


 #flaxfeed

FLAXSEED: Nutrition Benefits for Dogs and Cats

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- Pets are living longer and developing age-related problems similar to their human owners.
- Flaxseed is rich in nutrients that support pet health including omega-3 fatty acids, fibre, protein and lignans.
- Flaxseed is a sustainable, local and plant-based ingredient which makes it attractive for inclusion in dog and cat foods.

Omega 3 Fatty Acids

Flaxseed provides a unique mix of fatty acids and contains both essential polyunsaturated fatty acids, omega-3 alpha-linolenic acid (C18:3n-3; ALA) and omega-6 linoleic acid (C18:2n-6; LA). Essential fatty acids are those that are required from the diet because they cannot be made by the human or animal body. Most notably, ALA comprises 53 to 57% and 23 to 26% of flaxseed oil and flaxseed, making these the richest plant sources (Table 1).¹

Table 1. Average content of alpha-linolenic acid in select ingredients commonly used in pet foods²⁻⁴

Food Item	Average Content (%)
Flaxseed Oil	53
Flaxseed	23
Chia seed	18
Canola oil	9
Soybean oil	7
Sunflower oil	1

ALA is a precursor for the long-chain omega-3 fatty acids, docosapentaenoic acid (C20:4n-3; DPA) and eicosapentaenoic acid (C20:5n-3; EPA), and to some extent is also converted to docosahexaenoic acid (C22:6n-3; DHA), fatty acids that naturally occur in fish and fish oil. Similarly, LA is converted to long-chain omega-6 fatty acids, in particular arachidonic acid (C20:4n-6; AA), by the same series of enzymes that metabolize ALA (Figure 1).

The National Research Council has established recommendations of omega-3 fatty acids for dogs and cats (Table 2). These recommendations include both absolute amounts ALA, EPA, and DHA as well as dietary ratios of omega-6 to omega-3 fatty acids. For puppies and bitches in late gestation and peak lactation, the ratio of LA to ALA should be between 2.6 and 16.5. No requirements for ALA are noted for adult cats, although recommendations have been made for kittens and queens in late gestation and peak lactation.⁵ The Association of American Feed Control Officials (AAFCO) is the other major organization in North America that publishes nutrient profiles for dogs and cats and to which pet food manufacturers comply. AAFCO does not currently include requirements for ALA, EPA or DHA in dog and cat nutrient profiles, though levels have been



proposed and accepted for inclusion in the 2016 AAFCO Official Publication.⁶

Table 2. Omega 3 fatty acid requirements for adult dogs and cats⁵

	Adequate Intake		Recommended Allowance		Safe Upper Limit	
	Amt/kg DM*	Amt/1000 kcal ME	Amt/kg DM*	Amt/1000 kcal ME	Amt/kg DM*	Amt/1000 kcal ME
Dogs (adult)						
Alpha-Linolenic Acid (g) ^b	0.36	0.09	0.44	0.11		
EPA + DHA (g) ^c	0.44	0.11	0.44	0.11	11	2.8
Cats (adult)						
Alpha-Linolenic Acid (g)						
EPA + DHA (g) ^d	0.1	0.025	0.1	0.025		

DM, dry matter; ME, metabolizable energy; EPA, eicosapentaenoic acid; DHA, docosapentaenoic acid

^aValues calculated assuming a dietary energy density of 4,000 kcal ME/kg.

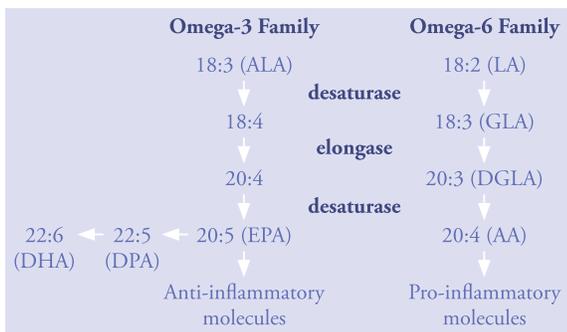
^bRequirement for alpha-linolenic acid varies depending upon linoleic acid content of the diet. The ratio of linoleic acid to alpha-linolenic acid should be between 2.6 and 26.

^c50-60% of the total amount should be EPA, and 40-50% should be DHA.

^dIncludes DHA only. It is advised that EPA is included but not exceed 20% of the total EPA + DHA amount.

