

Nutritional Management of Osteoarthritis

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Abstract: There is growing evidence of the role that nutrition can play in the management of veterinary patients with osteoarthritis. Current evidence supports nutritional management of body weight and dietary fortification with the long-chain omega-3 fatty acids eicosapentaenoic acid and docosahexaenoic acid. Additional studies suggest that supplements and diet additives such as glucosamine, chondroitin sulfate, antioxidants, and green-lipped mussel may also have some benefit in managing osteoarthritis. Additional research evaluating pets with naturally occurring disease, using validated owner questionnaires and objective measurements, is needed.

Osteoarthritis commonly occurs in dogs in association with articular diseases such as hip dysplasia, elbow dysplasia, and cranial cruciate ligament rupture. Osteoarthritis affects a large percentage of the canine population, approximately 20% of dogs older than 1 year.¹ Awareness of osteoarthritis in the feline population is growing, with documentation of osteoarthritis in 10.6% of cats in a hospital survey of feline radiographic studies.² Surgical and medical pain management have historically been the basis for treatment. However, there is growing evidence of the role that nutrition can play in the management of veterinary patients with osteoarthritis.

Weight Management

Nutritional management to help reach and maintain an ideal body condition is perhaps the single most effective means to help improve and maintain joint health. Obesity is known to increase stress on joint structures and articular cartilage. In addition, there is growing awareness of the metabolic activity of adipose tissue and the proinflammatory cytokines associated with obesity.³ Paired with osteoarthritis, obesity may contribute to reduced activity, leading to an increased risk for weight gain and perpetuation of the negative cycle.

Maintaining a lean body condition over an animal's lifetime has been shown to reduce the onset and severity of osteoarthritis in dogs.⁴ In dogs with clinical hip osteoarthritis, weight reduction of 11% to 18% of initial body weight was associated with a significant decrease in hindlimb lameness as assessed by subjective veterinary orthopedic examination using a numerical rating scale and visual analogue scale.⁵ In a more recent study,⁶ weight loss in obese dogs with osteoarthritis was shown to reduce lameness using both subjective and objective measurements. In this study, the dogs

Dr. Perea discloses that she is an employee of P&G Pet Care.

lost an average of 8.85% of their initial body weight.⁶ Improvements in lameness were seen beginning at a weight loss of 6.1%, and improvements in kinetic gait analysis were seen beginning at a weight loss of 8.85%. Force plate analysis has demonstrated that changes in body weight significantly affect peak vertical force in dogs with osteoarthritis, helping to confirm that improvements seen with weight loss are repeatable with objective measurements.⁷ Obesity in cats has also been associated with an increased risk of joint disease, with one study demonstrating that overweight cats were 2.9 times as likely to be taken to the veterinarian for lameness compared with lean cats.⁸ To my knowledge, there have been no studies evaluating the impact of weight loss on mobility in cats, but based on studies in other species, a benefit would be expected.

Omega-3 Fatty Acids

The use of long-chain omega-3 fatty acids, specifically eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), may help modulate the inflammatory response. Fatty acids incorporated into cell membranes serve as precursors for prostaglandins, leukotrienes, and thromboxanes. Those generated from arachidonic acid (an omega-6 fatty acid) are of the 2 and 4

Key Points

- Weight management should be part of the first-line approach in patients with osteoarthritis.
- High levels of the omega-3 fatty acids EPA and DHA may help to modulate inflammation and improve clinical signs of disease.
- Diets fortified with glucosamine and chondroitin sulfate may provide benefit, but supplementation may be needed to reach therapeutic dosages.
- Supplements such as antioxidants and green-lipped mussel may provide additional benefits, but more research is needed.

Table 1. Current Veterinary Therapeutic Formulas Indicated for Joint Disease

Product Name ^a	Protein (% ME)	Fat (% ME)	Carbohydrate (% ME)	Total Omega-6 (g/1000 kcal)	Total Omega-3 (g/1000 kcal)	Omega 6:3 Ratio	Total kcal
Canine Formulas							
Hill's Prescription Diet j/d dry	19	33	48	7.14	9.52	0.75	336/cup
Hill's Prescription Diet j/d canned	16	39	45	6.84	10.11	0.68	498/13 oz
Iams Veterinary Formula Joint Plus dry	27	28	45	3.59	0.72	4.99	296/cup
Iams Veterinary Formula Weight Loss/Mobility Plus Restricted-Calorie dry	30	20	50	3.42	0.59	5.80	227/cup
Purina Veterinary Diets JM Joint Mobility dry	30.6	30.8	38.5	4.40	2.50	1.76	351/cup
Purina Veterinary Diets JM Joint Mobility canned	33.7	41.9	24.5	9.20	3.40	2.71	426/13.3 oz
Royal Canin Veterinary Diet Mobility Support JS dry	24.3	26.2	49.5	6.77	2.19	3.09	324/cup
Royal Canin Veterinary Diet Mobility Support JS Large Breed dry	25.9	26.9	47.2	6.59	3.08	2.14	307/cup
Feline Formulas							
Hill's Prescription Diet j/d dry	30	44	26	9.30	3.96	2.35	506/cup
Hill's Prescription Diet j/d canned	32	38	30	10.25	2.97	3.45	152/5.5 oz
Iams Veterinary Formula Weight Loss/Mobility Plus Restricted-Calorie dry	37	26	37	2.63	0.53	4.96	288/cup
Royal Canin Veterinary Diet Mobility Support JS dry	27.4	33.0	39.6	9.34	2.97	3.14	370/cup

^aInformation obtained from company product guides.

