

THE INFLUENCE OF DIET ON SKELETAL DEVELOPMENT IN LARGE BREED DOGS

At a Large Breed Health Care Symposium symposium organised by The Iams Company, veterinarians from across Europe heard leading experts in canine and human health discuss the benefits of nutraceuticals and balanced minerals on cartilage and skeletal health of large breed dogs.

Speaking on the effects of nutraceuticals on cartilage health and integrity, Prof Yves Henrotin (University of Liege, Belgium) reviewed the evidence that some nutraceutical compounds can effectively interfere with cartilage degradation. He discussed the composition of adult human articular cartilage and its composition of hydrated extensive extracellular matrix (ECM) in which are embedded a small number of chondrocytes, metabolically functional units of the cartilage responsible for the elaboration and maintenance of the ECM¹. In normal conditions, cartilage matrix homeostasis is maintained by successive phases of cartilage resorption and formation. In osteoarthritis (OA) this metabolism is dysregulated and, progressively, the resorption of the cartilage exceeds the repair capacities of the chondrocytes until, finally, irreversible cartilage lesions appear².

For decades, the traditional pharmacological management of OA has been mainly symptomatic without well documented influence on the structural progression of the disease. However some nutraceuticals have shown symptomatic or structural efficacy in OA.

Chondroitin Sulphate

Chondroitin Sulphate (CS) is a major component of the ECM in many connective tissues, including cartilage. Several studies have demonstrated that CS (1,200 mg/day) may help alleviate symptoms of hip and knee osteoarthritis, as well as improving joint function³ and have shown evidence of structural effects on human hand and knee OA^{4,5}.

Glucosamine Sulphate

The efficacy of Glucosamine (GS) at relieving pain and improving joint function has been demonstrated in several randomised, placebo controlled clinical trials, in patients suffering from OA predominantly of the knee or spine^{6,7}.

Antioxidants

Whilst one study found no strong evidence that dietary intake of antioxidants can protect against incidence of knee OA, both its progression and the development of knee pain appeared reduced in people with high intake of vitamin C⁸. The clinical effectiveness of vitamin E (400 mg of α -tocopherol twice a day/six weeks) in OA of the limbs has also been demonstrated⁹.

In summary, Prof. Henrotin commented: “The effect of nutraceuticals on OA is most compelling with glucosamine sulphate showing potential for inhibiting its progression, whilst some evidence hints that chondroitin sulphate could be used in the same indication. However, both of these compounds have clearly demonstrated a symptomatic action, mainly in OA of the lower limbs, although all conclusive evidence resulted from the use of prescription medicines only”.

Calcium Metabolic Studies

Growing animals have a high calcium (Ca) requirement, as it is a principal element of bone mineral. Its ratio to other minerals such as phosphorus (P), and energy is of great importance for optimal skeletal development. Excessive Ca intake can result in retarded growth and osteochondrosis whereas deficient intake can result in hyperparathyroidism¹⁰.

Dogs are completely dependent on dietary vitamin D¹². Vitamin D is necessary in order to prevent rickets in growing animals and is an essential hormone in the regulation of Ca absorption¹¹.

Presenting an update on calcium metabolic studies in growing Great Danes,

Dr. Marianna Tryfonidou (University of Utrecht, The Netherlands) outlined research showing giant and large breed dogs to be more prone to distinct skeletal disorders than smaller dogs if they consume high calcium levels^{10,13}. However, this is not explained by the lower Ca:energy ratio requirements of small breeds – therefore other metabolic factors, including growth and growth velocity may be contributing factors¹⁴. In a study of Great Danes vs Miniature Poodles fed a wide range of calcium intake, it was shown that fractional Ca absorption decreased from weaning until puberty in Great Danes, whereas it did not change with time in Miniature Poodles. However, this decreased Ca absorption in Great Danes is not enough to protect them against detrimental effects of high dietary Ca.

In conclusion, the difference in vulnerability between small and large breed dogs in developing skeletal disorders at an inappropriate high Ca intake cannot only be attributed to a difference in their Ca absorption. Small and large breed dogs have differences in their vitamin D metabolism, which combined with a major difference in growth velocity and growth factors may play an important aetiological role in the development of skeletal disorders.

Diagnosis and Treatment of Skeletal Problems in the Growing Dog

Professor Hazewinkel from Utrecht University (The Netherlands) gave an overview of elbow disease due to either traumatic, hereditary, and/or nutritional causes¹⁵. Osteochondrosis of the elbow joint, together with medial coronoid fragmentation, represent two of the highest threats for the most popular large breed dogs having a hereditary component, with an important causative influence of a too high intake of dietary calcium. The ununited anconeal process with elbow incongruity, which can be due to breed standards, or due to excessive dietary calcium content, causes severe lameness if left untreated. Less frequently diagnosed diseases, including the loosening of the attachment of muscles of the carpus and digits, and broken or luxated elbow joints, were all clearly illustrated with slides and video during Professor Hazewinkel's presentation.

New techniques which are now available for the modern veterinarian are used to help localise unusual skeletal lesions (utilising bone scintigraphy), or to evaluate surgical and nutritional intervention for lameness in dogs (utilising force plate analysis).

All the diseases discussed by Prof. Hazewinkel can cause osteoarthritis of the elbow joint leading to serious consequences for the dog. The role of an unbalanced diet as a causative factor for these diseases was emphasized, as well as the role nutrition can play in osteoarthritis treatment, i.e. weight-reducing diets to prevent overloading of the arthritic joint, adapted fatty acid composition and anti-oxidants to reduce joint inflammation, and nutraceuticals which may support joint regeneration¹⁵.

Prof. Hazewinkel summarised: "In large breed dogs, osteochondrosis is more prevalent in males and faster growing females. Owners of at-risk breeds should be encouraged to provide high quality, balanced food for young dogs, with a guaranteed maximum calcium content of 0.8-0.9% on a dry matter basis. This type of diet would be appropriate for dogs to prevent other causes of elbow dysplasia and some generalised bone diseases as well."

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