Pulse Ingredients
A Healthy Choice for Pet Foods and Treats

By Gary Lynch, Ph.D., HORN Animal Wellness

Formulating healthy pet foods that meet an animal's nutritional requirement is not an easy task. The selection of ingredients is critical, and even more so, the specific formula for the combination of ingredients chosen. One category of ingredients that has been increasingly used in pet foods are pulses – a collective term for a variety of legume seeds – peas, lentils, various beans and chickpeas. The initial popularity of pulses, especially peas, was certainly assisted by the simple fact they are not "grains." Their nutrient composition validates that pulses are real nutritional tools that formulators can use to truly make healthier pet foods.

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Pulses – Nutritional Profile

The nutritional profile of peas, lentils and beans is very different from grains (Table 1). Pulses are a significant source of protein, being composed of 23%-26% protein. By comparison, pulses contain nearly three times the amount of protein as rice, a popular ingredient in super premium pet foods. Pulses are a substantial source of carbohydrates, which make them not only an important source

Table 1. Nutritional Profile of Pulses and Cereal Grains

	Protein	Fat	Carbohydrate	Fiber, TDF
Peas	23%	1%	60%	16%
Beans	23%-26%	1%-2%	67%-71%	17%-28%
Lentils	26%	1%	60%	14%
Chickpeas	22%	7%	59%	19%
White Rice	8%	1%	90%	1%
Brown Rice	9%	3%	85%	4%
Corn	9%	4%	84%	12%
Wheat	15%	3%	83%	13%
Oats	18%	8%	72%	12%

Health Canada 2010, NRC 2006, San Buenaventure 1987

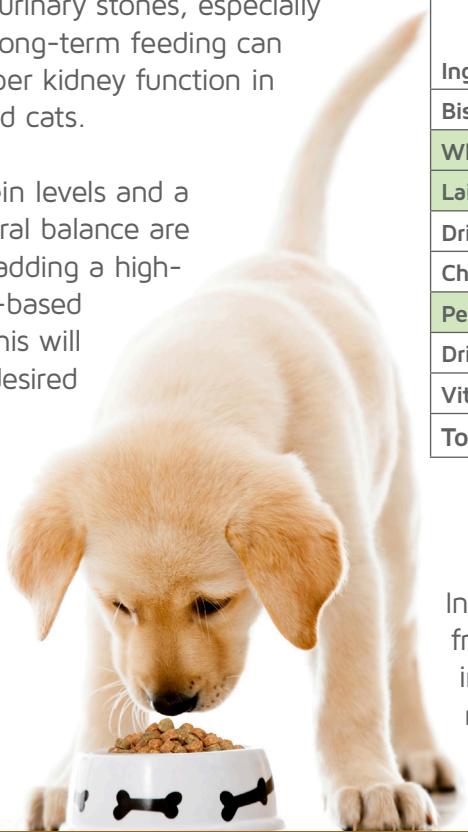
of dietary energy, but also an essential functional ingredient for proper extrusion and physical binding in treats. Pulses also contain a significant amount of fiber; most of which is soluble and beneficial for digestive health.

Pulse Proteins

Protein-containing ingredients, whether they are animal- or plant-based, get more attention than any other ingredient category in pet foods. Grain-free pet foods are often high in protein – 30% or more – and utilize novel meat protein ingredients. This can create formulation challenges in balancing protein ingredients to achieve both the protein target and other nutritional objectives.

Most novel meat meal ingredients run 50%-65% protein. However, the total mineral (ash) content of these ingredients can be as high as 25%-35%. The minerals – mainly calcium, phosphorus and magnesium – can result in a very "unbalanced" final pet food if levels of excess minerals are not held in check. High mineral content creates the potential for urinary stones, especially in cats, and long-term feeding can threaten proper kidney function in both dogs and cats.

Desired protein levels and a healthy mineral balance are achieved by adding a high-protein plant-based ingredient. This will provide the desired protein level and balances out mineral levels to a healthy minimum. Previous generations of pet foods used corn gluten meal or soybean meal to balance meat-based ingredients. Grain-free formulations have turned to pulse products such as pea protein 72% (contains a minimum protein level of 72%) to achieve the desired high protein levels while ensuring healthy final mineral levels (Tables 2A and 2B).



