Exploring the benefits of DHA

Long chain omega-3s are critical for growth and development of fish and other animals

Long chain omega-3s (DHA and EPA) are a specific group of polyunsaturated fatty acids that are essential components of dietary fats and oils.[1] They are critical elements of fish nutrition, especially in early stages of life.[2] Companion animals can also experience health benefits from long chain omega-3s in their diets.[3] Finally, omega-3s can play a positive role in the reproductive function of farm animals.[4]

Fish oil (from cold-water marine fish) and microalgae are important sources of DHA.

Aquaculture

Studies show that increased levels of DHA in aquaculture feed can provide health benefits for fish like salmonids (e.g. salmon and trout), and enrich the fillet. One of the primary ways that long chain omega-3s make their way into the human diet is through seafood (salmon and other oily fish, for example).[5]

Fillet enrichment

A recent study by Stirling University reveals that the amount of omega-3 fatty acid in farmed salmon in the UK has decreased by 50% in the past 10 years, thus requiring consumers to eat double the portion of farmed salmon to obtain the same amount of omega-3s. This reduction is believed to be largely due to changes in the way salmon are fed, as well as declining worldwide stocks of small oily fish, which have been a primary contributor of omega-3 oil in fish feed.[6]

Feeding fish such as salmon and trout DHA-rich feed can increase DHA content of the fillet, helping address declining omega-3 levels in the industry and enabling consumers to obtain more omega-3s.[7, 8, 9, 10]

Fillet enrichment is not limited to salmon and trout. The DHA content of white sea bass, tilapia and giant grouper fillets can also be enriched with a DHA-rich feed.[11,12,13]

Fish health

Omega-3s are essential for fish growth and optimal nutrition.[14] Studies show that increasing DHA-rich algae content in the diets of white sea bass can result in higher growth rates.[15] Similarly, juvenile tilapia fed with DHA-rich algae can experience higher weight gain and greater protein efficiency ratios compared to tilapia fed with diets containing fish oil.[16]

For longfin yellowtail tuna juveniles, studies show that DHA supplementation is essential for meeting long chain fatty acid requirements.[17] Fish meal can be replaced in large quantities with DHA-rich feeds like algae without sacrificing performance or intestinal integrity of longfin yellowtail tuna.[18]

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Production Animals

Studies show that increased levels of DHA in feed for livestock like cows, pigs and chickens can provide a range of benefits. Eggs and meat can also be enriched with DHA, enhancing nutritional quality for the consumer.

Chickens

Egg enrichment When laying hens are fed with DHA-fortified feed, the level of DHA can increase in the egg yolk.[19, 20, 21, 22]

Meat enrichment According to Longo et al, broiler chickens can exhibit DHA retention rates ranging from 4.5 to 10%, depending on the level of DHA in their diet.[23]

Ruminants (Cows)

Offspring health Studies show that diets high in omega-3s can reduce pregnancy losses.[24]

Reproductive ability DHA can improve reproductive performance of cows in a number of ways: [25,26,27,28,29,30,31,32]

- DHA can accumulate in the oocytes (female egg cells) and embryos (early stage of development of an organism during pregnancy) and increases the chances of survival of the oocytes.
- DHA can make spermatozoids (sperm) more active, improving male reproductive ability.
- DHA intake helps lower the omega-6: omega-3 fatty acid ratio in animal feed. This reduces the synthesis of hormones that are responsible for menstruation, and increases the chance of implantation of the embryo in the uterus as well as the embryo's chances of survival.

Pigs

Offspring health The long-term nourishment of sows (female pigs) with a source of omega-3 fatty acids or DHA has been shown to increase the number of piglets born alive.

Overall, positive effects of DHA on piglets, including better growth rates, seem effective with a long-term, low level treatment of a DHA-rich feed.[33,34,35,36]

Reproductive ability Omega-3 fatty acid intake has been shown to increase the performance of sows, such as helping the sow return to estrus.[37,38]

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AlgaPrime™ DHA

Pets

Studies show that increased levels of DHA in pet food can provide certain health benefits. Below are discussions and conclusions from studies.

Cognitive ability

Heinemann, K.M. et al. (2005) Long–chain (n-3) polyunsaturated fatty acids are more efficient than alpha-linoleic acid in improving electroretinogram responses of puppies exposed during gestation, lactation and weaning. Journal of Nutrition, 135(8) 1960-6.

