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ingredients

Finding the right ingredients for hybrid animal/plant-based or vegan pet food applications

By Geert van der Velden, Innovation Manager at IQI Trusted Petfood Ingredients

In the coming years, as global protein demand grows rapidly, the pet food market will be confronted by an animal and marine protein deficiency. This creates an increasing demand for alternative non-animal proteins. Likewise, as part of the humanization trend, more and more pet parents are turning to vegan pet food for their cats and dogs. Vegan pet food, like vegan food for humans, is entirely produced from plant-based, natural ingredients without any trace of animal-based raw materials. Both of these trends require plant-based alternatives which ensure that the nutrient requirements of the animal are met by animal/plant-based or vegan diets.

The vegan trend originally emerged because of ethical reasons, ensuring that the food chain is not responsible in any way for the cruelty or exploitation of animals. In the past 10 years, however, this has been surpassed by concerns over the environmental impact of animal production and fisheries. The vegan trend excludes a large number of traditional animal-based ingredients, including all kinds of meat, but also dairy, eggs, and other animal-derived ingredients, such as gelatin, honey, carmine, pepsin, shellac, albumin, whey, casein, and some forms of vitamin D3. Realizing either nutritious vegan or hybrid meat or fish/plant-based pet food requires close consideration of the right ingredients.

FOOD COMPOSITION FOR CATS AND DOGS

The nutrient requirements across different species of mammal, including humans as well as cats and dogs, are fairly similar, but the food composition must also take into account digestive function and capacity as well as taste preferences. True carnivores, such as cats, have a short and simple digestive tract with a low ratio between body length and intestine length. This is just 1:3 for cats, and 1:4 for dogs, while a true omnivore, like a pig, has a ratio of 1:14. This means that especially cats, and to a lesser extent dogs, have moderate colon fermentation capacity and require highly digestible food.

The natural primary food source of cats is meat and other animal-derived ingredients, due to the simplicity of their digestive tract and their dietary taurine requirement. While cats are strict carnivores, dogs are slightly better adapted to an omnivorous or plant-based diet. Dogs not only have longer intestines but also have 42 teeth, 12 premolars and molars more than cats, which have 30 teeth. Recent research, however, shows that cats as well as dogs can effectively live healthily on a vegan diet using various plant- and yeast-based ingredients to supply the required amino acids.

CHOOSING INGREDIENTS AND SUPPLEMENTS

When choosing ingredients and supplements for vegan or hybrid pet food, aspects such as nutritional properties, taste, stool quality, and technical properties should be taken into

consideration. Typical nutrients of animal origin that should be supplemented in vegan pet food include taurine, long-chain omega-3 fatty acids, carnitine, arachidonic acid, and vitamin D. As true carnivores, cats have certain different nutrient requirements to dogs. Cats have a higher protein and arginine requirement, taurine supplementation is essential, dietary arachidonic acid and dietary retinol (vitamin A) are required, since cats cannot utilize beta-carotene, and they have a high niacin requirement as they cannot convert tryptophan into niacin. Synthetic sources of retinol, B12, and niacin are available. Vitamin D can be produced from yeast or mushrooms. Minerals can be supplemented from non-animal sources and food could include added phytase to increase utilization of phytate bonded minerals.

THE NEED FOR HIGHLY DIGESTIBLE PROTEIN

Both cats and dogs require sufficient intake of high-quality, highly digestible protein: protein digestibility should be more than 83%. As true carnivores, cats have a higher protein requirement than dogs. The requirement for dogs is that at least 21% of total digestible protein should be highly digestible protein, whereby total protein should be no less than 24%. For cats, at least 31% of the total digestible protein should be highly digestible protein and preferably over 36% total protein of high quality.

There are different kinds of alternative protein sources with high digestibility available for vegan or hybrid pet food applications. These range from classical sources that have been on the market for a longer time to more novel protein sources. Examples of classical alternative protein sources are potato protein, wheat gluten, and corn gluten. Newer alternative protein sources are based on rice, non-GMO soy, and pulses, such as peas, faba beans, and chickpeas. Another category is hybrid fermented vegetable-based alternative protein made from vegetable protein and yeast. Processing is preferable for most of the vegetable protein ingredients, to concentrate protein and remove unwanted fiber and anti-nutrients. Novel alternative protein sources that have been introduced onto the pet food market more recently include hemp, algae, and single-cell proteins.

