Supplementing for Performance and Recovery in the Equine Athlete

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Athletic horses are particularly susceptible to the adverse effects of poor quality diets. Fortunately, special care and attention to the diet will improve exercise performance, recovery, overall health and well-being. Regardless of the event -- endurance, middle distance, sprint, or some combination thereof -- the principal dietary components are water, electrolytes, and energy. Once those needs are met, dietary supplementation can range from well-rounded vitamin and mineral supplements to specific amino acids, vitamin-like substances, antioxidants, and muscle and joint protectants.

Choosing the Best Source for Calories

The equine athlete's ideal diet is comprised of high quality grass and hay. Many horses, however, are unable to obtain adequate energy from hay alone, and their caloric intake is often augmented by energy-dense grains and/or oils. These should be fed with caution, as excessive grain intake leads to over-consumption of starch, which has been linked to metabolic syndrome.[1,2] In addition, the high level of pro-inflammatory omega-6 fatty acids present in grains, some oils and common feedstuffs (Table 1) makes these choices less desirable as a primary means of augmenting caloric intake. A dietary-induced imbalance between pro-inflammatory omega-6 and anti-inflammatory omega-3 fatty acids may predispose the horse to excessive inflammation, which is linked to many chronic diseases.[3] When compared to the effects of corn oil, ingestion of omega-3 fatty acids is associated with lower circulating concentrations of insulin, an improved glucose-to-insulin ratio, and lower heart rates during exercise.[4] When compared to a high-grain diet, a high fat diet that includes omega-3 fatty acids results in a reduction in the amount of heat produced during exercise and rest,[5] an increase in feed digestibility and decreased bowel bulk and fecal production.[6] Other metabolic improvements include reduction in lactate production during exercise,[7] increased intramuscular fat stores and dependence on fat for energy during exercise,[8] and a reduction in glucose utilization and sparing of muscle glycogen,[9] all of which could delay fatigue onset and improve performance.

Table 1. **Fatty Acid Ratios in an Omega-3 & Micronutrient Supplement* and Common Feedstuffs**

Feedstuff	Omega-3 : Omega-6 ratio
Grass	1 : 0.2
Omega-3 and Micronutrient Supplement*	1 : 0.4
Equine Commercial Feeds±	1 : 8.0
Corn **	1 : 54.5
Oats **	1 : 19.4
Barley **	1 : 9.6
Soybean Oil **	1 : 7.5
Soybean Meal, Fat Extracted **	1 : 6.9

±Average of five equine commercial feeds tested by an independent laboratory.
**Adapted from Hallebeek and Beynen[10]

Maintaining Muscle Mass

Maintenance and enhancement of lean tissue are major concerns for equine athletes participating in events ranging from short-term to ultra-endurance. Several nutrients can help with this. Under various conditions, omega-3 fatty acids can prevent muscle

*Platinum Performance® Equine Wellness and Performance Formula wasting.[11,12] This protection, at least in part, is due to their inhibitory effects on the ubiquitin–proteasome proteolytic pathway,[13] which has been implicated as a primary catabolic factor in muscle atrophy regardless of the cause (i.e., cancer, sepsis, starvation, etc). Although traditionally considered an anti-cachexic agent for cancer patients, omega-3 fatty acids may act in concert with the inhibitory effect of exercise on the ubiquitin-proteasome proteolytic pathway[14] to augment exercise-induced increases in muscle mass. Whey protein, a rich source of essential amino acids, has anabolic effects when combined with training,[15,16] and branched chain amino acids provide energy to exercising muscles and preserve muscle glycogen stores.[17] The leucine metabolite, beta-hydroxy-beta-methylbutyrate (HMB), has been extensively used as an ergogenic aid for strength/power athletes, primarily because it elicits anti-catabolic, anabolic, and lipolytic effects.[18-20] Chromium preserves lean tissue[21] and is of particular concern because it is excreted in the urine of strenuously exercised horses fed high-grain diets.[22] L-carnitine carries long-chain fatty acids into the mitochondria, is crucial for oxidation of fat, and reduces the production of lactate when oxygen is lacking, as occurs during strenuous muscular activity.[23,24] L-carnitine supplementation in training horses appears to enhance athletic performance.[25] Carnitine also reduces muscle damage and soreness after exercise,[26-28] possibly by causing vasodilation.[28]