The metabolism of omega-3 fatty acids depends on other nutrients, particularly omega-6 fatty acids due to competition for the same conversion enzymes.⁷ Higher amounts of dietary ALA, as well as decreased LA, result in increased conversion of ALA to EPA, DPA and DHA.^{7,8} Eicosanoids are hormone-like substances that affect inflammation. They are produced from both ALA (less inflammatory) and LA (mostly pro-inflammatory). Diets that are high in LA and low in ALA skew eicosanoid production towards a more inflammatory profile. Flaxseed can help to improve dietary omega-6 to omega-3 ratios since it contains more than three times as much omega-3 as omega-6 fatty acids. In addition, increasing dietary ALA intake from flaxseed can help to guard against inflammation and associated chronic diseases, such as obesity, diabetes and cancer.⁹

Figure 1. Key steps in the metabolism of omega-6 and omega-3 fatty acids showing enzyme competition between conversion pathways



Studies have found that DPA is the main ALA metabolite in cell membranes of many animals, and as such it may be an important reservoir for either EPA or DHA synthesis.¹⁰ Rapid accumulation of EPA, but not DHA, was reported in the serum of dogs when a 3% whole ground flaxseed supplement was added to a moderately high LA-containing diet (7.3% of energy as LA).¹⁰ In another study, when dogs were fed a diet containing flaxseed providing 10.1% of total fatty acids from ALA, the plasma levels of EPA and DPA increased quickly, achieving a steady state after approximately 28 days, though DHA levels did not change.¹¹ However, DPA may be transported to other tissues such as the brain and retina for DHA synthesis for local use within these tissues, especially when dietary sources of DHA are scarce.¹¹ In fact, dogs have been shown to be able to convert DPA to DHA in the retina and presumably other nervous system tissues.¹² Cats also are able to synthesize long-chain omega-3s in the liver and brain when dietary EPA, DPA, and DHA are not provided.¹³

DHA is a critically important omega-3 fatty acid during gestation and growth, particularly for brain and retina development. Dietary pre-formed DHA is recommended for pregnant or lactating dogs and cats as well as for puppies after weaning, though ALA from flaxseed also can help to support adequate DHA levels in puppies.¹⁴ Newborn puppies have been shown to preferentially synthesize DHA from ALA, suggesting that the enzymes involved in ALA to DHA metabolism are more active early in life when demand for DHA is high.¹⁴ Flaxseed can be used to increase ALA in mothers' milk in both dogs and cats in order for this essential fatty acid to be transferred to their offspring.¹⁵

Therapeutic pet diets high in omega-3 fatty acids are available for managing various diseases, particularly those with an inflammatory component, including cancer, skin disorders, cardiovascular disease, renal disease, gastrointestinal disorders and orthopedic disease.¹⁶ However, awareness regarding the importance of omega-3 fatty acids to overall pet health has led to higher inclusion levels in many adult maintenance diets as well.

Canine atopic dermatitis is a common skin disease with treatments including drug therapy and fatty acid supplementation.¹⁷ In a study that provided a placebo (mineral oil), an EPA (50-85 mg/kg) plus DHA (35-55 mg/kg) supplement, or flaxseed oil capsules (with ALA of 200-335 mg/kg) to dogs with non-seasonal atopic dermatitis, approximately half of the dogs in the two fatty acid treatment groups improved by more than 50%. Complete

remission was achieved in 10-20% of dogs.¹⁷ In cats, flaxseed oil also may be useful in controlling inflammatory responses, including allergic reactions. The inflammatory response of skin cells to histamine was found to decrease by 50% and 20-40% during the initial 45 minute post-injection period in cats fed flaxseed oil and in those fed fish oil, respectively, compared to control.¹⁸

Osteoarthritis involves an inflammatory component that may be influenced by nutritional supplementation, particularly omega-3 fatty acids. In dogs with osteoarthritis fed a test diet containing omega-3 fatty acids, owners reported significantly improved ability of their pets to rise from a resting position and play at 6 weeks, as well as an improved ability to walk at 12 and 24 weeks, compared with control dogs.¹⁹ The control diet consisted of a commercial food. The test diets (dry and canned formulas) contained a 31-fold increase in the amount of total omega-3 fatty acids (ALA, EPA, DHA) and a 34-fold decrease in the omega-6 to omega-3 ratio compared with the control food.¹⁹ The dry and canned test foods contained flaxseed, flaxseed oil and/or fish oil, providing 2.84% and 2.23% ALA, respectively.¹⁹

