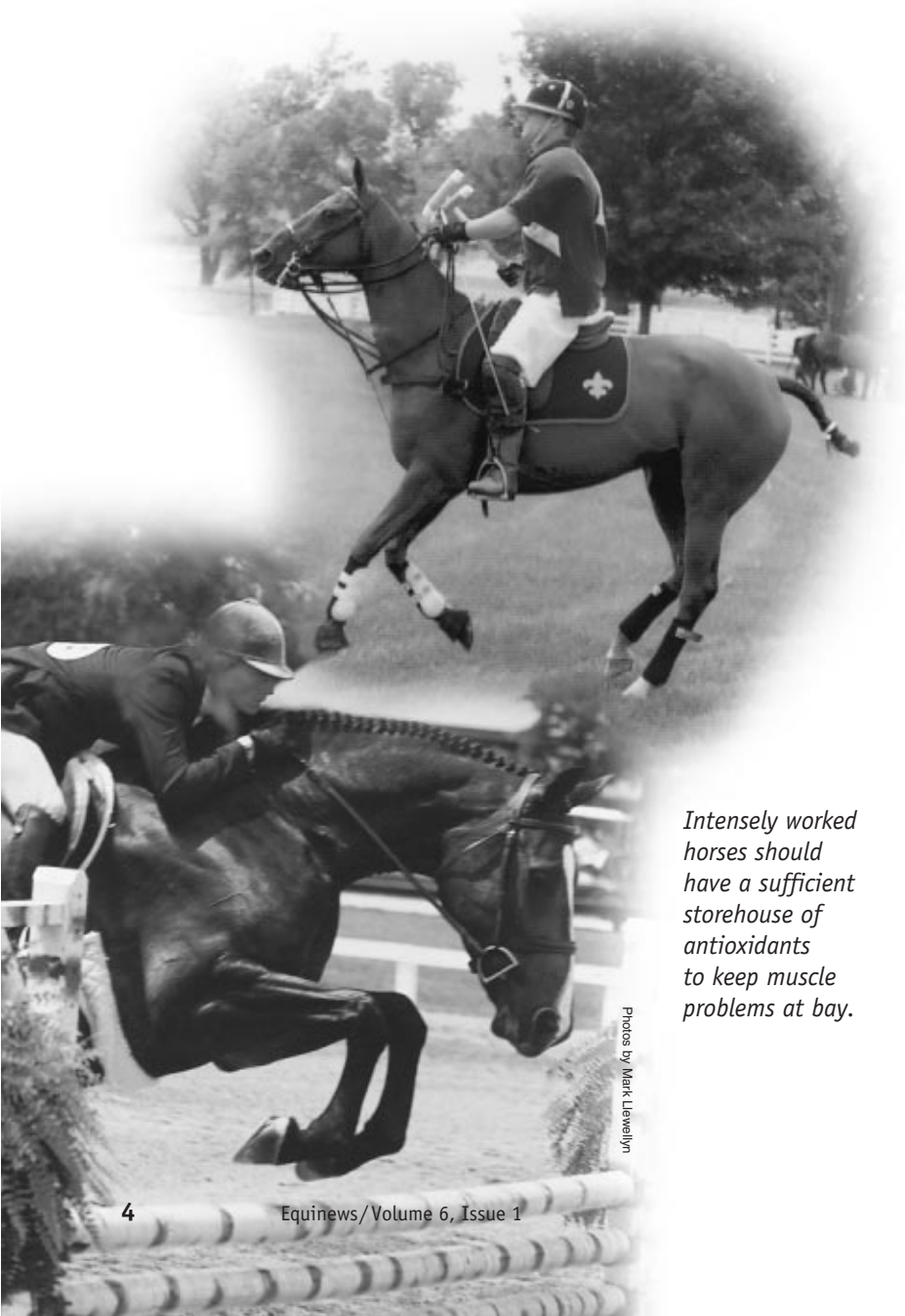
Antioxidants for Tip-Top Performance

The formation of ordinary rust is not a chemical enigma and is perhaps the most familiar example of oxidation. A mixture of moisture and oxygen chemically attacks metal and in time corrosion creates a reddish-brown, brittle coating that weakens and ultimately destroys the metal. Just as destructive, though invisible to the eye, is the oxidation that occurs at the cellular level in horses and other mammals. The end result of unchecked oxidation in the bodies of equine athletes may be muscular fatigue severe enough to compromise performance.

Oxidation is a normal metabolic process that allows horses to transform the carbohydrates, fats, and proteins they devour in meals to energy—energy to grow, perform, and reproduce. One unfortunate, although completely unavoidable, spin-off of oxidation is the creation of free radicals, compounds that have the potential to irreparably damage cells. Free radicals are particularly harmful to cell membranes, structures responsible for keeping destructive entities away from delicate inner organelles.

Under normal circumstances, substances called antioxidants thwart much of the wreckage caused by free radicals. However, oxidation speeds up during athletic effort due to increased oxygen consumption and accelerated aerobic metabolism. In instances of strenuous exercise, natural stores of antioxidants have difficulty providing sufficient protection against the cascade of free radicals generated from aerobic metabolism. Supplementation of antioxidants is therefore necessary to help ward off the ill effects of mass-produced free radicals associated with intense exercise. Horses with an inadequate reserve of antioxidants may experience muscle soreness or stiffness during an exercise bout and prolonged recovery following hard work.