Improving Recovery for Better Performance

How athletes recover from exercise is as important as how they train. Minimizing muscle and joint damage, as well as maintaining stores of key nutrients and energy, will enable the horse to continue intense training without injury. Strenuously exercising horses have decreased serum levels of branched chain amino acids,[29,30] possibly because they are broken down for energy.[30] Branched-chain amino acids, especially leucine, not only supply muscles with energy, they also regulate muscle protein synthesis and breakdown.[31] Supplementation with branched-chain amino acids can also reduce muscle soreness after strenuous exercise[31] and degradation of muscle glycogen.[32] Arginine and glutamine are two additional amino acids that are critical to the equine athlete. Arginine is a precursor to nitric oxide (NO), a compound that helps regulate blood flow.[33] Glutamine assists in the synthesis of NO by maintaining activity of the enzyme, nitric oxide synthase.[34] NO is a key factor in performance, partly due to its role in regulating blood flow and delivering nutrients to exercising muscles.[35]

Supplementation of the horse's diet with antioxidants is commonly done to prevent oxidative tissue damage that is likely to occur due to the 40-fold increase in oxidative metabolism that occurs during strenuous exercise in horses.[36] Indeed, increased oxidative stress occurs in horses partaking in both endurance and intense exercise.[37,38] Supplementing exercising horses with antioxidants, such as vitamins E and C and selenium, increases exercise tolerance, reduces measures of oxidative activity and airway inflammation,[39] and helps modulate exercise-induced oxidative stress.[40-42]

Protecting the Joint

Joint pain is a significant cause of lameness and "loss of use." Consequently, efforts should be expended to maintain healthy joints in equine athletes. This can be achieved by supplementing the diet with glucosamine, methyl-sulfonyl-methane (MSM), boswellia, cetyl-myristoleate, avocado-soy unsaponifiables (ASU), and omega-3 fatty acids. Not only is glucosamine a precursor to glycosaminoglycans, the compressive-resistant component of cartilage,[43] but it also has anti-catabolic activities in equine cartilage cells.[44,45] MSM is a naturally-occurring compound that helps maintain normal connective tissues and has anti-inflammatory and free radical scavenging activities.[46,47] ASU, a relatively new neutraceutical that is increasing in popularity, consists of the oil fractions of avocados and soybeans. ASU supplementation reduces the loss of joint space among osteoarthritic individuals,[48] increases glycosaminoglycan synthesis, and reduces cartilage breakdown.[49] Boswellia and cetyl-myristoleate have anti-inflammatory effects[50,51] and aid in alleviating symptoms of osteoarthritis in other species.[52-54] Lastly, omega-3 fatty acids, such as α-linolenic acid, cause the tissues that comprise the joint to produce less pro-inflammatory mediators such as interleukin-1, tumor necrosis factor-alpha, and prostaglandin E_2.[55,56] Furthermore, the analgesic effects of omega-3 fatty acids suggest that they may be a safe alternative to non-steroidal anti-inflammatory drugs.[57]

Immune System

Strenuous exercise, trailering for long distances, and competition often result in stress and a compromised immune system. Supplementation of the diet with omega-3 fatty acids may be helpful in these situations, as exemplified by the finding that supplementation of stressed humans with flax significantly decreases both systolic blood pressure and circulating concentrations of the stress hormone, cortisol.[58,59] Because stress also increases the production of reactive oxygen species and promotes oxidative damage,[60] dietary supplementation with antioxidants also may be warranted under these conditions. Transportation stress, as occurs during long trailer rides, impairs immune function as exemplified by a reduction in circulating concentrations of immunoglobulins among lambs during long transport.[61] For this reason, nutrients that bolster the immune system, such as a thymic protein extract,[62] may be beneficial under such conditions.

Putting it into Practice

- Feed a high-quality forage diet, with supplemental calories, if necessary, in the form of a vegetable oil containing a low omega-6 and high omega-3 fatty acid content.
- For lean tissue health, supplement with omega-3 fatty acids, essential amino acids, vitamins and minerals.
- For optimal performance and recovery, supplement with omega-3 fatty acids, branched-chain amino acids, antioxidants, and L-carnitine.
- For improved joint health, provide glucosamine, anti-inflamatory omega-3 fatty acids, MSM, ASU, boswellia, and cetyl myristoleate.
- For the traveling equine athlete, provide protection against stress and immune-enhancing nutrients, such as omega-3 fatty acids, immunoglobulins, and thymic protein extract.

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