



PROTEIN KINETICS
BY HAMLET PROTEIN

The use of fast protein improves production efficiency – *why speed matters*

Benefits of fast protein kinetics:

- Rapid and synchronized absorption of dietary amino acids
- Improved utilization of dietary amino acids
- Reduced nitrogen excretion into the environment
- Better indicator of feed efficiency than digestibility



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What is *protein kinetics*?

With protein kinetics we refer to how fast and where in the digestive tract protein is digested and absorbed. Both the speed and the location of absorption influence the subsequent availability of amino acids and are more indicative of feed efficiency and protein deposition than the digestibility coefficient of the protein ingredient.

The digestibility coefficient 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 similar digestibility but may differ largely in the

speed -and site of digestion and absorption. Consider for instance blood meal and SBM HP (Table 1) which both have a digestibility coefficient at the end of the small intestine (after which no protein absorption occurs anymore) of around 0.76. For blood meal, however, a lot more protein is hydrolyzed already in the first part of the small intestine while for SBM HP more is hydrolyzed in more distal parts of the small intestine. This means that the digestion speed of protein from blood meal is higher than that from SBM HP.

*Table 1. Apparent digestibility coefficients and protein digestion rate of blood meal and SBM HP**

Ingredients	Apparent digestibility coefficients				Protein digestion rate (min ⁻¹)
	Proximal jejunum	Distal jejunum	Proximal ileum	Distal ileum	
Blood meal	0.568 ^a	0.516 ^b	0.717 ^{bcd}	0.761 ^{bcd}	0.124 ^a
SBM HP	0.460 ^a	0.564 ^{ab}	0.762 ^{abcd}	0.765 ^{bcd}	0.066 ^b

* adapted from Toghyani et al., 2020

Why does protein digestion speed *matter*?

The digestion speed is important because the faster a protein is hydrolyzed the more of the protein is going to be used. We know now that fast absorbable protein ingredients improve nitrogen (N) retention and feed efficiency of the animals. The rate of protein hydrolysis, the consequent rate of amino acid (AA) absorption and the synchronization with AA 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.

How does protein kinetics improve growth performance?

Faster protein digestion leads to a faster absorption of amino acids after feeding, which increases the protein availability for tissues, milk and organs. The resulting rapid and synchronized absorption of amino acids increases protein deposition and thus reduces feed conversion rate. Since more amino acids are deposited in tissues the total nitrogen excretion (urinary+fecal) is reduced (in pigs 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. This is quite practical but limited as it ignores the variation in kinetics of different ingredients and does not account for interactions happening between ingredients before and after absorption.

The faster the protein source, the more readily available it becomes for the animal, but there needs to be synchronization in AA absorption as otherwise some of the amino acids will be excreted if not all amino acids are absorbed at the same time. So, kinetics is especially important when formulating diets with low protein content and synthetic amino acids.



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-based protein sources (see figure 1).

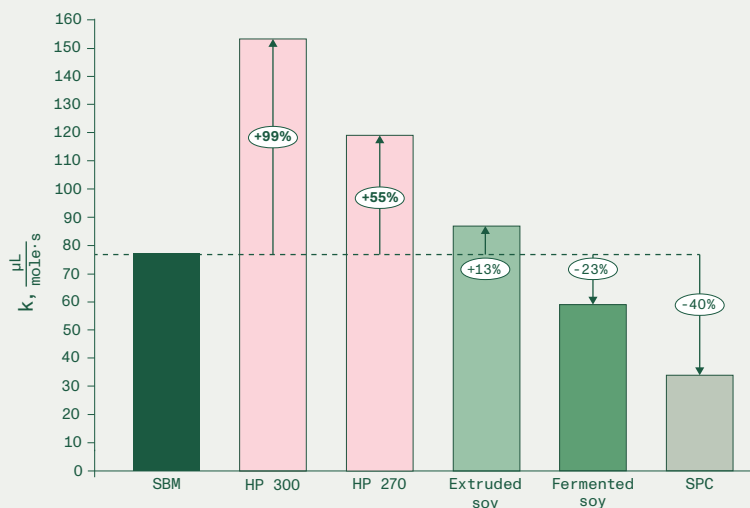


Figure 1 Speed of protein degradation for various soy proteins

Speed of protein degradation for various soy proteins as measured by the hydrolysis constant k [$\mu\text{L}/(\text{mole} \cdot \text{s})$; μL =microliter NaOH needed to keep pH at 8 during hydrolysis (acid is released) and s =seconds]. 6 different soy-based protein ingredients were incubated with proteolytic enzymes for 120 minutes (SBM=soybean meal; SPC=soy protein concentrate). Values in bubbles indicate the percentage difference to SBM. The higher the k -value, the faster the hydrolysis and thus absorption.

Hamlet protein offers the fastest vegetable protein

The unique production process of Hamlet Protein using enzymatic treatment does not only effectively reduce the

content of anti-nutritional factors but also may modify the protein in such a way that it becomes easier accessible for proteolytic enzymes, resulting in a very fast protein source. Protein from Hamlet Protein hydrolyzes faster than SBM and a lot faster than protein from SPC's.¹

References

1) Bible et al., 2023; Toghyani et al., 2020; Zhang et al., 2022



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