Fast protein improves animal production efficiency
– why speed matters

Benefits of increasing dietary fast protein

- Improved protein utilization during critical periods
- Rapid and synchronized absorption of dietary amino acids
- Reduced nitrogen excretion into the environment
- Solid return on investment by improved productivity



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What are digestive dynamics and *protein kinetics?*

With digestive dynamics we refer to how fast and where in the digestive tract nutrients are digested and absorbed, whereas protein kinetics focus on the digestive kinetics of the amino acid (AA) fraction of the feed.

Both the speed and the location of absorption influence the subsequent availability of AAs and are more indicative of feed efficiency and protein deposition than the ileal digestibility of the protein ingredient. The digestibility only considers how much protein is left at the end of the small intestine but does not indicate how fast and where the protein was digested and absorbed. Two protein sources can have the same ileal digestibility but may differ largely in the speed and site of digestion and absorption. Consider, for instance, the differences between blood meal and soybean meal (SBM) shown in Table 1. When fed to broilers, both ingredients have an apparent ileal digestibility of around 76%, but blood meal shows higher protein digestibility in the proximal jejunum than SBM. This means that the initial protein digestion rate of blood meal is almost twice that of SBM.

Table 1. Apparent protein digestibility and protein digestion rate of blood meal and soybean meal in the small intestine of 27-day-old broilers[1].

Ingredients	Apparent protein digestibility (%)				Protein digestion rate (min^{-1})
	Proximal jejunum	Distal jejunum	Proximal ileum	Distal ileum	
Blood meal	56.8	51.6	71.7	76.1	0.124[a]
Soybean meal	46.0	56.4	76.2	76.5	0.066[b]

[1]Adapted from Toghyani et al. 2020

Three functional protein fractions

From an animal nutrition perspective, protein can be divided into three functional fractions based on their rate and site of digestion:

Fast protein: Refers to peptides and soluble or easily hydrolyzed proteins. Rapid protein hydrolysis promotes an early release of peptides (or directly supplies di- and tripeptides), which promotes a greater uptake. Most fast proteins are absorbed in the proximal jejunum. Synthetic AAs are also considered fast proteins because they are absorbed quickly and require no hydrolysis.

Slow protein: Consists of proteins that require more extensive enzymatic hydrolysis before absorption. Depending on species, digestive capacity, and feed intake patterns, these proteins may contribute to a more sustained AA supply, but they may also be utilized less efficiently than rapidly digestible proteins. Slow proteins are typically absorbed further down the gastrointestinal tract.

Resistant protein: Represents the fraction that escapes enzymatic digestion and is calculated as the difference between total protein and digestible protein. This protein fraction contributes little to animal nutrition and is substrate for fermentation. This fraction can thereby promote the production of toxic metabolites and proliferation of pathogenic bacteria, which ultimately increases nitrogen excretion to the environment.

Table 2. Estimated protein fractions and fast-protein to resistant-protein ratios of common protein-rich feed ingredients

Protein Fractions (g/100g, as fed)	SBM[1]	HP 300	Extruded SBM	Fermented SBM	Fish meal	Porcine plasma[2]
Crude protein[3]	46.9	56.0	52.0	50.0	56.0	78.0
Digestible protein[3,4]	40.8	52.1	46.0	41.0	48.7	70.2
Fast protein	29.4	43.2	34.0	27.5	30.7	56.2
Slow protein	11.4	8.9	12.0	13.5	18.0	14.0
Resistant protein	6.1	3.9	6.0	9.0	7.3	7.8
FP:RP[5]	4.8	11.1	5.7	3.0	4.2	7.2

[1]SBM = soybean meal [2]Adapted from FEDNA, 2019 [3]Adapted from CVB, 2023
[4]Digestibility values correspond to standardized ileal digestibility (SID) for pigs [5]Fast-protein to resistant-protein ratio

Why does protein digestion speed *matter*?

The digestion speed is important because the faster a protein is hydrolyzed the quicker it will be utilized. We know now that fast absorbable protein ingredients improve nitrogen retention and feed efficiency of the animals.