ME = metabolizable energy.

series, while those generated from EPA (an omega-3 fatty acid) are of the less inflammatory 3 and 5 series. Therefore, feeding a diet that delivers high levels of long-chain polyunsaturated fatty acids and a low omega-6-to-omega-3 fatty acid ratio ($\leq 5:1$) may help to control inflammation related to osteoarthritis. **TABLE 1** lists currently available veterinary therapeutic diets indicated for joint disease and their omega-3 and omega-6 fatty acid concentrations.

Veterinary therapeutic diets designed with high omega-3 fatty acid concentrations have been evaluated in three recent clinical trials in dogs with naturally occurring osteoarthritis.⁹⁻¹¹ In the first two studies,^{9,10} dogs were fed a combination of an over-the-counter dry and canned diet delivering <0.01% combined EPA and DHA on a dry matter (DM) basis or a combination of a veterinary therapeutic dry and canned diet delivering approximately 0.81% combined EPA and DHA on a DM basis (2.25 g/100 kcal). The total omega 6:3 ratio was 24.33:1 in the control formula and 0.71:1 in the test formula. In the first study, there were no significant differences in investigator assessments of clinical signs at any of the

assessment points over the 24-week study period; however, owner questionnaires showed that, compared with dogs fed the control diet, dogs fed the test diet had a subjectively improved ability to rise from a resting position and play at 6 weeks and an improved ability to walk at 12 and 24 weeks.⁹ In addition to veterinary examination and owner questionnaires, the second study¹⁰ included force plate analysis evaluations at day 0 and day 90. Neither the veterinary examination nor owner scores showed significant differences over time in this study. The force plate analysis study did not show a difference between dogs fed the control and the test diets at the start or end of the study; however, when looking at improvements over time, the study did find that 82% of dogs fed the test diet had a significant improvement in peak vertical force compared with only 38% of dogs fed the control diet.¹⁰ Neither of these studies showed differences in body weight or body condition score between groups, helping to control for weight loss as a variable.

The third study¹¹ evaluated EPA and DHA supplementation at levels greater than those used in the first two studies. The three test

diets in this study provided 0.8% DM (2.2 g/1000 kcal; diet A), 2.0% DM (5.3 g/1000 kcal; diet B), and 2.9% DM (7.5 g/1000 kcal; diet C) of combined EPA and DHA. The total omega 6:3 ratios in these test diets were 0.79:1, 0.63:1, and 0.46:1, respectively. Results of this study found no differences in orthopedic examination scores throughout the study between dogs receiving diets A and B. Orthopedic examination scores showed improvements in lameness and weight bearing, but no difference in range of motion, reluctance to hold up contralateral limb, or pain on palpation in dogs fed diet C compared with dogs fed diet A, suggesting that the inclusion of additional EPA and DHA may provide some benefit. Additional studies with objective force plate analysis data may provide further insight into the most effective dosing strategy for dogs with osteoarthritis.

In cats, one study evaluated 40 patients with degenerative joint disease fed a control diet providing 0.03 g/1000 kcal of combined EPA and DHA or a test formula providing 2.97 g/1000 kcal of combined EPA and DHA.¹² There were no differences between diet groups for changes in orthopedic pain scores over the 70-day study period. However, the study did demonstrate an increase in activity via objective activity monitoring (accelerometry) in the test group and a concurrent decrease in activity in the control group. This test diet was also supplemented with green-lipped mussel extract and glucosamine and chondroitin sulfate, which may have contributed to the results seen.

Glucosamine and Chondroitin Sulfate

Glucosamine and chondroitin sulfate serve as precursors for glycosaminoglycans and other components of articular cartilage.¹³ Results of in vitro studies also suggest that glucosamine and chondroitin sulfate suppress proteolytic enzymes and inflammatory cytokines.¹⁴ Glucosamine and chondroitin sulfate have not been independently evaluated as components in commercial pet foods, and the levels provided in commercial pet food are generally much lower than levels shown to have clinical benefit when given in supplemental form.¹⁵ When given in supplemental form, dogs treated with glucosamine and chondroitin sulfate showed significant improvements in scores for pain, weight bearing, and severity of lameness by day 70 of treatment; however, lameness and joint mobility scores were not significantly improved from pretreatment. Additionally, this trial had a positive control (carprofen) but not a placebo, and objective measures (such as force plate analysis) were not attempted.¹⁵

Antioxidants

The use of supplemental antioxidants has not been extensively evaluated as an independent variable in clinical studies of veterinary patients with osteoarthritis. Boosted levels of antioxidants are commonly incorporated into therapeutic pet foods to help manage the excessive production of free radicals that can be associated with clinical disease, including arthritis.¹⁵ One small study evaluating 18 dogs with clinical osteoarthritis looked at the use of a proprietary antioxidant supplement over 14 weeks and reported improvements in lameness evaluations with supplementation.¹⁶ Detailed results of this study are limited, but they provide some evidence to suggest that antioxidants may have an independent positive effect.

Other Nutrients and Areas of Future Research

Many nutritional supplements have previously been reviewed and are beyond the scope of this article.¹³ One supplement that has been used in commercial therapeutic pet foods, green-lipped mussel, is credited with having antiinflammatory components.¹⁷ Dogs with clinical osteoarthritis that received green-lipped mussel included in their diet at 0.3% DM were shown to have improvements in subjective joint pain and swelling scores.¹⁷ Changes in joint crepitus and range of joint movement were not significantly different between the test and control groups, and objective measures (such as force plate analysis) were not attempted.

Recent clinical studies have provided a better understanding of nutritional management of osteoarthritis. Many nutritional approaches have been aimed at controlling body weight and inflammation. Other nutritional areas that have been shown to affect immune function, such as the use of probiotics, may build upon the benefits currently recognized.¹⁸ Future research evaluating pets with naturally occurring disease, using validated owner questionnaires and objective measurements, is needed.

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