Lignans

Lignans are phytoestrogens that are found in many plants, but flaxseed is the richest source.²⁰ The predominant lignan in flaxseed is secoisolariciresinol (SDG), although small amounts of other lignans are also present, including pinoresinol, lariciresinol, and matairesinol. After ingestion, SDG is converted to mammalian lignans by bacteria in the colon. The first step in the conversion produces secoisolariciresinol (SECO), which is then converted to enterodiol and enterolactone.²¹

SECO, enterodiol and enterolactone possess antioxidant activity.²¹ Oxidative stress occurs when there is an imbalance between reactive oxygen species and antioxidants in the body which results in cellular damage. Oxidative stress and inflammation are closely linked, while inflammation and cancer are considered analogous to fuel and fire.²² In animal models, flaxseed lignans have been shown to reduce tumour size, number, and degree of invasiveness of cancer cells.²¹

Some concerns have been raised about the impact of phytoestrogens on reproduction in dogs due to animal studies suggesting that soy-based diets high in phytoestrogens can negatively impact fertility.²³ Although

there is a lack of data for dogs and cats, in humans the adverse reproductive effects of phytoestrogens have not been reported. There is also limited research on flaxseed lignans and reproductive health in dogs and cats.

Dietary Fibre

Flaxseed contains 28 g of total dietary fibre per 100 g, including 9 g of soluble dietary fibre.²⁴ The insoluble fibre fraction in flaxseed, consisting of cellulose, hemicellulose and lignin²⁵, has a strong water-binding capacity, thereby adding bulk to the diet and providing potential benefits for pets with digestive disorders.²⁴ Stress diarrhea is a common complication among working dogs. Flaxseed meal, the material remaining after the extraction of the oil, is a high fibre ingredient that was shown to be well-tolerated by dogs at levels of 10-40 g/day.²⁶ However, a maximum inclusion 4% flaxseed meal in diets for working dogs is recommended since large amounts may increase fecal volume and increase satiety thereby limiting food intake.²⁶ Higher levels, up to 8.5% of dry matter, may be used for normal or obese adult dogs to reduce energy intake, control body weight, and help to manage diabetes.²⁶

The fibre from whole ground flaxseed or flaxseed meal may aid in weight control in pets. In dogs, a high protein, high fibre diet was found to induce greater and more rapid weight loss compared to a high protein, medium fibre diet.²⁷ On the high fibre diet, dogs lost a median of 31.8% of body weight at a rate of 1.0% per week. On the medium fibre diet, dogs lost a median of 20.0% of body weight at a rate of 0.7% per week.²⁷ The high fibre diet contained 28% total dietary fibre (17.5% crude fibre) and the medium fibre diet contained 18.5% total dietary fibre (11.5% crude fibre).²⁷ The fibre consisted of a mixture of soluble and insoluble fibres derived from cellulose, beet pulp,



fructooligosaccharides, psyllium husk and cereal grains.²⁷ In humans, a small amount of flaxseed providing 2.5 g of soluble fibre has been shown to significantly suppress appetite and energy intake.²⁸

Protein

Flaxseed provides about 20 g protein per 100 g, making it a relatively rich source of protein compared to cereal grains. Complete proteins, also referred to as high quality proteins, are those that provide all essential amino acids in ratios required for protein synthesis by dogs and cats. In contrast, an incomplete protein is low in one or more essential amino acids (i.e., limiting amino acid). Animal proteins are complete proteins, whereas most plant proteins are incomplete. In spite of this limitation, essential amino acid requirements can be met if two or more complementary plant sources are combined or, more typically for pet food, both animal and plant protein sources are used. Flaxseed protein is relatively high in arginine, aspartic acid and glutamic acid, whereas lysine, methionine and cystine are the limiting amino acids.²⁹

There has been a fundamental change in how consumers view their pets with the interest in healthy and natural foods finding a broader, more receptive audience. Flaxseed can play an important role in the formulation of pet products that are of both higher quality and healthier. Pets are living longer and subsequently developing age-related problems similar to their human owners. Consistent with their own ways of staying healthier by eating better, pet owners are looking for similar ingredients to promote health and wellness in their animals. Flaxseed offers a sustainable, plant-based oil and protein option for pet foods. With the increased focus on pet health and the power of the human-animal bond, the future demand for products with healthy ingredients like flaxseed will only increase.



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