

## Effects of heat treatment on digestibility of amino acids and concentration of metabolizable energy in soybean meal fed to pigs

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### Introduction

Heating improves the nutritional value of soybeans and soybean meal (SBM) because it denatures the native protein structure and destroys trypsin inhibitors and other antinutritional factors that may be present in raw soybeans. However, applying high temperature and moisture during production may reduce amino acid (AA) digestibility because of Maillard reactions that form sugar-AA complexes (González-Vega et al., 2011), but there is limited information about how temperature and duration of heating influences energy utilization in pigs. Therefore, 2 experiments were conducted to test the hypothesis that both the degree of heating and the time heat is applied will affect standardized ileal digestibility (SID) of AA, apparent total tract digestibility (ATTD) of gross energy (GE), and concentration of digestible energy (DE) and metabolizable energy (ME) in SBM fed to growing pigs.

### Materials and Methods

One source of SBM was divided in 9 batches and used in 2 experiments. The first batch was not autoclaved and considered the control. Two batches were autoclaved at 110°C for 15 or 30 min and 6 batches were autoclaved at 150°C for 3, 6, 9, 12, 15, or 18 min. In Exp. 1, nine cornstarch-based diets included 40% of each of the 9 sources of SBM. An N-free diet was also used. Ten growing barrows (36.8 kg) with a T-cannula installed in the distal ileum were allotted to a 10 × 7 Youden square design with 10 diets and 7 periods. Ileal digesta were collected on d 6 and 7 of each 7-d period. In Exp. 2, a corn-based diet and 9 diets based on corn and each source of SBM were fed to 20 barrows (43.6 kg) that were used in a replicated 10 × 4 Youden square. Urine and fecal samples were collected for 5 d after 7 d of adaptation.

### Results and Discussion

Results from Exp. 1 and 2 indicated that the SID of crude protein (CP) and all AA, the ATTD of GE, and the DE and ME were less ( $P < 0.001$ ) if SBM was autoclaved at 150°C than at 110 °C (Table 1). When samples were autoclaved at 110°C, the SID of CP and AA, ATTD of GE, and DE and ME were not affected by increasing duration of autoclaving, but there were linear reductions ( $P < 0.001$ ) in SID of all AA, the ATTD of GE, and in the DE and ME if duration of autoclaving was increased at 150°C. These observations demonstrate that over-heating of SBM not only results in reduced SID of AA, but ATTD of GE will also be impaired with a subsequent reduction in concentrations of DE and ME.

**Table 1.** Standardized ileal digestibility of CP and AA, ATTD of GE, and concentrations of DE and ME in SBM that was either not autoclaved or autoclaved at 110°C or 150°C (as-fed basis).

Item, %	Autoclaving temperature									Contrast <i>P</i> -value				
	Ctrl	110°C			150°C			SEM	110°C vs. 150°C	150°C				
		Duration (min)			Duration (min)					Linear	Linear	Quadratic		
	15	30	3	6	9	12	15	18						
Exp. 1.														
SID of CP	93.0	92.0	92.4	84.0	80.3	83.0	80.1	78.2	70.9	1.7	<0.001	0.731	<0.001	0.594
SID of Lys	94.8	94.1	93.3	84.2	80.7	80.1	75.9	74.9	62.6	1.9	<0.001	0.431	<0.001	0.831
Exp. 2.														
ATTD of GE	86.4	85.5	86.9	80.8	80.2	76.0	71.2	63.4	64.2	3.0	<0.001	0.828	<0.001	0.765
DE, MJ/kg	16.7	16.7	16.9	15.8	15.7	14.9	14.0	12.5	12.8	0.6	<0.001	0.693	<0.001	0.571
ME, MJ/kg	15.4	15.5	15.5	14.4	14.1	13.4	12.0	10.7	10.7	0.7	<0.001	0.811	<0.001	0.698

Ctrl = control SBM that was not autoclaved.

### References

González-Vega, J.C., Kim, B.G., Htoo, J.K., Lemme, A. & Stein, H.H. (2011). Amino acid digestibility in heated soybean meal fed to growing pigs. *J. Anim. Sci.* 89: 3617-3625.