OPTIMUM VITAMIN NUTRITION FOR HORSES

Vitamins are organic compounds in feed that are required in trace amounts for maintaining health and growth. Vitamins are essential components of a diet as deficiency causes disturbances in metabolism and can even lead to disease.

Vitamins are normally classed as either fat-soluble vitamins (Vitamin A, D, E and K) which can be stored in the horse’s body or water-soluble vitamins (the B vitamins and Vitamin C). Water soluble vitamins do not need to be stored as they are mainly produced by the microorganisms in the hind gut of the horse on a daily basis. Fat soluble vitamins are abundant in green leafy forage and would not be deficient unless a drought is experienced; in a rapidly growing horse or if the horse is under some other form of stress.

The following vitamins are essential for the horse:

**Fat-soluble vitamins**

**Vitamin A or Retinol:** Vitamin A is essential as it plays a role in maintaining vision, mucous membranes, growth, reproduction and disease resistance. Deficiency can lead to poor eyesight and eventually night blindness, sensitivity to light, prolonged shedding and dry hair coat, progressive weakness, brittle or uneven hoof growth, excessive tearing, decreased growth, diarrhea, anorexia, impaired mineral deposition and intestinal absorption, increased susceptibility to infections of the respiratory and reproductive tract. Vitamin A is mainly found in carrots and green, leafy forages in the form of Beta-carotene which is then converted to Vitamin A in the body (1mg of carotene is converted to 400IU Vitamin A). Excess Vit A is stored in the liver and these stores can be used for up to 6 months after below recommended levels are consumed to prevent deficiency symptoms. Too high levels of vitamin A (10 times the recommended level) can cause bone fragility and skin damage due to sloughing off of epithelial cells but this has not been reported in practice.

**Vitamin D or Calciferol:** Vitamin D3 (cholecalciferol) is the most effective form of vitamin D and its main function is the absorption, uptake and transportation of Calcium and Phosphorus. Sunlight (as well as colostrum) is a good source of Vitamin D and mainly only stabled horses that are not exposed to sunlight will require supplementation. Rickets in young horses and Osteomalacia in adult horses is due to a Vitamin D deficiency. Toxicity caused by excess Vitamin D (and enhanced by High Calcium and Phosphor from dietary origin) is a bigger problem than deficiency as hay and sunlight will provide horses with enough Vitamin D to meet their requirements. This is characterized by reduced growth rate, swollen joints, bone weakness, lameness, loss of appetite, hardening of soft tissue and enlargement of the jaw and skull. This is caused by a drop in blood Ca levels due to decreased efficiency of mobilization of Ca from bone and absorption from the intestine. Toxicity can occur as excess vitamin D causes improper transport of Ca which leads to Ca deposition in soft tissue.

**Vitamin K:** Vitamin K3 is a synthetic form of Vitamin K and is water soluble as well as fat soluble. Its main role is blood clotting and deficiency will lead to excessive bleeding as it takes part in the formation of pro-thrombin in the liver. Deficiency in horses is unlikely as vitamin K is produced by the bacteria in the gut and does not require additional supplementation. But deficiency will occur if the mycotoxin
produced by yellow clover (Dicoumarol) is fed or if rodenticides which prevent blood clotting are consumed. Vitamin K (Menadione) is nephrotoxic given at 1-2.5g/animal but even lower if administered intravenously.

**Vitamin E or Tocopherol:** α-Tocopherol is the most common form of vitamin E. Vitamin E is an anti-oxidant which protects cells against oxidation; it is also involved with Selenium as a red blood cell stabilizer maintaining the integrity of the vascular system. Vitamin E is important for the equine immune system and acts as a vasodilator ensuring blood flow to tissues. Deficiency of vitamin E causes swollen joints, loss of coordination and muscle degeneration, pale areas of muscle, fragile red blood cells, infertility and Equine Degenerative myeloencephalopathy (a degenerative disease of the spinal cord and brain stem). If a diet high in fat is fed, extra Vitamin E should be added (5mg/kg for every 1% fat above 3%). More Vitamin E is required if poor quality feed is available, feed is low in Selenium or if the horse is stressed but it should be remembered that high levels can interfere with other fat soluble vitamin utilization.

Breed differences with regards to Vitamin E requirements in horses have also been established with some breeds (Arabian, Appaloosa, Thoroughbred, Standard bred, and the Morgan) being predisposed to vitamin E deficiencies.

