

Osteoarthritis in Dogs—Effect of Diet

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Abstract

The pathogenesis of osteoarthritis in dogs involves genetic factors and environmental factors that elicit or accelerate cartilage damage, promoting degenerative changes. Excessive body weight is a risk factor for development of osteoarthritis in canines. Obesity may result in osteoarthritis as a result of excess forces placed on joints and articular cartilage, which may lead to inactivity and further development of obesity; thus, a vicious cycle ensues. Osteoarthritis cannot be cured and management aims at the relief of pain through reduction of inflammatory reactions and further breakdown of cartilage. Weight management is beneficial in the management of osteoarthritis. Over a long period of time, the association of osteoarthritis with nutrition in small animal medicine has been a center of study. This paper focuses on the role of diet and nutritional modification in the management of osteoarthritis in dogs. Various nutritional components capable of modifying the inflammation are discussed.

Keywords

Bone, Diet, Canine, Inflammation, Joint

1. Introduction

Canine osteoarthritis is a joint disease commonly seen in veterinary practice. Osteoarthritis is a degenerative and inflammatory condition in which there is a loss of cartilage matrix associated with a release of pro-inflammatory cytokines [1] which results in articular cartilage degradation, thickening, and sclerosis of subchondral bone, synovitis, and varying degrees of fibrosis. The pathogenesis of osteoarthritis in dogs involves genetic factors [2] and environmental (non-genetic) factors that elicit or accelerate cartilage damage, promoting degenerative changes. Ultimately, osteoarthritic diseases are manifested by morphologic, biochemical, molecular, and biomechanical changes of cells and matrix that lead to softening, fibrillation, ulceration, articular cartilage loss, sclerosis and subchondral bone eburnation, and osteophyte production. When clinically evident, osteoarthritic diseases are characterized by joint pain, tenderness, limitation of movement, crepitus, occasional effusion, and variable degrees of inflammation without systemic effects [3]. Osteoarthritis cannot be cured and management aims at the relief of pain through reduction of inflammatory reactions and further breakdown of cartilage. Current treatment involves the use of Non-Steroidal Anti-Inflammatory Drugs (NSAIDs) to decrease inflammation and consequently pain, and various nutraceuticals, administered as supplements or incorporated into industrially produced dog foods. For years, the discussion of osteoarthritis and nutrition in small animal medicine has centered on nutrition and developmental orthopedic disease or the association between obesity and osteoarthritis. This paper focuses on the effect diets in patients with chronic osteoarthritis.

Excessive body weight has been documented as a risk factor for development of osteoarthritis in canines [4]. Individual diet control intervention combined with telemedicine-based exercise intervention significantly improves the body composition and lower-limb functional performance [5]. Obesity may result in osteoarthritis as a result of excess forces placed on joints and articular cartilage, which may lead to inactivity and further development of obesity; thus, a vicious cycle ensues. Additionally, adipose tissue is recognized as being metabolically active and pro-inflammatory; therefore, obesity may contribute to inflammation [6]. Weight reduction from an obese state is beneficial in the management of

osteoarthritis [7, 8]. It may be possible to modify the inflammation by nutritional components as follows.

2. ω -3 fatty acids

Osteoarthritis cartilage destruction results from low grade inflammation triggered by a high-fat diet [9]. Degenerative osteoarthritis involves an inflammatory component; thus, it may be possible to modify the inflammation by ω -3 fatty acids. Many drugs used to treat degenerative osteoarthritis inhibit conversion of arachidonic acid to these eicosanoids. These n6-derived eicosanoids have, for the most part, vasoactive and pro-inflammatory effects. Substituting an n3 fatty acid in the membrane may decrease these responses [10].

3. Antioxidants

The formation of free radicals as a consequence of cellular metabolism occurs constantly, but the potential deleterious effects are minimized by antioxidants. The balance between free radicals and antioxidant defenses is a key factor in preventing development of noxious processes at the cellular and tissue levels. The excessive production of free radicals may be related to such processes as aging, cancer, diabetes mellitus, lupus, and arthritis. Thus, antioxidant therapy may be of benefit in the treatment of osteoarthritis [11].

4. Chondromodulating agents

Chondromodulating agents are purported to slow or alter the progression of osteoarthritis. These agents are considered to be slow-acting drugs in osteoarthritis and can be subdivided into symptomatic slow-acting drugs in osteoarthritis and disease-modifying osteoarthritis drugs. Beneficial effects may include a positive effect on cartilage matrix synthesis and hyaluronan synthesis by synovial membrane as well as an inhibitory effect on catabolic enzymes in osteoarthritic joints [12]. Examples include Glucosamine and Chondroitin Sulfate. Although many of these products are administered as a supplement or alternative treatment, some, such as glucosamine and Green-Lipped Mussel, are incorporated into pet foods.

5. Other dietary compounds

There are many other dietary supplements, including herbs and other nutraceutical agents that are recommended.

5.1 P54FP

P54FP is an extract of Indian and Javanese turmeric, *C domestica* and *C xanthorrhiza*, respectively, which contains a mixture of active ingredients, including curcuminoids and essential oils [13]. There is evidence that these active ingredients possess anti-inflammatory activity. Specifically, curcumin has been shown to inhibit prostaglandin E2 and cyclooxygenase-2 as well as nuclear factor- κ B [14].

5.2 Avocado/Soy

Avocado/Soy has anti-osteoarthritic property by inhibiting interleukin-1 and stimulating collagen synthesis in cartilage cultures [15]. It shows beneficial effects on symptoms of osteoarthritis and has some structure modification capabilities.

5.3 Boron

Boron deficiency in food may be part of the cause of some arthritides. Epidemiologic studies suggest that human beings in countries with low boron intake (less than 1.0 mg/d) have a higher risk of development of arthritis when compared with human beings in countries in which boron intake is higher (3-10 mg/d) [16].

5.4 Boswellia Resin

Resin from the bark of *Boswellia serrate* tree is purported to have anti-inflammatory properties. Boswellia resin has been shown to improve clinical signs and pain in human beings [17] and dogs [18].

5.5 Cat's Claw

Cat's claw, an Amazonian medicinal plant, has anti-inflammatory and antioxidant effects and has been shown to decrease clinical signs of knee arthritis and rheumatoid arthritis in human beings [19].

5.6 Creatine

Creatine is used in muscle for production of ATP, which provides energy for muscle contraction. Creatine supplementation with rheumatoid arthritis increases serum and skeletal muscle creatine content [20].

5.7 Special Milk Protein Concentrate

Milk contains a number of biologically active compounds, including immunoglobulins, cytokines, enzymes, hormones, and growth factors. These compounds impart anti-inflammatory properties that have been recognized in human breast milk [21] and milk from hyper-immunized cows [22]. A concentrate prepared from milk of hyper-immunized cows (Microlactin) exerts anti-inflammatory properties [23].

6. Conclusion

Research supports a role of nutrition and nutritional modification in the management of osteoarthritis in dogs. Furthermore, weight management, including weight reduction and prevention of obesity, has a positive impact on the incidence and clinical signs of osteoarthritis in dogs. Feeding diets that contain increased n3 fatty acids and other dietary compounds has been shown to help dogs with osteoarthritis. Whether other dietary ingredients provide benefit has yet to be determined.

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