

## DIETARY MINERAL LEVELS AFFECT BONE DEVELOPMENT IN GREAT DANE PUPS

(Reprinted from an article by Henry J. Baker, DVM in DVM News Magazine, Vol 29 Number 7, July 1997.)

Veterinarians have been concerned for years with advising their clients on how to provide adequate nutrition for growing large and giant breed puppies while minimizing the risk of developmental bone disease.

Breeders and owners often seek to produce large, healthy puppies and may feed and supplement for maximal growth rates in these breeds. However, such improvised nutritional plans are likely to result in a high frequency of developmental bone diseases.

Because genetics and environment may also play a role and because puppies fed complete and balanced commercial diets may develop these disorders because of non-nutritional effects, making specific, potentially preventive nutritional recommendations has been difficult. New research findings may enable veterinarians to provide their clients with more detailed information on how diets, specially formulated for large and giant breeds, may decrease skeletal disease.

Scientists at the Scott-Richey Research Center and the College of Veterinary Medicine of Auburn University (myself and Drs. Brawner, Cox, Goodman, Hathcock, Kincaid, Lauten, Montgomery and Rumph) in collaboration with Drs. Allan Lepine and Greg Reinhart of the Iams Company, have been studying skeletal development in Great Dane puppies fed diets containing 2.7 percent calcium and 2.2 percent phosphorous (designated "high mineral") and 0.8 percent calcium and 0.67 percent phosphorous (designated "medium mineral") or 0.48 percent calcium and 0.40 percent phosphorous (designated "low mineral").

Early results suggest that puppies fed a high mineral diet were more likely to develop lameness or clinical signs of acute skeletal abnormalities such as hypertrophic osteodystrophy and osteochondrosis, compared with puppies fed medium or low mineral diets. Although the concentrations in the medium-mineral diet are less than those usually found in puppy diets (minimum dietary levels established by the Association of American Feed Control Officials for growing dogs are 1.0 percent calcium and 0.8 percent phosphorus), pups fed the medium mineral diet did not show signs of mineral deficiency and met normal developmental milestones through 6 months of age. Data collection is ongoing and will continue until the pups have reached 18 months of age.

Lameness was a common finding on serial clinical orthopedic examinations during the first 6 months of life in pups fed the high mineral diet. Several pups had clinical signs of hypertrophic osteodystrophy as well as clinical and radiographic evidence of craniomandibular osteopathy. Some puppies fed the high mineral diet also had serious conformation problems and as a group, had more frequent stature and gain abnormalities than puppies fed the other diets.

Puppies fed the medium mineral diet grew at a moderately rapid rate during the first six months, but that growth was not associated with the clinical, radiographic and conformational problems seen in the high mineral group. This growth rate appeared to be less than the maximal growth rate for the breed, although pups in the medium mineral group seemed to mature more quickly than those in the other groups with a more advanced body composition profile and greater body size. During the first six months, puppies fed the low calcium diet grew more slowly than those fed the high and medium mineral diets. Like the medium mineral group, puppies fed the low mineral diet had fewer skeletal abnormalities.

High mineral content and caloric density of the diet have been associated with hypertrophic osteodystrophy, osteochondrosis and hip dysplasia in other studies of large and giant-breed dogs. Development of these conditions has been related to the rapid growth in pups fed high energy diets and the increased bone density and decreased bone remodeling in pups fed high mineral diets. Immature dogs do not appear to be able to effectively limit intestinal absorption of dietary calcium. Because of this inability, the higher the calcium level in the diet, the more calcium that will be absorbed and incorporated into developing bone. The resulting disturbances of endochondral ossification can lead to the characteristic skeletal and joint lesions.

Controlling skeletal growth is considered critical in decreasing the expression of developmental bone disease in large and giant breed puppies. For these puppies, intake of calories and calcium should be restricted to a level that supports an adequate, but not excessive growth rate. If large and giant breed puppies are given unrestricted access from weaning to a puppy food with usual mineral and energy content, high mineral intakes may quickly result in bone mineral changes that could contribute to persistent skeletal problems.

The optimal diet for large and giant breed puppies appears to be lower in mineral content (similar to 0.8 percent calcium/0.67 percent phosphorus) and calories than conventional growth diets. Decreasing the nutrient density allows owners to provide reasonable portions, without fueling too-rapid growth and increasing the risk of developmental bone disease. Such diets should be fed on a portion-controlled basis from weaning to maturity.

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