

# Omega Fatty Acids: Sources, Effects, and Therapeutic Uses in Dogs

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For many years, pet owners have given fatty acids to their dogs and cats to change a dull, dry hair coat into a more glossy one. More recently, veterinarians have found that fatty acids play important roles in other areas of skin and coat health such as allergies, the control of *inflammation*, joint health, and the function of other body organs in dogs and cats.

## What are fatty acids?

Fatty acids are specific types of polyunsaturated fats.

The two main classes of fatty acids we will be discussing are the omega-3's and the omega-6's. These classifications are based on molecular characteristics. (For you biochemistry buffs out there, check out the text box at the end of this article.) You may also have heard about omega-9 fatty acids. Omega-9's actually decrease the concentrations of omega-3 and omega-6 fatty acids in the blood and skin.

## Which fatty acids do pets need?

Animals can produce some of the fatty acids they need, but not all of them. Those fatty acids which they can not produce themselves, but must be obtained through their diet, are called 'essential' fatty acids. Interestingly, what is 'essential' for one species of animal is not necessarily essential for another. For example, the fatty acid, arachidonic acid is essential for cats but not for dogs.

In some disease conditions, certain *enzymes* which convert one fatty acid to another may be deficient, or the animal may not be able to adequately absorb fatty acids from the intestine. In animals with these conditions, some of the 'nonessential' fatty acids actually become 'essential,' that is, required in the diet, and in higher amounts. Deficiencies of fatty acids may also occur with the use of fat-restricted diets in overweight dogs.

Fatty acids in foods are subject to degradation. Overcooking can destroy fatty acids. Improper storage or a suboptimal amount of antioxidants in dry food may result in rancidity and a subsequent deficiency in fatty acids.

## Omega-3 fatty acids

Omega-3 fatty acids include:

- Alpha-linolenic acid (ALA)
- Eicosapentaenoic acid (EPA)
- Docosahexaenoic acid (DHA)

ALA can be converted into EPA, however, this conversion does not occur in the skin. EPA is the workhorse of the omega-3 fatty acids and is incorporated into the cell membrane.

## Omega-6 fatty acids

Omega-6 fatty acids include:

- Linoleic acid (LA)
- Gamma linolenic acid (GLA)
- Dihomo-gamma-linolenic acid (DGLA)
- Arachidonic acid (AA)

LA can be converted into GLA, but not in the skin. However, DGLA can be made from GLA in the skin.

LA is important because it optimizes water permeability in the skin. AA, on the other hand, in increased amounts, is the troublemaker among the fatty acids.

## Ratios of fatty acids

Research is being performed to determine the optimal ratio of omega-6 to omega-3 fatty acids that should be consumed. Previously, it was thought that the ratio should be approximately 15:1. Current recommendations are for ratios of 10:1 to 5:1.

Most pet foods contain far more omega-6 fatty acids than omega-3's. Some pet food companies have added omega-3 fatty acids to their foods to lower the ratio of omega-6 to omega-3 fatty acids. It is important to realize that although the ratios may be a guideline, the actual concentration of EPA in the omega-3's is what is most important.

## Sources of fatty acids

Fat may contain fatty acids, but in extremely varying quantities. For example, beef fat will have a very low percentage of fatty acids, whereas, sunflower oil and fish oil will have much larger percentages.

Fatty acids are found in different quantities in many plants and cold water fish. Marine oils are good sources of EPA and DPA. The other fatty acids are found in higher quantities in certain plants and grains. Sunflower oil and safflower oil are especially high in LA.

For animals allergic to fish, the seeds of the *Salvia hispanica* plant provide a rich source of omega-3 fatty acids. The seeds of the plant contain their own antioxidants.

As mentioned previously, most pet foods contain far more omega-6 than omega-3 fatty acids. It has been found that cattle and poultry fed increased omega-3 fatty acids will produce meat and eggs higher in omega-3 fatty acids. In the future, the use of these products in pet food may help to optimize the omega-6 to omega-3 ratio in the diet.

## How fatty acids function in inflammation

Both AA and EPA can be incorporated into cell membranes. When a cell is damaged, AA is released from the cell membrane and is *metabolized* by enzymes into substances which increase inflammation and pruritus (itching). EPA is also released when a cell is damaged. It competes with AA for the same metabolic enzymes. EPA results in the production of less inflammatory substances. DHA also results in the production of less inflammatory substances. So DHA and EPA decrease the harmful effects of AA.

**EPA, DHA, and DGLA decrease the harmful effects of AA.**

DGLA also competes with AA for enzymes. In addition, DGLA causes the release of *prostaglandin E<sub>1</sub>* (PGE<sub>1</sub>), a substance which inhibits the release of AA from the cell membrane.

## Indications for the use of supplemental fatty acids

From that complicated description, we hope you can see that by supplementing with EPA, DHA, and GLA (which the body can easily convert to DGLA) we may be able to lessen the effects of inflammation. Fatty acids affect a number of body systems and conditions, as described below.

