.00
Others	2.50	2.50	2.50	2.39	2.36	2.36
Analyzed composition						
GE, kcal/kg	3,705	4,015	3,991	3,800	4,087	4,063
CP, %	7.4	12.8	22.8	14.3	18.9	28.4

¹LPBD = low-protein basal diet; HPBD = high-protein basal diet.

²FFSB = full-fat soybean (37.7% CP); SPI = soy protein isolate (87.6% CP).

- Period = 4-d adaptation + 4-d feces and urine collection
- The marker-to-marker procedure was used.
- PROC MIXED of SAS (SAS Inst. Inc., Cary, NC) was used.
- Orthogonal contrasts were used to determine two main effect and interaction between the main effects.

Results

Table 2. Urinary gross energy (GE) output, digestible energy (DE) and metabolizable energy (ME) in pigs fed experimental diets (as-fed basis; n = 7)

Item	LPBD group			HPBD group			SEM	<i>P</i> -values for contrast ¹		
	LPBD	FFSB	SPI	HPBD	FFSB	SPI		BD	TI	BD × TI
Urinary GE output, kcal/d	74	139	316	105	184	440	6	0.018	< 0.001	0.288
DE in diet, kcal/kg	3,353	3,652	3,676	3,468	3,709	3,736	15	< 0.001	< 0.001	0.052
ME in diet, kcal/kg	3,322 ^d	3,585 ^{ab}	3,537 ^b	3,418 ^c	3,633 ^a	3,537 ^b	22	0.005	< 0.001	0.050
ME/DE ratio	0.991	0.982	0.962	0.986	0.980	0.947	0.004	0.014	< 0.001	0.225

^{a-d}Least squares means within a row without a common superscript differ (*P* < 0.05).

¹BD = LPBD group vs. HPBD group; TI = basal diet vs. FFSB vs. SPI; BD × TI = an interaction between BD and TI.

Table 3. Energy concentrations in test ingredients (as-fed basis; n = 7)

Item	LPBD group		HPBD group		SEM	<i>P</i> -values for contrast		
	FFSB	SPI	FFSB	SPI		BD	TI	BD × TI
DE, kcal/kg	4,947	5,067	4,756	4,876	53	0.004	0.035	0.886
ME, kcal/kg	4,756	4,517	4,565	4,111	84	0.004	0.002	0.270
ME/DE	0.961	0.891	0.960	0.843	0.014	0.099	< 0.001	0.144

Conclusion

- As the protein in the basal diet increases, metabolizable energy in a test ingredient determined using the difference procedure decreases mainly due to greater urinary energy output in pigs.

Reference

- Kong, C., and O. Adeola. 2014. Asian-Australas. J. Anim. Sci. 97: 917-925.