



Nutrient Spotlight – Understanding Protein

Leading with Technical Expertise - White Paper

Leah Lambrakis & Jarrod Kersey, Department of Technical Services

Essential & Extraordinary

Protein is not only an essential macronutrient but is quite extraordinary in its purpose in keeping all living beings strong and healthy. It is considered one of the most important nutrients in our pet's diet! The body uses proteins for repairing, building and maintaining tissues, organs and cells^[1]. They play a vital role in growth, they defend the body against disease, and are a major component of tendons, ligaments, and cartilage as well as hair, skin and nails. Additionally, proteins function as enzymes and hormones, and are involved in transporting oxygen and iron in the blood^[1]. Now do you see why we call proteins extraordinary?

Unpacking this nutrient a little further, proteins are large molecules that are comprised of smaller components called **amino acids**. After proteins are consumed, they are broken down by the digestive system and here is when amino acids go into action! Often called "*the building blocks of protein*," amino acids are powerful and function well independently and in combination with other amino acids and nutrients. Our pets require 12 "non-essential" amino acids, which they are able to synthesize on their own^[3,4]. Another 10 amino acids are considered "essential" or indispensable, and therefore must be supplied by the diet^[3,4]. Cats are a little more special as there is one more essential amino acid that they require, called taurine. While found in meats, poultry and fish, the importance of taurine means that it is almost always included as an added supplement in commercial cat foods. In some cases, research has found that taurine may be essential for dogs, depending on breed, genetics and possible pre-disposed health conditions^[5,6].

Figure 1 – Essential Amino Acids for Dogs and Cats

- ✿ Arginine
- ✿ Histidine
- ✿ Isoleucine
- ✿ Leucine
- ✿ Lysine
- ✿ Methionine
- ✿ Phenylalanine
- ✿ Tryptophan
- ✿ Threonine
- ✿ Valine
- ✿ Taurine*

*essential for cats, may be essential for some dogs

Protein Sources

Not all proteins are created equal, and we must consider amino acid content, biological value and digestibility when we think about protein quality and how useful they are to the animal. The quality, or biological value (BV) of



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Proteins are measured by how efficiently a protein source is converted into essential amino acids that can be used by the body^[1]. An example of high-quality protein with a BV of 100% is egg – a superfood! Eggs are often the benchmark for how other protein sources are measured^[4,2]. The protein-digestibility-corrected amino acid score (PDCAAS) is another method in human and animal nutrition that evaluates the food’s amino acid score compared to its digestibility^[2]. Other factors such as sources and processing are also important when evaluating protein quality and functionality.

Proteins used in pet food are generally animal sourced, plant sourced or a combined approach of the two. Animal-sourced proteins typically have higher and more balanced levels of essential amino acids compared to plant proteins, with plant proteins often being limiting in methionine and lysine^[3,4, 7]. A limiting amino acid means that an individual protein source contains a low level of one or multiple amino acids, thereby being “limiting” in delivering a complete and balanced profile.

Having an awareness and understanding of the amino acid content of protein sources allows pet food scientists to combine and complement different ingredients to achieve the most optimal balance^[3]. The concept of balancing amino acids is well described by the Liebig’s stave and barrel illustration below, with the shortest stave representing the limiting factor^[7,8]. Known as **Liebig’s Law of the Minimum** (originally in reference to plant and soil science), if one essential nutrient is deficient, growth will be impacted even when all other nutrients are abundant^[8]. Thereby complementing nutrients from multiple sources allows for an improved balance.



Figure 2 – Liebig Barrel – As described by Dodd et al, 2018, this is a schematic depiction of complementary proteins by use of the Liebig barrel to demonstrate fulfillment of amino acid requirements. The barrel on the left depicts an incomplete protein profile, whereas the barrel on the right indicates the use of complementary proteins to form a complete AA profile. Arg = Arginine. His = Histidine. Ile = Isoleucine. Leu = Leucine. Lys = Lysine. Met = Methionine. Phe = Phenylalanine. Thr = Threonine. Trp = Tryptophan. Val = Valine.