**Allergies and Autoimmune Conditions:** Allergies and autoimmune conditions occur because the *immune system* over-reacts. Certain fatty acids can lessen the harmful effects these diseases can have on the body.

**Arthritis:** Research is showing that omega-3 fatty acids, especially EPA, may be helpful in reducing the inflammation associated with arthritis.

**Other Inflammatory Diseases:** Other diseases which are accompanied by inflammation such as ulcerative colitis, inflammatory bowel disease, and rheumatoid arthritis may respond to the anti-inflammatory effects of certain fatty acids.

**Dull and Dry Hair Coats:** Haircoats which are dull, brittle, and dry often respond to supplementation with essential fatty acids, especially LA. It has also been found that in some cases of seborrhea, there is a deficiency of LA in the skin. In these cases, supplements high in LA are useful. The addition of EPA and GLA is also beneficial in that it would help negate the release of AA from cells damaged because of this skin condition.

**Yeast Infections:** Fatty acids have been shown to slow down the growth of *Malassezia pachydermatis*, a common yeast infection in dogs and cats, in the laboratory. It is thought, these fatty acids may play a beneficial role in the treatment of this yeast infection on the skin and ears in dogs and cats.

**Preventing Atopy:** Some researchers have suggested that fatty acid supplements may be useful to prevent atopy (allergies to inhaled substances such as pollens and molds) from developing in young animals. The theory is that pregnant atopic mothers have a decreased amount of PGE in their systems. PGE is necessary for the development of a healthy immune system in neonates. If the mothers are deficient in PGE, their offspring may be more likely to develop abnormal immune systems which would make them more prone to atopy themselves. Since GLA, when converted to DGLA, causes the release of PGE, giving GLA to a pregnant female in the last month of pregnancy and during lactation may increase PGE and decrease the incidence of the offspring developing atopy.

**Eyes:** In addition to their effects on the developing immune system, omega-3 fatty acids are also essential for the proper development of the retina and visual cortex.

**Heart Problems:** Evidence suggests, omega-3 fatty acids may prevent certain cardiac problems as well. Ventricular *arrhythmias* in dogs have been prevented and high blood pressure has been reduced in dogs supplemented with fatty acids. Animals prone to thromboembolisms may be helped by the anti-clotting effect fatty acids have on *platelets*.

**Cancers:** Omega-3 fatty acids have been shown to slow the development and *metastasis* of certain cancers. Omega-6 fatty acids, on the other hand, have been shown to stimulate tumor development.

**Plasma Triglycerides and Cholesterol:** Fish oils have been shown to decrease levels of triglycerides and cholesterol in the blood. Animals receiving retinoid therapy (synthetic vitamin A derivatives) for various skin problems may develop hyperlipidemia. Fish oils may benefit these patients.

It should be obvious that fatty acids are necessary for the normal function of many systems of the body. It is also obvious that not all fatty acids are equal. Because the different fatty acids have different effects, the choice of a fatty acid supplement needs to be based on the specific condition we are trying to manage.

The sources and uses of fatty acid supplements are shown below.

	Abbreviation	Essential for Cats	Essential for Dogs	Source	Indications for Use
<b>Omega-3</b>					Cancer, cardiac problems, inflammatory conditions, eye development
Alpha-Linolenic	ALA	X (?)	X (?)	Flax seed, pumpkin seed, soybean oil	--
Eicosapentaenoic	EPA			Marine fish oil	Atopy, arthritis, autoimmune disease, retinoid therapy, seborrhea, decrease cholesterol
Docosahexaenoic	DHA			Marine fish oil	Atopy, retinoid therapy
<b>Omega-6</b>					
Linoleic	LA	X	X	Sunflower oil, safflower oil, soybean oil, corn oil, evening primrose oil	Dry skin, dull hair coat, seborrhea
Arachidonic	AA	X			None - Can make inflammation worse
Gamma-Linolenic	GLA			Evening primrose oil, borage oil, black currant seed oil	Atopy, autoimmune disease, seborrhea, reduce development of atopy in neonates
Dihomo-gamma-Linolenic	DGLA				

## Choosing a fatty acid supplement

Animals being treated for atopy should have supplements with high amounts of EPA, DHA, GLA, and vitamin E.

Animals with seborrhea and other keratinization disorders will benefit from supplements high in LA. Zinc, folic acid, and other additives may also be helpful. Dry, dull hair coats are also an indication for supplementation with LA.

The polyunsaturated fats in fatty acid supplements increase the need for antioxidants. Fatty acid supplements should be fortified with vitamin E.

There are numerous brands of fatty acid supplements with different quantities of vitamins and minerals, as shown in the table below. You can see that the amount of various fatty acids and additives varies considerably. If one brand of fatty acid supplement is not beneficial, another one may be since the ratio of the various fatty acids differ from brand to brand.

