



DEER ASSOCIATES ENEWS

News from the Deer Research Program at the Caesar Kleberg Wildlife Research Institute



September 2011

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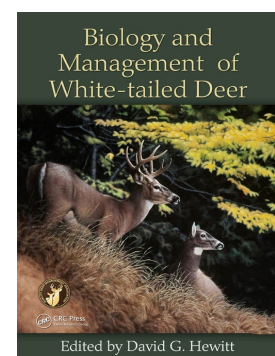


Dr. Fred Provenza, Utah State University
The Wisdom Body: Nutrition, Health and Nature's Pharmacopeia
October 6, 2011
4:00 p.m. to 6:00 p.m.
Texas A&M University-Kingsville
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Deer Nutrition - Part 2

Protein - Building Blocks for Everything Deer

by David G. Hewitt

Last month's CKWRI Deer Associate's eNews initiated a series on deer nutrition by discussing [energy and its role in deer management](#). This edition of the eNews will cover protein, another nutrient deer require in large amounts and one most people readily recognize as being important for deer.

What is Protein?

Proteins are like a train in that they are composed of subunits, just as a train is made up of cars, linked to make one large molecule. Like a train, proteins can vary in the number, type, and sequence of subunits. The subunits of a protein are amino acids. There are 25 amino acids that make up the thousands of different proteins in a deer's body. Amino acids are so named because they all contain an "amine" group, which contains nitrogen.

Protein is difficult to measure directly, so nutritionists estimate it indirectly by measuring the percent of the sample composed of nitrogen (remember the amine groups that contain nitrogen?) and multiplying by a constant. The resulting estimate is termed crude protein. This approach may not be accurate for some forages because not all nitrogen occurs in protein. For example, guajillo has several potentially toxic, but naturally occurring chemicals that contain nitrogen. Based on nitrogen in the leaves, guajillo appears to be a good source of protein, containing perhaps 20% crude protein. However, because of the non-protein nitrogen, the true protein content is lower.

Most people recognize that muscle, hair, and hooves are made primarily of protein. Many people do not know that antlers and bone are 45% protein, that skin is primarily protein, and organs in the deer's body are composed primarily of protein. In fact, once water is removed, a deer's body averages 74% protein (with 16% ash and 10% fat). In addition to structural function, proteins are used to transport materials around the body, such as hemoglobin that carries oxygen in the blood. Other proteins are hormones, such as insulin. Enzymes are proteins that serve as catalysts in all cells of the deer's body, ensuring the machinery of life operates as intended.



Protein is used to make all parts of a deer, from its hooves to its antlers.

Protein Metabolism -

Why Protein is not as Limiting as Most People Think

To understand protein metabolism and requirements in deer, it is important to remember deer are ruminants (for a refresher, see [Amazing Insights from a Deer's Insides](#)). Microbes in the deer's rumen use much of the dietary protein for their own growth and reproduction. This sounds bad for the deer until you realize that the microbes are continually passing out of the deer's rumen to be digested by the deer. In fact, the conversion of plant protein to microbial protein benefits deer. To understand why, recognize that deer do not need protein per se, they need amino acids so that they can make their own proteins. Many amino acids can be manufactured from other amino acids by the animal. Those that cannot must be obtained from the diet and are known as essential amino acids. Animals without a rumen, such as pigs, chickens, and humans require 10 essential amino acids in their diet. Without these specific amino acids, their growth is poor and they may develop other deficiency symptoms. Ruminants do not have requirements for essential amino acids because the rumen microbes convert plant protein to microbial protein, which the deer then digests. Amino acids in the microbial protein closely match the deer's requirements. So, one reason why deer are not as

limited by protein as many people believe is that microbes help ensure the amino acid composition of the diet matches that needed by the deer.

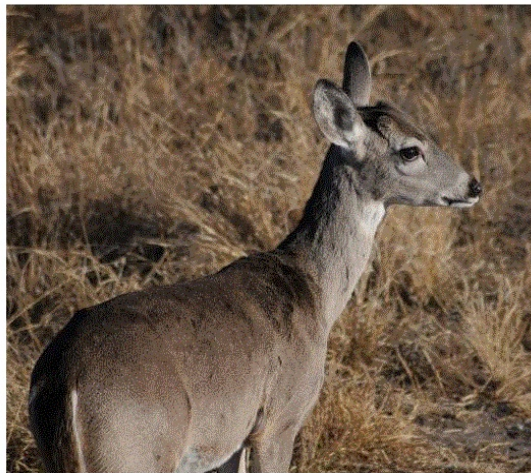
Rumen microbes also increase the efficiency of protein use. When a deer eats a low-protein diet, waste nitrogen from normal protein metabolism is routed back into the rumen, where the microbes use the nitrogen to manufacture new amino acids. The ability to recycle nitrogen enables deer to meet maintenance requirements on diets low in protein.