**Water-soluble Vitamins**

**Vitamin B1 or Thiamine:** Thiamine is an important part of enzyme systems in the Carbohydrate and fat metabolism pathways. It regulates energy release from stored carbohydrates and fat and helps with proper nerves system function. A Thiamine deficiency can lead to lack of energy, muscle weakness, muscular contractions which can be seen under the skin, reduced heart rate and skipped heartbeats as well as occasional hypothermia in the extremities. Slight deficiencies can even lead to a drop in condition due to decreased feed intake. Deficiencies are rare as Thiamine is found in Lucerne, yeasts, green leafy crops, beans and cereal germs and is also produced in the hind gut by bacteria. It is essential that a performing horse has adequate levels of Thiamine as carbohydrate metabolism increases with exertion and requires this vitamin in the enzyme complex.

**Vitamin B2 or Riboflavin:** Riboflavin is an essential part of enzymes in protein and carbohydrate metabolism. The horse cannot produce Riboflavin and has to consume green forage, milk or milk products or additional supplements to ensure that they receive adequate amounts to prevent deficiency. Deficiency will result in retarded growth and loss of body condition as Riboflavin is needed for protein utilization and energy production. Severe deficiency can lead to rough hair coat, inflammation of the tissue covering the eyeball (known as Moon blindness), light sensitivity and excessive tearing; but this has not been seen in horses.

**Vitamin B3 or Niacin:** Niacin is part of two co-enzymes that catalyze the transfer of hydrogen in protein, fat and carbohydrate metabolism. Deficiency is usually first seen as loss of appetite, reduced growth and diarrhea but as it progress the nervous system becomes affected, skin appears scaly and the mouth ulcerated. Niacin deficiency rarely occurs seeing as sources are available (such as lucerne, oil-seeds and animal by products) and it can also be produced in the hindgut in the presence Tryptophan.

**Vitamin B5 or Pantothenic Acid:** Pantothenic acid plays a role in energy metabolism, fatty acid metabolism and antibody formation. Weight loss, retarded growth and skin disorders can be due to Pantothenic acid deficiency but horses can produce sufficient levels of this vitamin in the hindgut to prevent deficiency.

**Vitamin B12 or Cyanocobalamin:** Vitamin B12 contains Cobalt and is part of the enzyme system that is involved in the metabolism of protein. It is essential for red blood cell production and deficiency leads to anemia (reduced red blood cell formation), loss of appetite and eventually poor growth. Vitamin B12 can only be produced in the hind gut of horses and is not present in feedstuffs of plant origin which means that diets low in animal protein can cause deficiency. In order for the microorganism in the horses gut to produce Vitamin B12, a minimum level of 0.1mg/kg diet of Cobalt is necessary. Even though deficiency in horses is rare, horses’ in general poor condition (stressed, anemic or severe parasitic infections) will benefit from vitamin B12 supplementation.

The following table is a basic guideline for the supplementation of vitamins for horses per head per day as suggested by BASF.

<table>
<thead>
<tr>
<th>Supplement intake/head/day</th>
<th>Vit A (IU)</th>
<th>Vit D3 (IU)</th>
<th>Vit K (mg)</th>
<th>Vit E (mg)</th>
<th>Vit B1 (mg)</th>
<th>Vit B2 (mg)</th>
<th>Vit B3 (mg)</th>
<th>Vit B5 (mg)</th>
<th>Vit B12 (µg)</th>
</tr>
</thead>
</table>

References:


Freeman, D.W., Nutrient needs of the horse. Division of Agricultural Sciences and Natural resources, Oklahoma State University.

Dr. Cardina, J., Dr. Kline, R., Dr. Parr, S., Horse Nutrition Bulletin 762-00. The Ohio State University Bulletin Extension.

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<table>
<thead>
<tr>
<th>Animal Type</th>
<th>Vitamin Requirements (mg)</th>
</tr>
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<tbody>
<tr>
<td>Foal 3 month (weaning 150kg+)</td>
<td>15000</td>
</tr>
<tr>
<td>Foal 6 month (200kg +)</td>
<td>20000</td>
</tr>
<tr>
<td>Yearling (300kg +)</td>
<td>30000</td>
</tr>
<tr>
<td>Leisure Horse (550kg)</td>
<td>33000</td>
</tr>
<tr>
<td>Race and Breeding (550kg +)</td>
<td>66000</td>
</tr>
</tbody>
</table>

The ADVIT Std Horse premix (FE1004) is based on these BASF vitamin requirements and will be sufficient for the various life stages of the animal if concentrate intake is calculated as percentage of body weight. Seeing as horses are one of the most sensitive specie to toxicity, supplementation of vitamins should only be done as according to a nutritionist’s recommendation.