Product	ALA (mg)	EPA (mg)	DHA (mg)	DPA (mg)	GLA (mg)	LA (mg)	AA (mg)	Vit.A (IU)	Biotin (mcg)	Vit.C (mg)	Vit.D (IU)	Vit.E (IU)	Zinc (mg)	Manufacturer's recommended dose for adults
Drs. Foster and Smith Omega-3 Gel Caps		180	120									Yes		1 capsule per 20 lbs
3V Caps Small-Medium		103	68					1250			125	75		1-2 caps for pets up to 30 lbs
3V Caps Medium-Large		180	120					1250			125	75		1-2 caps for pets 30-60 lbs
3V Caps Large-Giant		250	167					1250			125	75		1-2 caps for pets 60-90 lbs
Drs. Foster and Smith Vitacaps Small Dogs		80	55	5	8	45		3000		15		18	1	1 capsule per 10-25 lbs
Drs. Foster and Smith Vitacaps Large Dogs		125	90	10	15	75		5000		25		30	2	1 capsule per 50-70 lbs
Drs. Foster and Smith Vitacaps Liquid	25	125	80	10		150	5	2500				10	.025	1 ml per 60 lbs
Drs. Foster and Smith Premium Plus		40	30			2900		50	24	10		12.5	2	1 tsp per 20 lbs
Drs. Foster and Smith Vitacoat Plus for Dogs		50	30			2000		50	24		62	12.5	2.9	1 tsp (5 ml) per 20 lbs
Derm Caps ES		76	50		20	282						75		1 capsule per 50-70 lbs

Important for treatment of allergies.

Derm Caps ES Liquid		78	52		30	283						46		1 ml per 60 lbs
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Important for treatment of dry skin and seborrhea.

## Fatty acids as part of a management plan

In some animals, fatty acids alone can decrease pruritus or inflammation to an acceptable level. More often, fatty acids are used in conjunction with other therapies. Fatty acids have a *synergistic* effect with both antihistamines and *glucocorticoids*. By using fatty acid supplements, we can often decrease the dose of glucocorticoids by 50% or even eliminate them in animals with allergic pruritus.

Since fatty acids need to be incorporated into cell membranes, they usually do not have an immediate effect. Often a pet must be on a fatty acid supplement for a month before any positive results can be seen. Many veterinary dermatologists recommend that fatty acids be used for 9-12 weeks before considering discontinuation because of lack of positive results. Most experts advise treating with fatty acid supplements twice daily. Some research has shown that 2-10 times the recommended dose may be necessary to control pruritus in dogs.

**Many veterinary dermatologists recommend that fatty acids be used for 9-12 weeks before concluding they are not helping the condition.**

Dermatologic conditions in cats such as *miliary dermatitis* and eosinophilic *granuloma* respond well to fatty acid supplementation, having success rates of 40% and 66.7% respectively. The success rate in dogs with allergic pruritus appears to be less, most studies reporting around 20%.

## Risks and side effects of fatty acid supplementation

There are few side effects of fatty acid supplementation. At high doses, the most serious, but rare complication, is pancreatitis. This is an inflammation of the pancreas that can cause pain, diarrhea, vomiting, and dehydration.

Since fatty acids are polyunsaturated fats, they do add *calories*. If a pet is on large doses of fatty acids, a pet food lower in calories, and fewer treats, may need to be given to prevent weight gain. Some pets may develop diarrhea from fatty acid supplements. Often, starting supplementation at a low dose and gradually working up to the therapeutic dose can help alleviate this problem. It has also been suggested that diets low in fat may increase the effectiveness of fatty acid supplements.

Because fatty acid supplements contain large amounts of fish oils, some pets develop a 'fishy' breath.

The long-term or high-dose effects of fatty acid supplements have not been determined.

## Conclusion

Fatty acids have been shown to be important in the health of skin, coat, joints, and other body systems. The various fatty acids have different actions and the choice of supplement needs to be based on the effect desired. For dry skin and dull hair coats, supplements high in LA are recommended. For allergies and inflammations, supplements high in EPA, DHA, and GLA are most effective. In the treatment of atopy and other allergies, fatty acid supplements have been shown to be synergistic with antihistamines and glucocorticoids, enabling the dose of glucocorticoids to be decreased. Therapeutic trials with fatty acid supplements should last 9-12 weeks.

To make the best use of fatty acid supplements, additional research needs to be performed to determine the optimal dosage, ratios, dietary modifications, concurrent therapies, and long-term effects.

### The Biochemistry of Fatty Acids

The two main classes of fatty acids are the omega-3's and the omega-6's. These classifications are based on molecular characteristics - the location of the first double bond from the methyl group. Omega-3's have the double bond at the third carbon and omega-6's at the sixth.

ALA + 2 carbons and a double bond → EPA

LA + one double bond → GLA; GLA + 2 carbons → DGLA

LA + 2 carbons and 2 double bonds → AA

## References and Further Reading

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