DIET AND CIRCULATING 25-HYDROXYVITAMIN D LEVELS IN DOGS

KA Selting, CR Sharp, R Ringold, Backus

University of Missouri, College of Veterinary Medicine, Columbia, MO.
Tufts Univ., Cummings School of Veterinary Medicine, North Grafton, MA.
Veterinary Diagnostics Institute, Inc., Simi Valley, CA.

Background
The vitamins D2 and D3 are secosterol prohormones whose active metabolite, 1,25-dihydroxyvitamin D (1,25(OH)2D), is an important hormone, transcriptional activator, and immunomodulator. Since circulating levels of 1,25(OH)2D are tightly regulated by the body, serum 25-hydroxyvitamin D (25(OH)D) is the best indicator of vitamin D status.

Vitamin D modulates cell growth, neuroendocrine and immune function, and reduces inflammation. Many genes, modulated in part by vitamin D, encode proteins that regulate cell proliferation, differentiation, and apoptosis. Many cells have vitamin D receptors, and some convert 25(OH)D to 1,25(OH)2D.

Expanding models of vitamin D look to its impact on cellular health. “Deficiency”, “insufficiency,” and “sufficiency” terms that define increasing levels of vitamin D which are linked to many disease states including cancer and other serious diseases.

In dogs, the primary source of vitamin D is diet (predominantly via commercial dog food). Our goal was to determine how food source and supplements affect 25(OH)D concentrations.

Methods
Study Population
German Shepherd, White Shepherd, and Golden Retriever dogs, recruited from breed clubs across the USA between April 2011 and January 2012, were eligible for inclusion. Dogs were "apparently healthy" according to the owner (and in most cases, veterinarian) with no history of serious disease or current illness. Serum was collected and 25(OH)D levels were determined. Pet owners completed a questionnaire regarding diet and supplements.

VDI-25(OH)D Assay
Serum 25(OH)D was evaluated by Veterinary Diagnostics Institute. The assay is a direct competitive chemiluminescence immunoassay specific for total 25(OH)D.

Objective
To evaluate the vitamin D levels in 'apparently healthy' dogs to determine how food source and supplements affect circulating blood stores of 25(OH)D.

Results
Cohort
A total of 320 dogs met the criteria and were enrolled in the study. The signalment distribution is listed in Table 1.

Commercial Manufacturers
There were 41 different manufacturers of commercial dog food represented along with a group solely on a 'home-made' diet and a mixed group comprised of both commercial and home-made. Overall serum 25(OH)D levels ranged from 9.5 – 249 ng/ml, with median, Q1, Q3 at 69.7, 54.5, 88.1 ng/ml, respectively.

Discussion
Serum 25(OH)D levels vary widely among 'apparently healthy' dogs (9.5 – 249 ng/ml). Because skin synthesis of vitamin D is minimal in dogs, these differences can be attributed to dietary intake. Salmon oil supplementation, known for its high concentration of vitamin D, has a significant impact on vitamin D levels, whereas the effect of fortified dog biscuits is far less. Surprisingly, fish oil has no effect, though information on dose or timing relative to meals was not available. Differences in bio-availability and absorption may affect how much vitamin D is actually absorbed, especially given that vitamin D is fat soluble.

Neuter status correlated with vitamin D concentration. Median 25(OH)D was 9% lower in spayed compared to intact females, but 27% lower in neutered compared to intact males. Intact status, particularly males, appears to have an impact on serum vitamin D.

An evolving model of vitamin D and its impact on health is redefining levels needed to reduce the risk for cancer and other serious diseases. Vitamin D deficiency, below that needed for proper skeletal development, is typically defined as less than 20-25 ng/ml (Hazenwinkel, HAE, MICE, 2002). In dogs, low 25(OH)D has been associated with lymphoma, mast cell neoplasia, sarcoma, heart and kidney disease, hemangiosarcoma, and IBD (Gerber, B, AVP, 2003; Gerber, B, VRC, 2004; Gown, AG, JAP, 2011; Wakshlag, J, Brin nko 2011; Selting K, ACS abstract, 2012). Our group has defined vitamin D insufficiency at serum levels at or above 100ng/ml. In the cohort reported in this study, and using these limits, many apparently healthy dogs are vitamin D insufficient and a few are even deficient.

Conclusion
Diet plays an important role in 25(OH)D levels in dogs. Significant formulary differences exist by brand and, other than salmon oil, standard supplements have a minimal impact on serum concentrations of 25(OH)D. Intact status, particularly in males, significantly affects vitamin D absorption.

Commercial dog food manufacturers may need to reassess their formulary policies on vitamin D content to adapt to an evolving model of vitamin D sufficiency. A growing body of evidence associates low stores of 25(OH)D with cancer and other serious diseases. Further studies are warranted to assess how absorption levels may be affected by intact status, breed, age, weight and other factors.