THE BENEFITS OF CORN FERMENTED PROTEIN

A particularly interesting new ingredient for vegan or hybrid pet food applications is fermented corn protein, as an alternative, fermented, functional, high-concentration vegetable protein for cats and dogs. Fermented corn protein is produced via an engineered bio-refinery process designed to extract the most valuable constituents of corn. The protein comes from an optimum balance of 75% corn with high digestibility and 25% spent yeast components with high palatability.

Table 1: Suitable high-quality protein sources for vegan pet food applications

Protein source	Protein %	Digestibility	Palatability	Cost	% protein	Availability	Remarks
Potato protein	75%	+++	0	0		++	A less bitter version is available
Soy protein concentrate	55-70%	++	+	0		+++	Extraction or fermentation non-GMO available
Wheat gluten	82%	++	0	0		+++	
Corn gluten	60%	++	+	0		+++	Important protein already in many pet food formulas
Rice protein	50-70%	++	0	++		++	Important protein already in many pet food formulas
Oat protein	55%	++	0	+++		0	Food grade only
Pea protein	56%	++	+	+		++	Natural process
Faba bean protein	55-65%	++	?	++		0	Various extraction methods
Chickpea	70%	++	?	+++		0	Food grade only
Fermented Corn protein	55%	++	+	0		+++	Combination of yeast & corn protein
Hemp protein	60-70%	++	?	+++		+	Legal situation
Algae protein	60%	?	?	+++		-	Protein depends on strain and extraction method
Guar	35-70%	++	+	+		+	
Single-cell protein	70%	?	?	+++		-	First commercial products coming soon
Brewer's yeast	>40%	++	+++	+		+	Spray or drum dried

TAURINE AS AN ESSENTIAL SUPPLEMENT

One of the most important areas of concern for plant-based pet food is taurine supplementation. Taurine is an amino sulfonic acid that occurs naturally in the bodies of mammals. This makes taurine plentiful in the natural diet of true carnivores, but taurine levels may be low in pet food products due to processing of the meat. Dogs are normally able to synthesize sufficient amounts of taurine from dietary sulfur-containing amino acid precursors, namely cysteine and methionine, found in animal protein in dog food, but will require taurine supplementation when switching to a vegan diet. Unlike dogs, cats are unable to synthesize their own taurine in sufficient amounts and will always need taurine, which can be produced chemically, to be supplemented in pet food. Taurine is involved in a number of physiological processes, including conjugation of bile acids, osmoregulation, neuronal excitability, inflammatory reactions, and glucose metabolism. This makes it essential for the health and well-being of cats and dogs. Sufficient taurine ensures the healthy development and functioning of skeletal muscle, the retina and vision, and the central nervous system. It also strengthens the heart, supports healthy blood flow, and is found to have an antioxidant effect that supports healthy aging. Without taurine supplementation in a vegan diet, cats and dogs can suffer from taurine deficiency, which may lead to the heart condition dilated cardiomyopathy (DCM), feline central retinal degeneration, and poor reproduction.

OMEGA-3 AS AN ESSENTIAL NUTRIENT

Besides taurine, omega-3 fatty acid is another essential nutrient with an essential role in the physiological processes of mammals, such as cats and dogs. In particular, the intake of adequate levels of the long-chain eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) offers a number of benefits to the health and well-being of cats and dogs. These fatty acids increase the absorption of vitamins and minerals, and help to manage inflammatory problems related to joint health and functioning, skin/coat, and in the prevention and treatment of heart and bladder diseases.



The intake of these omega-3 fatty acids also has a positive influence on eye health and supports cognitive functioning in aging brains.

Since cats and dogs are unable to synthesize any of the essential omega-3 fatty acids, they must be obtained through diet. The most common is the short-chain alpha-linolenic acid (ALA), which is present mainly in vegetable oils, such as flax oil, soya oil, and canola oil. But to achieve any health benefits, ALA first needs to be converted in the body into EPA and then into DHA, which only happens at a very low, almost negligible conversion rate. The most efficient and effective method to ensure sufficient inclusion levels of the beneficial long-chain fatty acids EPA and DHA in the diets of dogs and cats is therefore to supply them directly via pet food.

EPA and DHA long-chain omega-3 fatty acids are mostly found in marine oils, such as fish oil and krill oil, or in microalgae. Algae DHA is produced from cultured microalgae and is the only vegan source of long-chain omega-3 fatty acid. Algae DHA has a consistently high level of DHA long-chain fatty acid and very good palatability with high acceptance amongst cats and dogs. Algae, along with seaweed, is also a source of arachidonic acid.

