

Nutrient composition and energy concentration in soybean meal from 5 different countries fed to pigs

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Abstract

An experiment was conducted to compare nutritional composition and concentrations of digestible energy (DE) and metabolizable energy (ME) in soybean meal (SBM) from the 5 largest soybean producing countries when fed to pigs. Five sources of SBM from China, Argentina, and the U.S., and 4 sources from Brazil and India were collected. A basal diet based on corn and 23 diets based on corn and each source of SBM were formulated. Twenty-four growing barrows were individually housed in metabolism crates and allotted to a 24 × 7 Youden square design with 24 diets and 7 periods. Apparent total tract digestibility (ATTD) of gross energy (GE) and concentrations of DE and ME in each diet and source of SBM were calculated. Results indicated that the ATTD of GE was greater ($P < 0.05$) in SBM from Argentina and China than in Brazilian and Indian SBM. The DE and ME values (88% dry matter) of Indian SBM were the lowest ($P < 0.05$) among countries, but there were no differences in the ME of SBM among the other 4 countries. Few differences in the DE and ME of SBM among countries were observed, indicating that the conditions that may affect growing conditions of soybeans have limited effect on the energy value of SBM fed to pigs.

Keywords: digestible energy, metabolizable energy, pigs, soybean meal, soybean origin

Introduction

In addition to providing AA, soybean meal (SBM) also contributes to the energy value of the diet. However different factors such as soil, weather, crushing methodology, and length of soybean storage may affect the amount of energy and nutrients that pigs obtain from SBM (García-Rebollar *et al.*, 2016). These variations may result in inaccuracies in feed formulation because variability in concentrations of digestible energy (DE) and metabolizable energy (ME) results in difficulties in predicting the amount of energy in the diets. Therefore, the objective of this work was to compare the DE and ME in SBM from 5 different countries where around 89% of global soybean production takes place.

Materials and methods

Five sources of SBM from Argentina, China, and the U.S., and 4 sources from Brazil and India were included in 23 corn-SBM diets. A basal corn-based diet was used to determine apparent total tract digestibility (ATTD) of gross energy (GE) and concentrations of DE and ME in corn by using the direct method, and the DE and ME in each source of SBM were then calculated by difference. Twenty-four barrows of 25.0 ± 1.7 kg body weight were individually housed in metabolism crates and allotted to a 24 × 7 Youden square design with 24 diets and 7 periods of 14 d. The initial 7 d of each period was considered the adaptation period to the diet, whereas fecal and urine samples were collected from feed provided from d 8 to 13.

Results and discussion

Soybean meal from Brazil had a greater ($P < 0.05$) concentration of crude protein than SBM from the U.S., Argentina, and China, which concurs with previous data (Goerke *et al.*, 2012; Table 1). There is a negative correlation between the concentration of DE and the concentrations of ADF and NDF,

as well as a positive correlation between DE and ME (Li *et al.*, 2015). Therefore, the fact that Indian SBM had the lowest ($P<0.05$) values for DE and ME among countries may be due to its greater ($P<0.05$) ADF and NDF concentrations compared with SBM from other countries. The reason for the high concentrations of fiber in SBM from India may be the addition of hulls back to the meal. The greater ($P<0.05$) concentration of trypsin inhibitor units in SBM from India than in SBM from the other countries may also have contributed to the low DE and ME in Indian SBM. Although there were no differences in the ATTD of GE between SBM from Argentina and SBM from China, the DE in Argentinian SBM was greater ($P<0.05$) than in Chinese SBM. This is because of the numerically greater GE in SBM from Argentina than in SBM from China. The ATTD of GE in SBM from Brazil was lower ($P<0.05$) than in SBM from China and the U.S., but no differences in DE values among the 3 countries were observed. Likewise, there were no differences in the ME among SBM from Argentina, Brazil, China, or the U.S. This observation indicates that the conditions that affect the chemical composition of soybeans appear to have limited impact on the energy value of SBM.

Table 1. Chemical composition, apparent total tract digestibility (ATTD) of gross energy (GE) and concentrations of digestible energy (DE) and metabolizable energy (ME) in soybean meal (SBM) from 5 different countries.^{1,2}

Item	Origin of SBM					SEM	P-value
	Argentina	Brazil	China	India	USA		
n	5	4	5	4	5	22.4	0.069
GE, kcal/kg	4,715 ^{ab}	4,778 ^a	4,688 ^b	4,705 ^b	4,685 ^b	0.63	<0.001
Crude protein, %	53.08 ^b	55.77 ^a	51.22 ^c	56.26 ^a	53.76 ^b	0.61	0.007
ADF, %	4.19 ^b	5.88 ^{ab}	6.36 ^a	7.28 ^a	4.19 ^b	0.95	0.098
NDF, %	8.16 ^b	9.88 ^{ab}	10.74 ^{ab}	11.32 ^a	8.23 ^b	0.40	0.006
TIU, mg/kg	2.26 ^c	4.08 ^{ab}	3.32 ^{bc}	4.66 ^a	3.06 ^{bc}		
n	35	28	35	28	35	2.59	0.024
ATTD GE, %	86.66 ^a	83.34 ^c	86.51 ^a	83.45 ^{bc}	86.03 ^{ab}	126	0.001
DE, kcal/kg	4,178 ^a	4,079 ^{ab}	4,018 ^b	3,867 ^c	4,098 ^{ab}	137	0.003
ME, kcal/kg	3,938 ^a	3,895 ^a	3,798 ^a	3,622 ^b	3,837 ^a		

¹ Values for chemical composition, DE, and ME were adjusted to 88% dry matter.

² ADF = acid detergent fiber; NDF = neutral detergent fiber; TIU = trypsin inhibitor units.

References

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