Protein and Mineral Levels in a Bison Grain-Free Dog Food Formulation Using Pulse Flours and Proteins

Table 2A.

Ingredients in Formula	Protein Level in Each Ingredient, %	Mineral Level in Each Ingredient, %	Ingredient Level in Final Formulation, %
Bison Meal	60	20	31
Whole Green Pea Flour	24	2.5	17
Laird Lentil Flour	26	2.5	17
Dried Potato, Ground	12	4	15
Chicken Fat	0	0	8
Pea Protein 72%	72	2	0
Dried Egg	85	2	4
Vitamins, Minerals, Misc.	0	4	8
Total			100

Pet Food Final Protein Level: 32.30%
Pet Food Final Mineral Level: 8.10%

Table 2B.

Ingredients in Formula	Protein Level in Each Ingredient, %	Mineral Level in Each Ingredient, %	Ingredient Level in Final Formulation, %
Bison Meal	60	20	19
Whole Green Pea Flour	24	2.5	17
Laird Lentil Flour	26	2.5	17
Dried Potato, Ground	12	4	15
Chicken Fat	0	0	10
Pea Protein 72%	72	2	10
Dried Egg	85	2	4
Vitamins, Minerals, Misc.	0	4	8
Total			100

Pet Food Final Protein Level: 32.30%
Pet Food Final Mineral Level: 5.90%

Including a pea protein 72% reduces total mineral levels from more than 8% to less than 6%. In addition, pulse ingredients like pea and/or lentil flour will contribute more than twice the protein to a formula compared to grains like rice or corn.

The novel ingredient concept promoted by grain-free and limited ingredient pet foods is based on supporting overall health and wellness. The majority of food related allergic responses are caused by proteins. For dogs or cats that have developed dietary sensitivities, transitioning them to a novel meat- and plant-based protein

> "High-protein plant-based ingredients have excellent amino acid profiles and support all life stages."

diet may improve both digestive health and skin and coat issues. Pea and lentil proteins are not recognized as a common cause in adverse food reactions (AFR) in dogs or cats, and often have the advantage of being a novel (not previously fed) dietary ingredient (Verlinden et al., 2006).

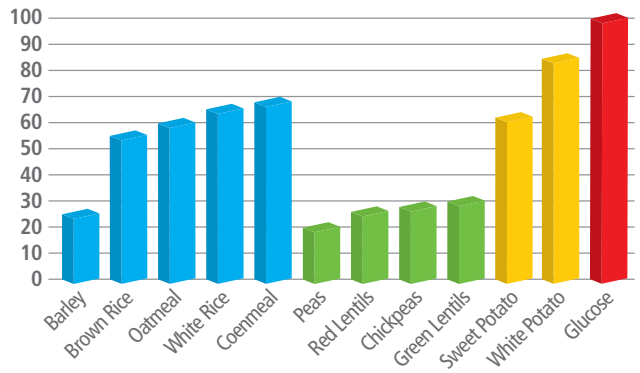
A Source of Healthy Carbohydrates

While carbohydrates are often demonized in pet foods, as a nutrient category, they play an important role in meeting the nutritional needs of pets. Polysaccharides, mainly starch from plants, comprise one of the main sources of energy in pet foods. Especially, when extruded, starches are efficiently digested and absorbed as glucose. Structural carbohydrates, including the fiber fractions, are important, impacting nutrient digestion, intestinal transit time and providing prebiotic fermentation. Pulses have been received in a positive light due to the beneficial digestion of pulse starches and the attributes of pulse fiber digestion.

As with humans, the rate of starch digestion can have direct implications on animal health. The

glycemic index of a food ingredient represents the rise of blood sugar – glucose – that occurs following ingestion of food. Carbohydrate sources are classified as having low (0-55), moderate (56-69) or high (70-100) glycemic indexes. Foods with high glycemic index are digested and absorbed quickly, which results in a rapid rise, and a subsequent rapid drop, in blood glucose following a meal. Foods with low glycemic index are digested at a slower rate, and avoid the rapid rise and fall in blood glucose. Pulses such as peas and lentils have much lower glycemic index than common grain ingredients (Figure 1).

