Introduction: Omega-3 (N3) fatty acid supplementation has been used as adjunctive therapy for inflammatory and degenerative osteoarthritis. Inflammation involves release of cytokines from membrane-bound fatty acids. These fatty acids may be modified by feeding different types of polyunsaturated fatty acids (PUFAs). Arachidonic acid (AA), a 20-carbon omega-6 (N6) fatty acid, is the predominant PUFA incorporated into cell membranes. However, when N3 PUFAs are fed, eicosapentaenoic acid (EPA), a 20-carbon N3 fatty acid, substitutes for AA. When eicosanoid metabolism is induced, EPA competes with AA as substrate for cytokine-producing enzymes and different inflammatory prostaglandins, leukotrienes, and thromboxanes are produced.1,2 These cytokines of the 3 and 5 series tend to be less inflammatory. We tested the hypothesis that consumption of a low N6 fatty acid diet by healthy dogs would be associated with incorporation of N3 fatty acids into synovial membranes, lower serum lipid parameters, lower synovial prostaglandin E synthesis, and no adverse effects when compared with consumption of a high N6:N3 diet.

Materials and Methods: The study was conducted with the approval of the Animal Care and Use Committee (ACUC #A960087C2). Eighteen dogs were randomly assigned to 3 dietary groups. Group 1 (High N6) was fed a diet formulated to contain an N6:N3 ratio of 28.8:1.0, group 2 (Control) was fed a diet formulated as a maintenance diet with an N6:N3 ratio of 8.7:1.0, and group 3 (Low N6) was fed a diet with an N6:N3 ratio of 0.7:1.0. Diets were fed to dogs prior to induction of osteoarthritis. Serum was obtained at baseline, 3, 6, and 12 months following stifle stabilization (pre-stabilization) and 1, 2, 3, and 6 months post-stabilization (post-stabilization). Synovial fluid and phospholipid concentrations were measured using commercially available colorimeter assays (Fischer Stanbio #8000, tricerycide #2000, cholesterol #1010, Waco phospholipid B, 99654001). Fatty acid composition of synovial membranes and diet were determined using gas chromatography after extraction.3 Mean and standard deviation results were calculated using absolute numbers as well as changes from baseline. A mixed linear-model repeated measures analysis was used. (p < 0.05)

Results: Serum cholesterol, triglyceride, and phospholipid concentrations were measured using commercially available colorimeter assays (Fischer Stanbio #8000, tricerycide #2000, cholesterol #1010, Waco phospholipid B, 99654001). Fatty acid composition of synovial membranes and diet were determined using gas chromatography after extraction.3 Mean and standard deviation results were calculated using absolute numbers as well as changes from baseline. A mixed linear-model repeated measures analysis was used. (p < 0.05)

Discussion: Consumption of a Low N6 fatty acid diet by healthy dogs undergoing cranial cruciate transection and extra-capsular surgical repair was associated with lower serum concentrations of cholesterol, triglyceride, and phospholipids, incorporation of N3 fatty acids into synovial membranes, decreased PGE2 concentrations, and less severe clinical and radiographic evidence of osteoarthritis. A low N6 diet may decrease joint inflammation and inflammatory cytokine production as well as decreasing lameness when fed to dogs prior to induction of osteoarthritis.


Neural lipid and phospholipid concentrations were not significantly different between time points; however, diet groups were significantly different from each other. Synovial fluid PGE2 levels increased post-transection in all dietary groups, by 3 months, the High N6 group had significantly higher PGE2 than did the Low N6 group. At 1 month post-stabilization, PGE2 levels in the High N6 group were significantly greater than both the Control and Low N6 groups. This relationship continued until 9 months post-stabilization. Radiographic scores. As expected, radiographic scores increased in all dietary groups after transection (Fig 1). Post-stabilization, radiographic scores continued to increase at a slower rate, with the low N6 group score significantly lower than the other groups at 9 months post-stabilization.