

DO THE MATH EPA and DHA may be beneficial in disease states, but because of their pharmacologic effects, use care when recommending EPA and DHA-containing VTDS and pet supplements concurrently.

NUTRITION NOTES

Fish Oil Dosing in Pet Diets and Supplements

Donna Raditic, DVM, CVA, DACVN, and Laura Gaylord, DVM, DACVN
Veterinary Nutritional Consultations, Inc., Hollister, N.C.

Commercial pet food production uses an array of animal and vegetable fats and oils to supply energy and, when applied topically during manufacturing, as palatability enhancers.¹ Fats are composed of fatty acids with carbon chains of various lengths and are described as “unsaturated” or “saturated” (no double bonds in the carbon chain). Fatty acids with the first double bond occurring between carbons 3 and 4 from the methyl group comprise the omega-3 family, whereas the omega-6 family has the first double bond between carbons 6 and 7. Fatty acids from both families that are not synthesized by the body are considered essential fatty acids (EFAs) for dogs, cats, and other mammals.

Omega-6 EFAs include linoleic and arachidonic acid. The omega-3 EFAs are α -linolenic acid, eicosapentanoic acid (EPA), and docosahexaenoic acid (DHA). Linoleic acid is known to be a dietary requirement for adult dogs and cats; adult cats also require dietary arachidonic acid. DHA is required for growing puppies and kittens, and there is growing consensus that it, along with EPA, should be considered an essential nutrient for all life stages of dogs and cats, but the optimal amount and form to be included in pet diets are still unknown.

Animal fats used in pet diets are high in omega-6 fatty acids, whereas fish oils, dried algae, marine microalgae, fish meals, or whole fish are used specifically as sources of omega-3 fatty acids. Fish oil supplements with concentrated amounts of EPA and DHA should therefore be considered as providing a “therapeutic or even pharmacological effect,” rather than simply supplying an essential nutrient in pet foods.²

ESSENTIAL FATTY ACIDS IN PET FOODS

Recommended Levels

Studies in growing puppies have identified DHA’s role in developing neurologic tissues with improved retinal development and cognitive function testing.³ The Association of American Feed Control Officials (AAFCO) uses these types of studies, as well as published data by the National Research Council (NRC), to recommend nutrient levels for pet food manufacturers. The NRC states adequate intake and recommended allowances of EPA and DHA for growth as well as adult maintenance of dogs and cats.⁴

Currently, AAFCO has no minimum EPA or DHA requirements for adult canine or feline maintenance



diets. However, AAFCO does recommend that diets for canine growth and reproduction contain a combination of EPA and DHA at 0.05% dry matter basis or 10 mg/100 kcal, and that feline growth and reproduction diets contain 0.012% EPA and DHA or 3 mg/100 kcal.⁵ AAFCO recommends a safe upper limit of omega-6:omega-3 fatty acids at 30:1 for dog foods, but as a ratio of the total grams of linoleic and arachidonic acid (omega-6s) to total grams of α -linolenic acid, EPA, and DHA (omega-3s). The NRC's safe upper limit for dogs, and specifically for total EPA and DHA content, is 280 mg/100 kcal.

Functions

Dietary fats in pet diets supply 2.25 times the metabolizable energy of protein and carbohydrates. EFAs also have a structural role in the bilipid membranes of cells. Here, they are used by the lipoxygenase and cyclooxygenase enzyme systems to form prostaglandins and leukotrienes, which mediate inflammation. Prostaglandins and leukotrienes derived from arachidonic acid (omega-6) are proinflammatory, whereas those derived from EPA and DHA (omega-3) result in a reduced inflammatory response with decreased platelet aggregation and immunologic stimulation. The resolution of inflammation is an active process involving resolvins and protectins derived specifically from EPA and DHA.⁶ These endogenous mediators form in the resolution phase of the inflammatory response and serve to stop inflammation and to reduce leukocyte-mediated tissue injury.

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SUPPLEMENTATION OF EPA AND DHA

As the market for human and pet supplements continues to grow, clients are increasingly aware of the numerous reported health benefits of cold-water fish oil supplements containing EPA and DHA. Some of the benefits of these supplements may be explained by the decrease and resolution of inflammatory responses by EPA- and DHA-derived resolvins and protectins.

