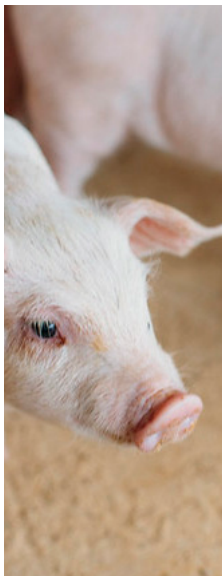


U.S. SOYBEAN MEAL'S AMINO ACID PROFILE BEST PROMOTES DIGESTIBILITY FOR POULTRY AND SWINE

- To know the true value of soybean meal, its amino acid profile and the digestibility of those amino acids must be considered
- Soybean meal digestibility impacts formulation costs of poultry and swine diets
- **U.S. soybean meal has better digestibility characteristics for poultry and swine compared to Argentina and Brazil**

It is well known that soybean meal is a major component of poultry and swine diets. The quantity and value of soybean meal in the diet are determined by its amino acid (AA) profile and the digestibility of those amino acids. **The quality and consistency, not the total amount, of amino acids supplied by dietary protein in soybeans and its resulting soybean meal represents what is available to monogastric animals for the key components of digestibility -- tissue synthesis and other metabolic processes.** Therefore, it is critical that the value of soybean meal protein is based on the capability by the animal to digest amino acids.

When comparing U.S. soybeans and resulting soybean meal to those of other origins, there are differences in AA profiles and how digestibility is impacted by the initial quality of the bean. **The most accurate measurement of amino acid (AA) digestibility for poultry and swine is the Standardized Ileal Digestibility (SID). SID is measured by the difference of amino acids ingested with the feed and the amino acids recovered from the digesta in the ileum¹, adjusted by the basal endogenous amino acid losses.** It can be represented as a relative (%) or an absolute measure.



¹ Measuring the ileum (the final section of the small intestine) AA content is more accurate than other methods such as total tract digestibility (difference between the amount of amino acids ingested and the amount of amino acids recovered from the feces), due to fermentation that occurs in the hindgut that can overestimate digestibility. The process utilizes markers in the feed that enable measuring the amount of AA in the recovered ileum digesta. The adjustment by the basal endogenous amino acid losses accounts for the fact that protein is synthesized for metabolic functions by the animal, such as enzymes and sloughed cells, and may not be absorbed at the end of the small intestine and are lost.

To start, **the quality of the soybean being crushed is extremely important**. As soybeans are crushed into soybean meal, the digestibility of amino acids varies depending on genetics, moisture, storage conditions, the amount of anti-nutritional factors and soybean processing methods utilized, especially heat treatment. Although **heat treatment is necessary in some regions to reduce anti-nutritional factors, improper heat application of soybean meal may reduce amino acid digestibility**.

The digestibility of amino acids is also impacted by the origin of the soybean². The table below compares the digestibility coefficients and the digestible content of the five essential amino acids (Cysteine, Lysine, Methionine, Threonine and Tryptophan) between the U.S., Argentina, and Brazil for swine³ and poultry⁴.

Mean SID Digestibility of 5 EAA (%)							Mean Content of SID of 5 EAA (%)						
	AA	USA	ARG	BRA	USA/ ARG (%)	USA/ BRA (%)		AA	USA	ARG	BRA	USA/ ARG (%)	USA/ BRA (%)
Swine	Cysteine	86.2	81.5	81.6	5.45%	5.34%	Swine	Cysteine	0.54	0.49	0.51	9.26%	5.56%
	Lysine	92.9	90.0	90.6	3.12%	2.48%		Lysine	2.84	2.67	2.76	5.99%	2.82%
	Methionine	94.7	93.5	93.6	1.27%	1.16%		Methionine	0.62	0.59	0.60	4.84%	3.23%
	Threonine	90.8	88.5	88.4	2.53%	2.64%		Threonine	1.62	1.57	1.59	3.09%	1.85%
	Tryptophan	94.3	93.0	92.6	1.38%	1.80%		Tryptophan	0.66	0.64	0.64	3.03%	3.03%
	5 EAA	91.9	89.6	89.7	2.53%	2.44%		5 EAA	6.28	5.96	6.10	5.10%	2.87%
Poultry	Cysteine	72.0	64.8	67.1	10.02%	6.78%	Poultry	Cysteine	0.54	0.46	0.49	14.81%	9.26%
	Lysine	87.5	85.9	85.7	1.81%	2.10%		Lysine	2.52	2.44	2.39	3.17%	5.16%
	Methionine	87.5	86.8	87.0	0.84%	0.62%		Methionine	0.63	0.59	0.60	6.35%	4.76%
	Threonine	81.2	79.2	79.0	2.40%	2.65%		Threonine	1.51	1.45	1.47	3.97%	2.65%
	Tryptophan*	90.9	90.9	90.9	0.00%	0.00%		Tryptophan*	0.61	0.61	0.61	0.00%	0.00%
	5 EAA	84.4	83.2	82.5	1.47%	2.32%		5 EAA	5.81	5.55	5.56	4.48%	4.30%

Note: SID Digestibility of 5 EAA was implied based on the SID and total content.
*Tryptophan was referenced from Rostagno et al., 2017

The U.S. has an advantage over Argentina and Brazil in both the content of SID amino acids and the SID digestibility of each amino acid listed above.