Figure 1. Glycemic Index (Food)



Foster-Powell et al., 2002

Pet foods formulated with low glycemic index ingredients offer the same health advantages in dogs and cats as research has found in humans. Rapid rises and declines in blood glucose can

lead to excess hunger and weight gain. Obesity is a common issue in pets. A study found that overweight cats fed with a low glycemic diet ate less and gained less weight than cats fed with a high glycemic index diet (Appleton et al., 2004). Incorporating low glycemic index ingredients like peas and lentils into dog and cat diets has been recommended as a tool for the management of diabetes and obesity, especially in older pets (Rucinsky et al., 2010).

Fiber for Digestive Health

Pulses are distinct from grains, such as corn and rice, since they contain a significant amount of fiber. Fiber can be found in both the outer seed coat (such as pea hull fiber) and in the inner cotyledon (internal fiber). Unlike fibers found in the hulls of wheat or oats which are high in cellulose, pulse fibers are much higher in pectin and fructan. These fibers are fermentable to butyrate and other volatile fatty acids in the large intestine. In humans, pea fiber has been found to reduce the risk for colon cancer and can moderate cholesterol levels (Costa et al., 1994). Pulse fiber components also contribute to the reduced risk of heart disease, diabetes and obesity (Geil and Anderson, 1994). When measuring the total dietary fiber digestion, which corresponds to intestinal fiber fermentation, both dogs and cats digested more than twice the amount of fiber when fed pea- or lentil-based diets compared to rice- or corn-based diets (de-Oliveira et al., 2012).

Ground-Up Sustainability

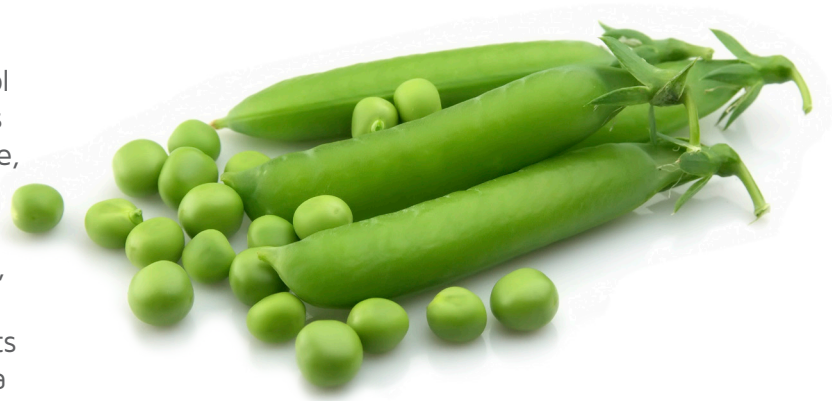
An important global challenge in the coming years is to provide sufficient quantities of protein to meet both human and animal needs. Pulse crops are playing an ever import role. Being a legume, crops such as peas, lentils and beans, fix nitrogen from the air; thus requiring only half of the nonrenewable energy as conventional grains, giving them a low carbon footprint (Zentner et al., 2004). The high protein content of pulses, with a nutritious amino acid profile, make them valuable as a complimentary protein ingredient in both companion animal and human food products.

Pulse Ingredient Highlights

- Protein content of 23%-26%
- Excellent source of carbohydrates
- Boasts soluble fibers ideal for digestive health
- Complements novel meat proteins
- Hypoallergenic
- Sustainable

A Valuable Tool for Pet Food Formulation

When creating a dog or cat food, there are an infinite number of options to meet both consumer's desires and a pet's nutritional requirements. Pulse ingredients – peas, lentils, beans and chickpeas – are a valuable tool for formulators to make pet foods and treats that are desired by current consumer trends and offer real health benefits to pet owners' furry family members.



For more than 20 years, Gary Lynch, Ph.D. has been contributing to the progression of the industry through a career in formulation, sales and marketing for the pet food and commercial feed markets. He is a senior project and account manager at HORN, a leading distributor of specialty products for more than 50 years. HORN represents world-class ingredient manufacturers including leaders in pulse ingredients supply, Emsland Group and Best Cooking Pulses. Dr. Lynch is part of HORN Animal Wellness, a specialty team with expertise in product formulation, supply chain and the delivery of quality ingredients to the pet food industry.