Taken together, the data from this study indicate an advantage of dietary DHA for retinal function in young dogs. Puppies consuming the highest concentrations of DHA in both milk and dry diet consistently demonstrated improved rod sensitivity (as measured by a-amp, ai, and It) and elicited the greatest increase in the amplification of the phosphodiesterase cascade. Although visual performance in puppies fed the high-ALA diet was not significantly lower than in those fed DHA, it was not generally equivalent to the level of retinal function observed in the DHA-fed puppies. Thus, when data from previous studies and the present work are considered collectively, the likelihood of dietary DHA in dogs resulting in retinal enrichment and its associated improvement in ERG-related measures helps confirm and extend the importance of DHA in fetal and neonatal development comparatively among mammalian species. New data reported here on the relation of dietary PUFAs and milk fatty acid composition will also aid in the development of the most appropriate diets for gestation, lactation, and weaning in dogs.

http://jn.nutrition.org/content/135/8/1960.long

Jewell, E.D. et al. (2012) Evaluation of cognitive learning, memory, psychomotor, immunologic, and retinal functions in healthy puppies fed foods fortified with docosahexaenoic acid–rich fish oil from 8 to 52 weeks of age. JAVMA, 241 (5) 583-594.

Results of the study reported here support the hypothesis that feeding foods rich in nutrients that enhance neurologic development (DHA, vitamin E, and taurine) and immune function (vitamin E) and combat oxidative stress (vitamin E and taurine) results in improved outcomes of various tests for discrimination learning, psychomotor ability, retinal function, and immunologic response to anti-rabies virus vaccination. Elucidation of which nutrient, or combination of nutrients, was responsible for the differences detected was not possible in the present study because of the complexity of the foods tested. Nonetheless, serum concentrations of DHA were positively correlated with contrast discrimination learning and ERG-measured retinal function, suggesting that this nutrient may be an important component in neurocognitive development in puppies.

http://avmajournals.avma.org/doi/abs/10.2460/javma.241.5.583?url_ver=Z39.88-2003&rfr_id=ori:rid:crossref.org&rfr_dat=cr_pub%3dpubmed

Wright-Rogers A.S. et al. (2005) Dietary fatty acids after plasma lipids and lipoprotein distribution in dogs during gestation, lactation and the perinatal period. Journal of Nutrition, 135(9), 2330-5.

It is of particular interest that plasma LDL cholesterol fractions of immature puppies were increased compared with normal adult dogs especially because dogs transport cholesterol predominantly via HDL. The present work is the first report of increased LDL cholesterol in puppies during suckling. An early study of canine LP metabolism showed that immature dogs demonstrated greater hepatic LDL receptor activities than mature animals in which such activities were undetectable at 24 mo of age (40). Canine liver contains 2 distinct LP receptors, an apo-B,E receptor, which binds both LDL and HDL cholesterol, and an apo-E receptor, which binds only HDL cholesterol. The apo-B,E receptor is active in immature, growing dogs, whereas only the apo-E receptor is present in mature animals (40). This observation is consistent with the increased concentration of LDL fractions present during early life in this study and reflects a period of increased metabolic demands for cell growth and maintenance. The reduction in plasma lipid and lipoprotein cholesterol concentrations with maturation suggests that apo-B,E receptors necessary for lipid metabolism are active soon after birth and decline rapidly thereafter.

http://jn.nutrition.org/content/135/9/2230.full

Cardiovascular health

Freeman et al. (1998) Nutritional Alterations and the Effect of Fish Oil Supplementation in Dogs with Heart Failure. J. Med. Int. Med. 11, 440-448

Although n-3 fatty acids have been tested in several studies of humans and animals, they have not previously been studied in dogs with heart failure. The current study demonstrates that administration of fish oil at a dosage of 27 mg/kg/day EPA and 18 mg/kg/day DHA altered plasma fatty acids and improved cachexia score in dogs with heart failure secondary to DCM. In addition, fish oil reduced IL- 1 production. Although these short-term changes are important, reductions in IL-1 also may have long-term benefits in this population of dogs because a reduction in IL-1 correlated with improved survival.

https://www.ncbi.nlm.nih.gov/pubmed/9857337

http://onlinelibrary.wiley.com/doi/10.1111/j.1939-1676.1998.tb02148.x/abstract

http://onlinelibrary.wiley.com/doi/10.1111/j.1939-1676.1998.tb02148.x/epdf

Sarrazin et al. (2007) Reduced Incidence of Vagally Induced Atrial Fibrillation and Expression Levels of Connexins by n-3 Polyunsaturated Fatty Acids in Dogs. J. Am. College Cardiol. 50 (15) doi:10.1016/j.jacc.2007.05.046

Oral treatment with fish oils increased atrial n-3 PUFA levels and reduced vulnerability to induction of AF in this dog model. Modulation of cardiac CX by n-3 PUFAs probably contributes to the antiarrhythmic effects of fish oils.

http://www.onlinejacc.org/content/50/15/1505

Laurent et al. (2008) Long chain n-3 polyunsaturated fatty acids reduce atrial vulnerability in a novel canine pacing model. Cardiovasc. Res. 77, 89–97

The main results of this study demonstrate that oral n-3 PUFAs supplementation, in an animal model of atrial remodelling and AF, reduced AF inducibility and maintenance, reduced conduction anisotropy in the left atrium, and prevented pacing-induced increase in collagen turnover and collagen deposition in atrial appendages.

http://cardiovascres.oxfordjournals.org/content/77/1/89