Therapeutic Uses in Dogs

The “anti-inflammatory effects” of EPA and DHA in dogs with various diseases—including hyperlipidemia, kidney disease, cardiovascular disorders, osteoarthritis, atopy, and inflammatory bowel disease—have been evaluated.⁷ In dogs, recommended doses of EPA and DHA supplements for therapeutic purposes range from 50 to 220 mg/kg body weight. The highest dose is recommended for osteoarthritis. These therapeutic doses are based on adding the milligrams of EPA and

TABLE 1 EPA + DHA Content of Commonly Available Fish Oil Supplements

SUPPLEMENT	TOTAL EPA + DHA	TOTAL OMEGA-3 ^a
Salmon oil (generic per U.S. Department of Agriculture) ^b	283 mg/mL	NP
FISH OIL		
Nordic Naturals Omega-3 Pet Cats & Small Breed Dogs liquid	248 mg/mL	285 mg/mL
Nordic Naturals Omega-3 Pet Large to Very Large Breed Dogs liquid	248 mg/mL	285 mg/mL
Bayer Free Form Snip Tips Omega-3s for Medium and Large Dogs	853 mg/cap	NP
Welactin Canine	240 mg/mL	295 mg/mL
KRILL OIL		
Nature Made Krill Oil 300 mg Softgel	92 mg/cap	114 mg/cap
NOW Foods Neptune Krill Oil Softgel	195 mg/cap	250 mg/cap
ALGAL OIL		
Nordic Naturals Algae Omega	293 mg/cap	358 mg/cap
Nature's Way NutraVege Omega-3 Plant Based Liquid	100 mg/mL	100 mg/mL

cap=capsule; NP=not provided.

^aDosing for therapeutic conditions is based on total EPA + DHA content, not total omega-3 content.

^bU.S. Department of Agriculture Food Data Central available online at: fdc.nal.usda.gov.

TABLE 2 Omega-3 Content of Available Dry Canine Veterinary Therapeutic Diets

VETERINARY THERAPEUTIC DIETS	EPA + DHA (MG/100 KCAL)			
	BLUE BUFFALO	RAYNE	PURINA	ROYAL CANIN
Joint	340	160	220	220
Novel protein	160	118	240	120
Hydrolyzed	120	N/A	0	70
Renal	190	N/A	30	120
Gastrointestinal	30	50	20	70
Weight loss	N/A	160	0	150

N/A=diet not available.

DHA per supplement capsule or milliliters of liquid, which is meant to be the “active ingredient” in many common pet fish oil supplements (TABLE 1).⁷⁻¹⁰

Pet supplements for joint, skin, and gastrointestinal problems are increasingly popular, and supplements containing EPA and DHA are common. As the EPA and DHA in fish oil supplements are being used for their pharmacologic effects, their potential adverse effects should be considered. Supplement–drug interactions, altered platelet function, gastrointestinal disturbances, detrimental effects on wound healing, nutrient excess/weight gain, altered immune function, and effects on insulin sensitivity have the potential to make fish oil supplementation problematic.¹¹ In a study of 31 dogs with reticulocytosis in the absence of anemia (RAA), more than 90% of dogs regularly consumed omega-3 EFAs and/or glucosamine, either in the diet or as a separate supplement. Furthermore, RAA dogs were often administered nonsteroidal anti-inflammatory drugs (NSAIDs). The authors speculated on the potential role of NSAIDs in gastric ulceration and enhanced chronic blood loss with concurrent omega-3s and/or glucosamine, which can interfere with normal platelet function, as being a potential cause of RAA in this population of dogs.¹²⁻¹⁷

Cats and Omega-3s

Data on omega-3 therapeutic supplementation in cats are scarce. One retrospective study of survival of cats with chronic kidney disease compared cats consuming a maintenance diet with those eating 1 of 7 commercially available renal diets. The renal diet with the highest EPA content (200 mg/100 kcal) was associated with the longest survival.¹⁸ Another randomized, controlled, blinded prospective study that evaluated 40 client-owned cats with osteoarthritis fed a feline diet containing 188 mg EPA + DHA/100 kcal and supplemented with

green-lipped mussel extract (a source of glucosamine/chondroitin sulfate) noted improved objective measures of mobility.¹⁹ Using the milligrams of omega-3s per kilocalorie in these studies would suggest a dose of approximately 112 or 120 mg of combined EPA + DHA per kilogram of body weight for cats with chronic kidney disease or osteoarthritis, respectively.

COMBINING EPA AND DHA IN PET FOODS AND SUPPLEMENTS

Practitioners should be aware of the benefits and potential for adverse events when using fish oil supplementation in conjunction with diets containing EPA and DHA. Manufacturers should provide information to allow practitioners to easily assess the milligrams of EPA and DHA in pet supplements, over-the-counter diets, and veterinary therapeutic diets (VTDs).

EPA and DHA Content of Commercial Diets

For this article, the authors contacted 5 pet food companies by email to obtain the current total omega-6, omega-3, EPA, and DHA content of their bestselling canine VTDs (joint, novel protein, hydrolysate, renal, gastrointestinal, and weight loss, if available) and 3 top-selling over-the-counter diets. Two companies complied, 2 referred to their current product guides, and 1 did not provide guidance. Only 2 companies provided specifics on diet sales; therefore, fatty acid analysis and comparisons were restricted to selected VTDs. TABLE 2 summarizes the information obtained. While the amount of EPA and DHA varies by category of diet and company, in general, the highest amounts are in the joint diets, ranging from 160 mg to 340 mg/100 kcal. Noteworthy among the other diets are Purina’s (purina.com) novel protein (240 mg/100 kcal), Blue Buffalo’s (bluebuffalo.com) renal (190

