



Highly Digestible Protein Feed Ingredients for Piglets

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Postweaning growth and weaning stress

Postweaning growth depression may last for 1 to 3 weeks and is associated with weaning stress that reduces feed intake and increases intestinal inflammation, intestinal damage, and gut leakage [1]. Most pigs are weaned between 18 to 28 days of age, while their intestinal digestive and immune systems are not fully developed, and it may take pigs 5 to 10 days after weaning to achieve the same dry matter intake they were consuming while nursing the sow. It is critical from both an animal welfare and production economics view, that pigs are fed highly digestible and palatable feed to help pigs recover from weaning stress, quickly get started eating feed, and minimize intestinal inflammation and gut leakage. The consequences of a slow start on feed right after weaning can have short-term and long-term detrimental effects on pig growth performance and health to market weight [2,3].

Highly digestible protein sources

Traditional protein sources like soybean meal, canola meal, cereal grain co-products, rendered meat animal and poultry co-products are used in limited amounts in pre-starter feed because they can contain anti-nutritional factors or have been subjected to thermal processes that reduce their digestibility. Pre-starter diets for weaned pigs should contain highly digestible protein ingredients to reduce the amount of undigested protein entering the hindgut. Protein that is fermented in the hindgut can favor dominance of pathogenic microbes, leading to poor animal health.

Specialty protein sources such as hydrolyzed or fermented soy protein concentrates, soy isolates, spray dried plasma, colostrum, milk, and egg products are highly digestible, contain less antinutritional factors, and may contain functional proteins that can support better immunity and health. Spray dried animal proteins, like plasma or blood cells, are considerably more digestible than traditional rendered blood or meat and bone meal products [4]. In a recent review of 135



publications, weaned pigs fed diets with spray dried plasma consistently had increased growth and feed intake compared to pigs fed diets containing other protein sources [5]. Spray dried plasma contains a diverse mixture of functional proteins, including immunoglobulins, transferrin, growth factors, etc., that help support an efficient immune system response to stress and pathogens commonly associated with weaning [6].

Precision nutrition

The goals for precision nutrition are to avoid over or under supplying nutrients relative to daily requirements and involves synchronizing the dietary supply of energy and protein to improve protein retention and overall protein utilization efficiency in pigs [7]. A better understanding of protein digestion and kinetics are needed for the nutritionist to synchronize both energy and protein rate of digestion and uptake of amino acids into circulation to optimize protein utilization efficiency and minimize nitrogen excretion [8]. Accurate determination of the true nutritional value, including detrimental and functional components, and the physiological response to various feed ingredients used in diets for various stages of production is critical to provide precision nutrition to maximize feed efficiency and reduce nutrient waste [9].

Methods for determining digestibility

Standardized ileal digestibility (SID) of protein and amino acids is the most common method to measure the digestibility of various feed ingredients for formulation purposes because these SID values for ingredients can be additive in a complete mixed feed formulation and closely estimate the SID of the complete diet in most cases [10]. Determination of SID involves detailed and tedious measures including surgical cannulation of the ileum and is expensive. Although a lot of hard work and progress has been made to establish SID digestibility coefficients of amino acids for commonly used feed ingredients, there are many other ingredients that have limited or no information available for formulation purposes. In such cases, the nutritionist may use proximate analysis of an ingredient and in vitro methods to estimate SID coefficients, but these predictions may or may not be very accurate for determining the true nutritional value of the ingredient [11]. Also, most SID values for protein and amino acids reported for common grain and protein sources were done using growing pigs instead of nursery aged pigs and thus may overestimate the digestibility of an ingredient or that of a complete diet by a nursery pig. Digestibility of soybean meal was significantly lower for a 10-day versus 21-day of age broiler chicken [12].

Impact of spray dried plasma on SID protein and amino acid digestibility of various diet mixtures

A recent digestibility study [13] at the University of Illinois reported results of the SID protein and amino acid digestibility by 9.3 kg BW pigs fed diets representing various global regions with different grain combinations (corn, wheat, barley, rice) and protein sources (soy protein concentrate, soybean meal, hydrolyzed soy protein or fermented soy protein, and fish meal) without or with spray dried plasma. Results revealed that spray dried plasma increased the measured SID lysine of all regional diets, whereas there was a regional diet by spray dried plasma interaction for the measured SID protein and most of the other individual amino acids. In the regional diet consisting of wheat, barley, soybean meal and fermented soy protein, the measured SID protein (83.5%) of this diet was significantly higher than the predicted SID protein (72.2%) and there was a similar pattern for the measured vs predicted SID for the various individual amino acids. Therefore, the measured SID protein and amino acids in this regional diet were not additive and suggests that spray dried plasma promoted better gut health thereby improving protein and amino acid digestibility of the diet. The results for determining the impact of SDPP on dietary energy, calcium and phosphorous digestibility of these same regional diets are forthcoming. Once these results are completed, then the true nutritional value of spray dried plasma on nutrient digestibility in such diets can be more accurately estimated to aid in precision nutrition formulations.

Conclusions

Highly digestible feed is important to help overcome weaning stress and has both short-term and long-term benefits. An accurate determination of SID AA values for ingredients and diets per stage of pig production can improve precision nutrition formulations leading to more efficient production. A better understanding of the detrimental and functional components in feed ingredients and how they impact the true nutritional value and physiological response is important to improve feed efficiency and reduce nutrient waste.

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