The rate of protein hydrolysis, the consequent rate of AA absorption and the synchronization with AAs from other protein sources are especially important in young animals, due to their high AA requirements for the synthesis of muscle tissue and vital organs. These factors are likewise critical during other physiologically demanding periods, such as lactation, during health challenges, or phases with elevated metabolic load, where efficient and well timed AA supply becomes essential for maintaining production and recovery.

How does protein kinetics improve growth performance?

Faster protein digestion leads to faster absorption of AAs, increasing their availability for growth and productivity. Since more protein is deposited in tissues, the total nitrogen excretion is reduced (Zhang et al., 2022).

Why should I consider kinetics when formulating diets?

In feed formulation, we use digestibility and energy content as fixed values of feed ingredients to optimize our diets. While this approach is practical, it has limitations, as it overlooks differences in the digestion kinetics of individual ingredients and does not account for nutrient interactions during digestion and metabolism.

Synthetic AAs are largely absorbed in the proximal jejunum, while fast protein sources are rapidly hydrolyzed, providing a complementary supply of peptides and AAs for efficient tissue protein deposition. This more synchronized nutrient supply may reduce protein catabolism and the amount of undigested protein reaching the distal ileum, thereby supporting gut health and animal performance.

Kinetics are especially important when formulating diets with low protein content and/or synthetic AAs.

PROTEIN KINETICS
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How do I choose *a fast protein source* for diet formulations?

Protein kinetics can be simulated *in vitro*. Research has revealed that Hamlet Protein products have the fastest kinetics among all tested soy protein products (see Figure 1).

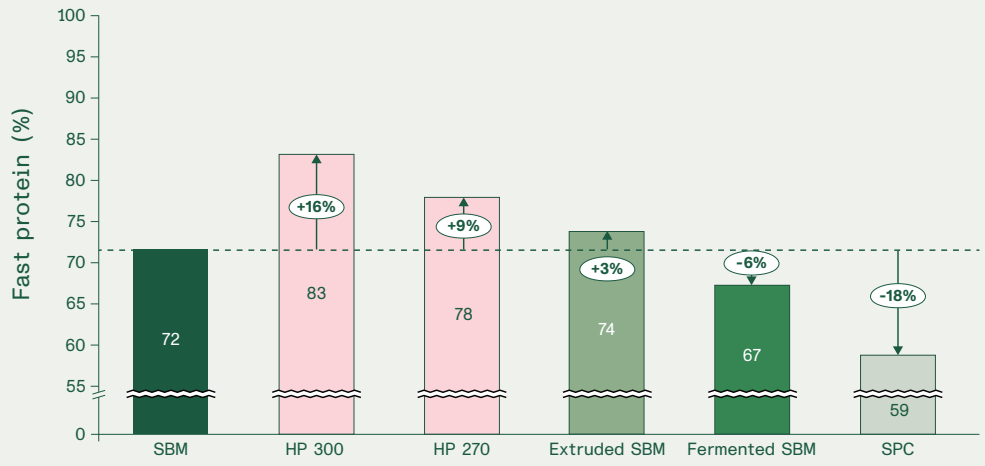

Figure 1 Speed of protein degradation of different soy protein products. Fast protein (%) is defined as the protein fraction which has been hydrolyzed within 30 minutes. Values shown in circles indicate the percentage difference compared with SBM. Results obtained from PH-stat analysis, for procedure and description see Bible et al., 2023. SBM = soybean meal, SPC = soy protein concentrate.

Enhanced protein accessibility - from processing to digestion

Hamlet Protein's unique enzymatic treatment does more than reduce anti-nutritional factors (ANFs). It also pre-digests the protein, generating more small peptides and making the protein structure more accessible.

Once ingested, this increased accessibility allows proteolytic enzymes in the gastrointestinal tract to access and hydrolyze the protein more efficiently.

As a result, Hamlet Protein's products are hydrolyzed faster than conventional SBM and other soy protein products.

This enhanced protein accessibility is driven by a combination of more small peptides, high protein solubility, increased water-holding capacity, and low levels of ANFs.

References

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