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A Comparative Study of Fiber Digestion and Subsequent Nutrient Absorption in the Ostrich Versus the Ruminant

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Many comparisons have been made and documented on the efficiency of fiber utilization being as great in the ostrich when compared to ruminants such as cattle and sheep. The ostrich is able to utilize up to 60 percent of the neutral detergent fiber fraction of its feed resulting in excellent digestion of fiber sources such as alfalfa. The ruminant is also known for its excellent use of fiber sources; however, the digestive mechanisms for fiber digestion in the ruminant versus the ostrich are **very** different, resulting in quite different feeding programs to meet the respective animal's protein, amino acid and energy requirements. For a short anatomy review, *Figures 1* and *2* show the digestive tracts of a bovine and ratite species, respectively. The ostrich's digestive tract is more similar to a chicken, than the cow.

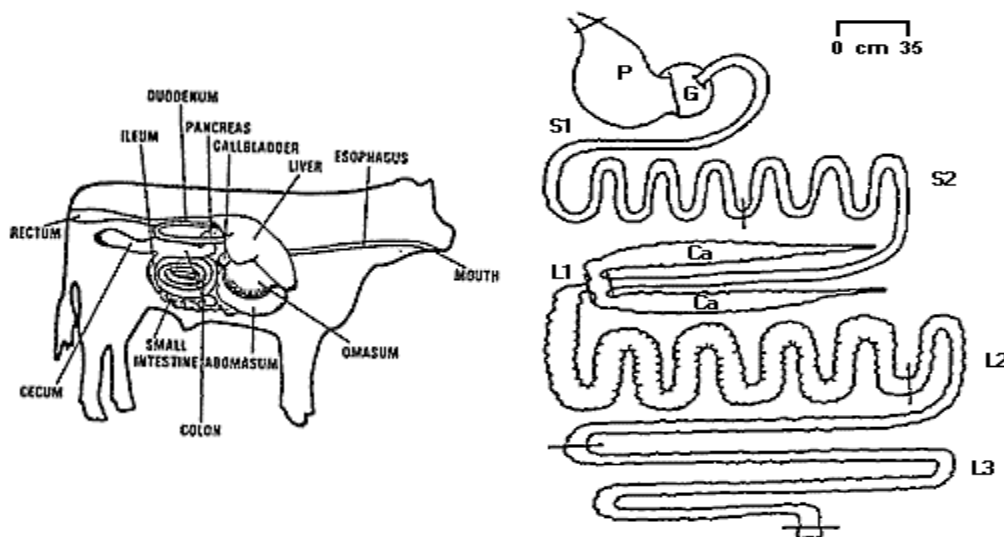


Figure 1. The digestive system of the Figure 2. Gastrointestinal tract of

bovine – a ruminant.*

**an ostrich chick at 35 kg live mass.
(P = proventriculus; G = gizzard; S1
= small intestine; Ca = caeca; L1 =
proximal colon; L2 = mid-colon; L3
= distal colon)****

* Figures taken from Feeds & Nutrition Digest
edited by M. E. Ensminger, et al., 1990.

** Figure taken from Swart et al., 1993, S.
Afr. J. Anim. Sc. 23(516).

Cattle have a four-compartment stomach (rumen, reticulum, omasum and abomasum), compared with a smaller, one-compartment stomach (proventriculus) in avian and ratite species. The rumen is where most of the microbial digestion of fiber occurs in cattle. The rumen is located strategically before the small intestine where the majority of the essential nutrients such as amino acids, lipids, minerals and vitamins are absorbed. The microbial population of the rumen has a protein requirement which it obtains from the diet. Microbes leaving the rumen provide a protein source to the animal (host). "By-pass protein" is a term for protein that passes protected from microbial breakdown through the rumen to the small intestine where it is absorbed and utilized by the animal (host) use (not for microbes). Fiber breakdown in the rumen, as well as resulting microbial protein release into the small intestine. Volatile fatty acids (VFA) are produced and absorbed through the ruminal wall for energy utilization and fat synthesis by the bovine. This system of fiber digestion by the rumen allows the bovine maximum utilization of both the energy and protein stores in forages primarily because of the location of forage digestion in the rumen before the small intestine.

The ostrich's anatomy and location of forage digestion is quite different from that of bovines. The ostrich has a relatively small stomach (proventriculus) which serves primarily as a storage organ and secretes pepsin and acid. There is some fiber digestion in the proventriculus but its significance is thought to be limited. Fiber digestion in the ostrich occurs in the large intestine and cecum where there is a substantial microbial population and after most of the absorption of amino acids, vitamins and minerals has occurred in the small intestine. Because the site of fiber digestion is after the small intestine, this means that little to no protein or amino acid utilization can occur during the microbial forage breakdown. Protein and amino acids are basically only absorbed in the small intestine which is located before the microbial fiber digestion occurs in the ostrich large intestine. By-pass protein is not beneficial to the ostrich because there is a very limited microbial population in the ostrich stomach to by-pass. What the ostrich does need is a balanced protein diet meeting its essential amino acid requirement. This cannot be done with an all forage diet just supplemented with corn. Even the best ostrich forage — alfalfa — is inadequate in several essential amino acids for growth.

What fiber digestion does provide to the ostrich is a rich energy source of VFA. The ostrich's large intestine and cecum are capable of absorbing the VFA's produced from fiber digestion and these are primary energy sources to the bird providing as much as 60 percent of the energy. These VFA's can either be utilized as energy sources to the bird, utilized for muscle deposition, or deposited as fat if the bird does not have a diet balanced for amino acids. Muscle deposition in finishing ostrich's will not be optimized unless the bird has an adequate intake of amino acids along with other essential vitamins and minerals. Technically, the ratite species do not have an essential requirement for forage in their diet. But we know it is a key factor for a healthy gut microflora, optimum rate of passage, and efficiency of nutrient digestion.

In summary, the ostrich does utilize fiber nearly as efficiently as the bovine. However, because of a very different anatomy, the ostrich does not utilize protein, amino acids, minerals and vitamins from fiber sources in the same manner as the bovine. This difference must be kept in mind when planning a feeding

program for the ostrich. A ration balanced for all the amino acids, vitamin and minerals must be fed to the ostrich to sustain optimum growth and performance. A diet of alfalfa and corn may keep the birds alive for a period of time, but will not result in optimum and economical performance.

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