**TABLE 3 Therapeutic Doses of EPA + DHA in Specific Disease Conditions⁷**

CLINICAL DISORDER	DOSE (MG/KG ^{0.75}) ^a	DOSE MG/KG/DAY	APPROXIMATE EPA + DHA (MG) DOSE FOR A 20 KG DOG/DAY
Idiopathic hyperlipidemia	120	57	1135
Kidney disease	140	66	1324
Cardiovascular disorders	115	54	1088
Osteoarthritis	310	147	2932
Inflammatory or immunologic (atopy or IBD)	125	59	1182
NRC recommended allowance	30	14	284
NRC safe upper limit	370	175	3499

^aCalculated on a metabolic body weight (kg) basis (if weight is in pounds, divide by 2.2 to convert to kilograms). IBD=inflammatory bowel disease.

mg/100 kcal), and Rayne's (raynenutrition.com) weight loss (160 mg/100 kcal) diets. **TABLE 3** provides therapeutic doses of EPA + DHA for specific disease conditions.

Example: Diet Plus Supplementation

Using the data in **TABLE 2**, the authors calculated the total daily intake of EPA and DHA for a 20 kg dog consuming its daily energy requirement of 927 kcal of the VTD in each category that contained the highest amounts of EPA + DHA/100 kcal (**TABLE 4**). Next, the daily intake of EPA and DHA was compared to the recommended therapeutic dose of EPA + DHA for the corresponding disease state to determine the percentage of the therapeutic dose that would be met by VTD intake. In most cases, a 20 kg dog consuming a veterinary joint, novel, hydrolyzed, renal, or weight loss therapeutic diet containing high levels of EPA and DHA would likely obtain the recommended therapeutic dose from the diet alone; therefore, additional omega-3 supplementation may be unnecessary or, at least, should be carefully assessed.

Because the canine joint VTDs assessed for this article contained the highest amounts of EPA and DHA,

it may be prudent to avoid omega-3 supplements or at least assess their dosing for safety and economics when recommending a canine joint VTD. In the **TABLE 4** example of the 20 kg dog consuming 3152 mg of EPA + DHA per day in its joint diet, the addition of a daily capsule of a typical omega-3 pet supplement containing 500 mg of EPA +DHA (**TABLE 1**) would result in a total daily intake of 3652 mg. This amount exceeds the NRC safe upper limit of 3499 mg of EPA + DHA for this patient (**TABLE 3**).

CONCLUSION

Based on the data provided in **TABLE 2**, when considering the use of a canine novel, hydrolysate, renal, gastrointestinal, or weight loss VTD, the authors recommend determining total EPA and DHA intake provided by the diet to ensure safe and economic omega-3 supplementation. This may require contacting the manufacturer. Question clients about current diet and all supplements that they may be feeding. In summary, EPA and DHA may be beneficial in disease states, but because of their pharmacologic effects, care should be used when recommending EPA and DHA-containing VTDs and pet supplements concurrently. **TVP**

TABLE 4 Dietary Intake of EPA + DHA Compared to Therapeutic Dosing in a 20 kg Dog^{7,a}

	DIET TYPE					
	JOINT (340 mg/100 kcal)	NOVEL PROTEIN (160 mg/100 kcal)	HYDROLYZED (120 mg/100 kcal)	RENAL (190 mg/100 kcal)	GI (70 mg/100 kcal)	WEIGHT LOSS (160 mg/100 kcal)
EPA + DHA mg/day from diet	3152	1483	1112	1761	649	1483
Disease-state dose EPA + DHA mg/day	2932	1182	1182	1324	1182	1182
% of dose met by diet	108%	125%	94%	133%	55%	125%

^aBased on consumption of daily energy requirement of 927 kcal/day ($[20 \text{ kg}^{0.75} \times 70] \times 1.4 = 927$). GI=gastrointestinal.

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Donna Raditic

Dr. Raditic is a former professor for both the nutrition and the integrative medicine services at the University of Tennessee College of Veterinary Medicine. Currently, she is an independent consultant member of Veterinary Nutritional Consultations, Inc., the East Coast Think Tank, which offers independent information and consulting on companion animal nutrition and supplements. Her career includes being a general practitioner, veterinary nutritionist, academician, and consultant. She offers unique perspectives on the role of clinical nutrition, supplements, and integrative veterinary care for companion animals.



Laura Gaylord

Dr. Gaylord has been a general practitioner in North Carolina for more than 20 years. She is currently an independent consultant member of Veterinary Nutritional Consultations, Inc., the East Coast Think Tank, with Dr. Raditic. She also offers homemade diet recipe consultations through PetDiets.com. Combining her clinical experiences with “out of the box” thinking, she consults on pet nutrition and supplements for general practitioners and their clients, as well as the pet-vested industry.