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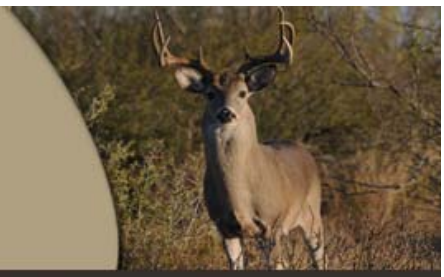

Deer Nutrition - Part 4
Vitamins - Minding Mom's Mandate

by David G. Hewitt

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Vitamins are the fourth nutrient category in the Deer Associates eNews nutrition series. Compared to **energy**, **protein**, and **minerals**, even less research has been done on vitamin nutrition in white-tailed deer.

What are Vitamins?
Vitamins are complex organic compounds necessary in small amounts for normal metabolism. Translation: To be healthy, both you and your deer need to follow your Mom's advice – Take your vitamins. In contrast to protein, carbohydrates, and fats which are required in relatively large amounts (e.g. grams/day), vitamins are required in minute amounts (milligrams or even micrograms/day). Vitamins differ from minerals because minerals are inorganic, whereas vitamins are produced by plants, microbes, and even the deer themselves, and thus are organic.

Vitamins are generally part of enzyme systems, the metabolic machinery that makes a deer work. Because enzymes have specific functions in an animal, too little of a vitamin often has characteristic deficiency symptoms, such as night blindness for too little vitamin A, rickets for too little vitamin D, and scurvy for vitamin C.

There are two broad categories of vitamins, fat-soluble and water-soluble. The distinction is important because fat-soluble vitamins can be stored in the deer's liver and fat, whereas water-soluble vitamins cannot be readily stored. Storage enables a deer to integrate its vitamin requirements over long periods, reducing the probability of deficiency if intake is reduced for several weeks. For example, livestock fed diets with insufficient vitamin A may not develop deficiency symptoms for 2-4 months. In contrast, water-soluble vitamins are readily excreted and therefore must be continually replaced.

Another important difference between water- and fat-soluble vitamins is that water-soluble vitamins can be synthesized by microbes in the **rumen**, whereas only one of the four fat-soluble vitamins can be produced by rumen microbes. Thus, deficiencies of water-soluble vitamins are less likely in deer than are deficiencies of fat-soluble vitamins.

Fat-Soluble Vitamins

Vitamins A, D, E, and K are fat-soluble. Vitamin K is produced in sufficient quantities by rumen microbes to meet a deer's normal requirements. Vitamin D is synthesized in sufficient amounts when deer are exposed to sunlight. Therefore, vitamins A and E are the fat-soluble vitamins that could be a concern.

Green, leafy plants have high concentrations of vitamins A and E.

Vitamin E and precursors of vitamin A are abundant in green, leafy forage; thus deficiencies are only likely during extended drought or perhaps winter. Vitamin E is important in immune function and in the integrity of cell membranes. Vitamin A is important in tissue differentiation and growth. Thus, adequate intake of both these vitamins is important for all deer, but especially for production of large, healthy fawns. Paul Brady and colleagues in Michigan conducted one of the few studies of vitamin nutrition in white-tailed deer. They demonstrated that pre-weaning mortality of fawns born to does fed a diet deficient in vitamin E was greater than fawns whose dams consumed a diet with sufficient vitamin E. Other research has investigated the role of vitamin A in antler growth. High concentrations of vitamin A in growing antlers appears to increase antler size. Thus, adequate intake of vitamins A and E during spring and summer appears to be especially important.

Water-Soluble Vitamins

There are 10 water-soluble vitamins (including all the B vitamins, niacin, folic acid, and vitamin C) that vertebrate animals typically require. A large body of research on domestic ruminants suggests that rumen microbes produce sufficient amounts of water-soluble vitamins to meet the ruminant's requirements. Although conventional wisdom suggests vitamin synthesis by rumen microbes also enable white-tailed deer to meet their requirements, supporting research is lacking. Furthermore, there are instances in which growth and production of domestic ruminants improves with supplementation of water-soluble vitamins, but the effects have not been consistent. Given the variable results, the consensus at this time is that deer do not need water-soluble vitamins in their diet.

Fawns in the process of being weaned may be susceptible to vitamin dificiencies because of their high requirements for growth, their inexperience in foraging, and their small, developing rumen.

Fawns less than 2-3 months of age are effectively non-ruminants and have high nutrient requirements to support their rapid growth. Consequently, fawns could be susceptible to water-soluble vitamin deficiencies. Fawns are protected by high concentrations of vitamins in the doe's colostrum and by adequate concentrations in the milk.

Managing Vitamin Nutrition in Southern Texas

Vitamins are not likely a problem during seasons when plants are growing. Although plant growth may be reduced during winter, vitamin requirements are probably low because deer are not growing; they are only maintaining themselves. As a result, deer can likely meet their requirements using stored fat-soluble vitamins and rumen-produced water-soluble vitamins. Vitamin deficiencies are most likely during extended summer drought when females are producing fawns and males are growing antlers. However, energy and other nutrients are also likely limiting during summer, all of which result in decreased production.

One answer to vitamin deficiencies is supplementation. Most pelleted supplements are fortified with vitamins A and E. Beware that more is not necessarily better when supplementing vitamin A. Because vitamin A can be stored, it can accumulate to the point of toxicity. Toxicity is not a problem when deer eat vegetation because vitamin A is generally in a precursor form and is not converted to active vitamin A unless needed.

There are other potential interactions between supplementation and vitamins. Diets high in starch, such as grains and some supplements, ferment quickly in the rumen and may cause acidosis. Acidosis, at least in livestock, results in greater degradation of vitamin A by rumen microbes and could cause a deficiency. A low fiber, highly fermentable diet can also cause a thiamin deficiency, a condition called polioencephalomalacia that has been diagnosed in captive white-tailed deer. Similar problems are not likely in free-ranging deer

because they have other foraging options and routinely eat some forage even with ad libitum supplement.

What is a manager to do to ensure deer "take" their vitamins? Deer and livestock numbers should be controlled and habitat should be managed to ensure a diversity of palatable forbs and browse. Food-plots and pelleted supplements may be considered, but should not be the sole source of vitamins. Food-plots often fail during drought when they are needed most and supplements are often not available to all deer, especially does and fawns. The bottom line is that management techniques that provide digestible energy, protein, and minerals will also enable deer to meet their vitamin requirements. Supplementing only vitamins is probably ineffective because during times when deer may experience vitamin A and E deficiencies, energy and other nutrients are probably more limiting.

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