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Often a single protein source that would be typically used in pet foods, such as ground or mechanically separated meats, organs or dried meat formats, may not independently provide an optimal balance of amino acids and nutrients. Carefully combining complimenting ingredients not only allows for an optimal balance, but also provides **nutritional diversity** to the animal. These combinations can be across animal sources, or can effectively include plant sources as well.

Are Novel Proteins Better?

We have certainly seen a shift in the protein options available for our pets across the plethora of food products available in the market. Legacy pet food typically focused on mainstream sources such as chicken, turkey, pork, beef and fish, with lamb once being considered the novel and unique protein for animals with sensitivities. Today, we see a broad range of animal and aquatic sources, such as duck, bison, quail, venison, kangaroo, alligator, lobster and several sources of fish, just to name a few! Are these better sources of protein? Not necessarily better, nor can these be used interchangeably during formula development, as each protein delivers its own unique profile of amino acids. For this reason, it is important to have several laboratory analyses of each protein's amino acid profile when considering novel sources. Remember, proteins are the vehicle to deliver these powerful nutrients to the body.

Let's not forget the bugs! Insect nutrition has become an emerging market in both human and animal foods, and we have seen continued interest in identifying new and innovative ways to feed our pets. The Association of American Feed Control Officials (AAFCO) has approved the use of Black Soldier Fly Larvae as a protein source for complete and balanced adult dog foods^[9], with additional efforts underway in industry to expand these approvals across life stages and species. Similarly, we are seeing alternative protein sources in the innovation funnel for pet foods such as algae, single-cell proteins such as yeast-based cultures, and lab-grown solutions^[10,11]. Extensive and time-consuming research is required to validate that these alternative proteins are safe and provide long-term feeding solutions for our pets to grow and thrive. This is expected as regardless of the source of protein, we as pet food scientists and manufacturers have the obligation to do so.

How Much Protein do our Pets Need?

An animal's protein requirement is dependent on their life stage and health status. AAFCO has published guidelines for the nutritional requirements of adult, growing, gestating and lactating cats and dogs^[9]. These guidelines provide minimum requirements of protein and amino acids for the broader population of healthy pets. The key word here is "minimum" requirements, with the exception of two amino acids having maximum limits (methionine and tryptophan for cats).



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Protein requirements are higher for kittens and puppies to support growth, and cats being obligate carnivores have a higher protein requirement than dogs. However, we often see pet food labels with much higher guaranteed analyses for protein than what may be required, often over 2x the amount. It can be easy to get swayed by “better for your pet” claims, but over-nutrition is not necessarily the best approach, even if an essential nutrient. While a high protein diet is likely not harmful for most healthy pets, it is important to be mindful of those with certain health conditions such as kidney and liver disease. As always, it is wise to consult an animal health and nutrition expert regarding the long-term feeding of a higher protein food.

Key Takeaways – Protein Principles

- ✿ Proteins serve the body in multiple ways to promote growth and tissue repair, as hormones, as enzymes in metabolism, as transporters and as a major component of tendons, ligaments, cartilage as well as hair, skin and nails.
- ✿ Amino acids are the building blocks of proteins. There are two types of amino acids: essential and non-essential.
- ✿ Dogs and cats require 10 essential amino acids. Cats require an additional essential amino acid, taurine, that is understood to be conditionally required for dogs.
- ✿ The quality of a protein depends on the concentration and balance of amino acids, the biological value, the source and processing conditions.
- ✿ Combining and complimenting ingredients not only allows for an optimal balance of amino acids and nutrients, but also provides nutritional diversity to the animal.
- ✿ An animal’s protein requirement is dependent on their life stage and health status.
- ✿ Novel protein sources are emerging in the pet food market, requiring extensive research to validate that they are safe and provide long-term feeding solutions for our pets to grow and thrive.

Our Commitment – Leading with Technical Expertise – Leah and Jarrod are here to provide guidance and insights – do not hesitate to connect with us at Simmons Pet Food, pfcomments@simfoods.com. We would love to hear from you and be part of your pet’s nutrition solution!



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