Intensely worked horses should have a sufficient storehouse of antioxidants to keep muscle problems at bay.

Photos by Mark Llewellyn

The All-Star Antioxidants

Vitamin E contributes most generously to the natural antioxidant defenses of the horse. The term vitamin E is actually a collective one that encompasses eight distinctive compounds of plant origin. These eight are divided into four tocopherols and four tocotrienols. Of these only two—alpha-tocopherol and gamma-tocopherol—have antioxidant properties, and alpha-tocopherol is the most biologically active. On the cellular level, alpha-tocopherol embeds in cell membranes and protects cells from the ravages of free radicals. Alpha-tocopherol has an affinity for fat and is therefore attracted to cell membranes, which are composed of polyunsaturated fatty acids.

Feeds typically fed to horses have variable vitamin E concentrations. Cereal grains such as corn, oats, and barley contain minimal vitamin E, and processing may further decrease vitamin activity. Drying corn artificially, for example, reduces the alpha-tocopherol level by as much as 50%. And

while vegetable and soybean oils possess substantially more vitamin E than grains, refining can diminish content. Even if they undergo only minimal refining, these oils have such low inclusion rates in diets that their contribution to total vitamin E intake is miniscule.

Horses may derive sufficient amounts of vitamin E from fresh forage or hay; however, the vitamin content abates as forages mature and are harvested. Up to 90% of vitamin activity may be lost between the pre-bloom or boot stages and complete heading out in grasses. Losses also occur in legumes, although to a lesser extent. Storage negatively impacts vitamin composition as well. In one month, for instance, a 50% loss in vitamin E can occur in stored hay.

Because of the irregularity in vitamin E content of forages and other feedstuffs, the nutrient is often added to fortified feeds. Synthetic forms of vitamin E are absorbed well by horses; however, natural forms are far more digestible, and natural tocopherol is thought to be preferentially used by horses during digestion.

Deficiencies of vitamin E are often thought to precipitate nervous disorders such as equine degenerative myeloencephalopathy, a disease characterized by deterioration of the brain stem and spinal cord. Ataxia is the foremost sign of equine degenerative myeloencephalopathy, usually beginning in the hind limbs and progressing to the forelimbs. Equine motor neuron disease, a debilitating neurological affection that may cause profound paralysis and death, is often partially attributed to vitamin E insufficiency. Treatment for both diseases centers on the provision of megadoses of vitamin E, often 10 to 20 times the normal daily requirement. In some cases of equine degenerative myeloencephalopathy, supplemental vitamin E has completely arrested signs, although few horses return completely to normal.

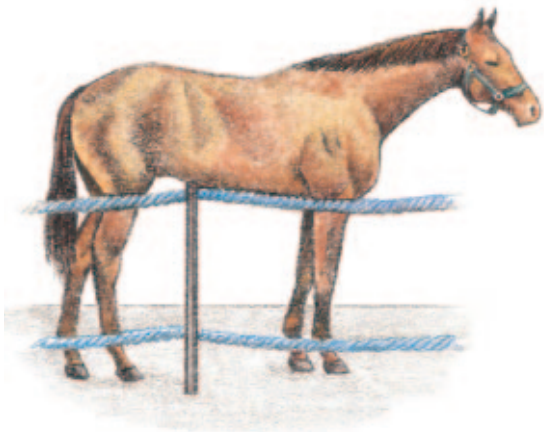
Vitamin E is often linked with selenium, a micromineral that possesses potent antioxidant properties. Because it is an essential component of glutathione peroxidase, an intercellular enzyme that helps prevent the formation of free radicals, selenium is integral in the diets of performance horses. In addition to inadequate antioxidant defenses, a selenium deficiency may be detrimental to the muscular, reproductive, and immune systems.

Vitamin C, often referred to as ascorbic acid, also plays a pivotal role in neutralizing harmful free radicals. Because of its water-soluble nature, vitamin C can work both inside and outside the cell to combat free radical damage. In the exercising horse, perhaps the foremost contribution of vitamin C is its synergistic relationship with vitamin E. Once a molecule of vitamin E inactivates a free radical, its ability to short-circuit others is forsaken. In the presence of vitamin C, however, vitamin E can be regenerated to continue its raid on free radicals. The rejuvenating properties of vitamin C, therefore, make it an essential ingredient in an effective antioxidant supplement.

Vitamin C is not included in the diets of most horses because the liver synthesizes sufficient quantities under normal circumstances. In periods of stress, such as during sustained exercise, vitamin C levels may drop and reduce the efficiency of antioxidant mechanisms in the body. In one study completed by Virginia Polytechnic Institute and State University, 35 endurance horses competing in 80- and 160-km race incurred vitamin C depletion, suggesting supplementation may be necessary to maximize antioxidant defenses.

An antioxidant cocktail has been advocated by human physicians for several years, and the positive effects of such a concoction have proven effective in nourishing the equine athlete as well. A triad of antioxidants including vitamin E, selenium, and vitamin C ensures a degree of coverage not afforded by vitamin E alone.

Many stressed horses develop ulcers.



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