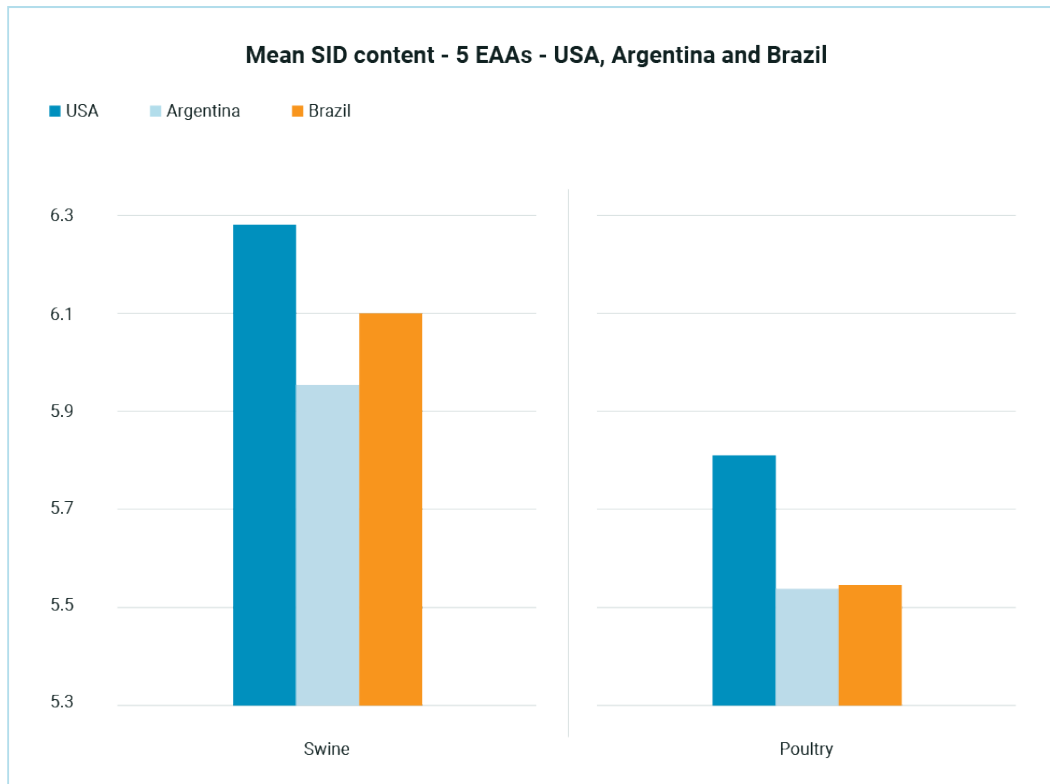
² Lagos, L. V., & Stein, H. H. (n.d.). Chemical composition and amino acid digestibility of soybean meal produced in the United States, China, Argentina, Brazil, or India. *Journal of Animal Science*, 2017, 95(4), 1626–1636; Ravindran, V. (1), Abdollahi, M. R. (1), & Bootwalla, S. M. (2,3). (n.d.). Nutrient analysis, metabolizable energy, and digestible amino acids of soybean meals of different origins for broilers. *Poultry Science*, 2014, 93(10), 2567–2577, 2014; García-Rebollar, P., Cámara, L., Lázaro, R.P., Dapoz, C., Pérez-Maldonado, R., Mateos, G.G., 2016. Influence of the origin of the beans on the chemical composition and nutritive value of commercial soybean meals. *Anim. Feed Sci. Technol.* 221, 245–261.

³ Lagos, L. V., & Stein, H. H. (n.d.). Chemical composition and amino acid digestibility of soybean meal produced in the United States, China, Argentina, Brazil, or India. *Journal of Animal Science*, 2017, 95(4), 1626–1636

⁴ Ravindran, V. (1), Abdollahi, M. R. (1), & Bootwalla, S. M. (2,3). (n.d.). Nutrient analysis, metabolizable energy, and digestible amino acids of soybean meals of different origins for broilers. *Poultry Science*, 2014, 93(10), 2567–2577, 2014. Rostagno, H. S.; Albino, L. F. T.; Hannas, M. I.; Donzele, J. L.; Sakomura, N. K.; Perazzo, F. G.; Saraiva, A.; Teixeira, M. V.; Rodrigues, P. B.; Oliveira, R. F.; Barreto, S. L. T. and Brito, C. O. 2017. Brazilian tables for poultry and swine: Composition of feedstuff and nutritional requirements. 4th ed. Departamento de Zootecnia, Universidade Federal de Viçosa, Viçosa, MG.

⁵ No digestibility data exist for the U.S., Argentina and Brazil for Tryptophan in poultry; thus, the same coefficient was considered based on Rostagno et al., 2017.

The following chart illustrates the benefit the U.S. has over Argentina and Brazil for the five essential amino acids listed in the table above.



	AA	USA	ARG	BRA
Swine	5 EAA	6.28	5.96	6.10
Poultry	5 EAA	5.81	5.55	5.56

It is critical to include these digestibility measures when comparing soybean meal from different origins. **Failing to consider the digestibility can misrepresent the actual value of the soybean meal and lead to increased costs and over or under supplying nutrients when formulating diets.**

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