HIGH-QUALITY FATS

Algae DHA is not only an important source of long-chain omega-3 fatty acids, but also of high-quality fats. Cats and dogs on a plant-based diet require alternative high-quality fats with good digestibility and a low percentage of free fatty acids (FFA), which are not oxidized and have a good fatty acid profile, and a ratio between omega-6 and omega-3 of around 4 to 1. While marine products are rich in the long-chain omega-3 fatty acids EPA and DHA, vegetable oils, such as rapeseed and linseed oil, are rich in the short-chain omega-3 fatty acid ALA as well as omega-6. A point of attention is that this can result in pet food with an imbalance between the amounts of omega-6 and omega-3.

High amounts of omega-6 may cause inflammatory health problems.

DIETARY FIBERS FOR GOOD GUT HEALTH

A healthy diet for cats and dogs contains a mix of both soluble and insoluble, fermentable and non-fermentable dietary fibers. Soluble fibers dissolve in water and gastrointestinal fluids when they enter the stomach and intestines, and become a substrate for the beneficial microflora in the gut. These ferment the fibers into short-chain fatty acids, thereby increasing their population in the gastrointestinal tract and acting as a prebiotic – the basis for good gut health. Different kinds of red, brown and green seaweed have a very high content of soluble prebiotic dietary fibers, and are suitable for vegan pet food applications. Particularly green seaweeds offer a cost-effective ingredient with high palatability, low level of contaminants, and an excellent reputation as a healthy source of food for both humans and pets. Blends of seaweed of all three colors can also be formulated based on the seaweeds' bioactive properties to achieve broader efficacy, targeting specific performance and bioactivity.

As opposed to soluble fibers, or prebiotics, insoluble fibers do not dissolve in water or gastrointestinal fluids and pass through the intestinal digestive tract fully or mostly intact. Insoluble fibers are particularly important for healthy bowel functioning and offer additional advantages, such as feline hairball control and weight management for senior pets. Cellulose fibers add bulk to pet food but contain no calories and ensure a longer period of satiation. Of the available fiber sources, purified cellulose powder offers the highest concentration of insoluble fibers, but other, more novel sources of insoluble fibers, such as Miscanthus or elephant grass, and functional carrot fiber, can also be considered. Another advantage of including cellulose fibers in pet food is the scouring effect that helps to keep teeth clean.



PLANT-BASED PET NUTRITION SOLUTIONS FROM IQI TRUSTED PETFOOD INGREDIENTS

Together with its different suppliers, IQI delivers a range of ingredients that are beneficial for vegan or hybrid pet food applications. These include seaweed, algae DHA, fibers and taurine.

For more information on these different ingredients for vegan pet food and the finest ingredients for the pet food industry, please visit our [website](#) or contact us directly.

Want to know more?

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[Vegan versus meat-based pet foods: Owner-reported palatability behaviours and implications for canine and feline welfare](#)

[Vegetarian versus Meat-Based Diets for Companion Animals](#)

[The state of research on vegetarian pet foods](#)

[IQI white paper 'Microalgae as a clean source of long-chain omega-3 fatty acid for pet food'](#)

[IQI white paper 'Seaweeds as a rich source of prebiotic dietary fibers and important nutrients for pet food'](#)

[IQI white paper 'The benefits of insoluble cellulose fibers as an ingredient in pet food'](#)

[IQI white paper 'Careful consideration of taurine as a conditionally essential supplement in pet food'](#)

ABOUT IQI TRUSTED PETFOOD INGREDIENTS

IQI Trusted Petfood Ingredients is a global provider of premium-claim ingredients to the top brands in the pet food industry. Founded in 1994 as a trading company in raw pet food materials, today IQI offers an extensive variety of services to aid and assist our customers and suppliers worldwide. IQI Trusted Petfood Ingredients employs highly skilled personnel, owns and operates a global network of logistical hubs, and relies on a global supply network to obtain the purest natural resources available.

For IQI, quality is key. IQI Trusted Petfood Ingredients goes to great lengths to ensure the quality of its products and develop innovative new products. IQI also invests a great deal in maximizing the quality of its partnerships. Since this business is all about trust, IQI needs to bond with its partners to succeed. By working closely with both its customers and suppliers, IQI creates full transparency in the supply chain. IQI oversees and controls every step in the process from source to shelf and supplies products that are pure and traceable to their source.



ABOUT GEERT VAN DER VELDEN

Geert van der Velden is IQI Trusted Petfood Ingredients' Innovation Manager responsible for Business Development, generating new products and concepts that meet the needs of existing and new customers. Geert has more than 25 years' experience in the international pet food industry and has gained knowledge and experience in many sections of IQI's business.

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