Cattle and sheep are also ruminants, but seem to be more limited by protein than deer. Cattle and sheep are primarily grazers; cattle not only forage extensively on grass, but often eat mature grass. Mature, cured grass is often exceedingly low in protein. By contrast, deer eat shrubs and forbs, forages that contain more protein than cured grass. Unlike deer, cattle and sheep are more likely to be limited by protein and to respond positively to protein supplements. Carryover from the livestock industry may be the reason supplemental feeds for deer are typically called "protein pellets," even though the energy in the pellets is probably more critical than the protein.

Are there any benefits, or problems, with diets containing high concentrations of protein? If a deer consumes more protein than it needs, the extra protein can be used for energy. However, using protein for energy is inefficient. Furthermore, forages with high concentrations of protein (e.g. greater than 25% crude protein) may cause ammonia toxicity. Thus, deer may limit intake of such foods. Additional research is needed to identify protein concentrations that may cause deer to reduce intake.

Protein Requirements

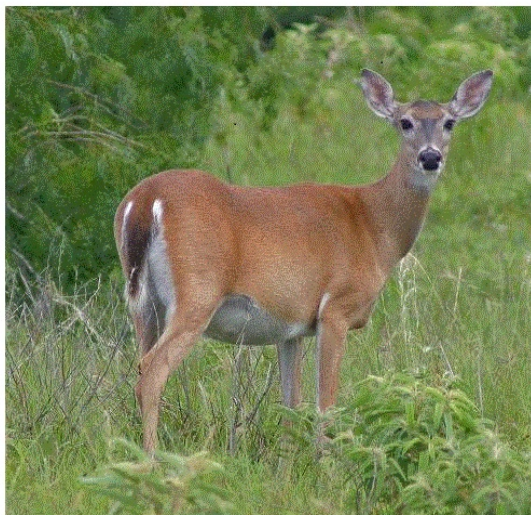
Maintenance requirements for adult deer are 8-9% protein in the diet. Antler growth requires 10% protein; the increase in requirements is small because less than 7% of daily protein intake is deposited in antlers. Does require 16% crude protein during late gestation and peak lactation, although this requirement assumes does meet some of the lactation costs by using protein from their muscles. Lactating does typically use muscle protein even when high-quality forage is available. Newly weaned fawns require diets with up to 19% crude protein to achieve peak growth rates. Donnie Kahl, a CKWRI graduate student, allowed 6 - 18 month-old deer to choose their own diets from feeds containing 8 to 25% crude protein. These deer selected diets with 13-16% crude protein and had growth rates similar to those of deer eating a pelleted diet with 17% protein. Thus, even deer with high growth requirements selected a diet with a lower protein content than most people would predict or would provide in the form of supplement.



Recently weaned fawns need more protein in their diet than adult deer to support their body growth.

What are Implications of Low Protein Intake?

- Just like low energy intake, low protein intake can reduce growth rates of young deer.
- Low dietary protein can result in smaller antlers, particularly in yearling bucks which need protein to support body growth.
- Although protein intake is not especially important in determining if a doe will enter estrous, protein intake during the third trimester of gestation can have a dramatic impact on fawn health and survival. Does forced to eat low-protein diets during late spring and summer give birth to small, weak fawns. The fawns may not be strong enough to nurse and therefore often die a day or two after birth.
- Protein could be limiting for deer during some seasons, such as during summer droughts. Cactus pads and various types of mast, such as fruits of prickly pear, persimmon, and brasil may be a large part of deer diets during dry summers when forbs are scarce. Mast and prickly pear pads are typically moderate to high in energy, but low in protein. Such forages may keep adult deer alive but do not have sufficient protein for body growth or fawn production.



Female deer need a diet with at least 16% protein during the last trimester of gestation and when nursing.

Implications for Deer Management

Diets with 10% crude protein are sufficient for adult deer during autumn, winter, and early spring. Protein requirements increase during late spring and summer, when deer are most productive. Ensuring deer have access to forages or feeds with 16-20% protein during summer will enable deer to meet their requirements. Access to high-protein forages in autumn will enable recently

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Student Highlight



Kory Gann
Master of Science Candidate
Thesis: Effects of Population Density on White-tailed Deer Diet Quality

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weaned fawns to adjust to a forage-based diet and continue to grow. Management for forbs and diverse browse communities will improve both protein and energy status of deer. Succulent, newly growing grass may have over 20% protein and can be an important forage for a brief time after rainfall or disturbances such as fire.

The goal of a manager should be to provide deer with foraging choices to mix a diet with the appropriate amount of protein. Pelleted supplemental feed can be one of these foraging choices. Protein requirements are low during late autumn, winter, and early spring; a supplement with 10–15% protein could be mixed with most forages to meet deer requirements without causing the deer to avoid the feed because of excess protein. During late spring, summer, and early autumn, deer protein requirements are higher; pelleted feeds with 16–20% would enable deer to achieve an average protein intake to meet their needs. The higher protein supplement may be especially beneficial during summer drought when some forages are exceedingly low in protein.

Next in the Nutrition Series - Elemental Deer Management

The next installment in the CKWRI Deer Associates eNews nutrition series will be in November and will cover what is known about minerals in deer ecology and management.

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