Comparing the Cost to Provide Vitamin E for Our Horses

Vitamin E - which type or “matrix”

There is a lot of interest in natural (d-alpha tocopherol) water soluble” (micellized water dispersible) vitamin E and how it compares to vitamin E powders and soft-gel capsules for providing this important nutrient to our horses. Micellized vitamin E may be the most cost effective way to provide vitamin E for your horse, especially those challenged with EPSM/PSSM or other metabolic issues and pregnant and lactating mares at a negligible increase in price over using powdered or soft-gel types.

Forms of vitamin E

See http://lpi.oregonstate.edu/infocenter/vitamins/vitaminE/ for more information on why the alpha tocopherol is the preferred form for vitamin E supplementation. From the Linus Pauling Institute Site:

- Alpha-tocopherol is the form of vitamin E that appears to have the greatest nutritional significance.
- "Natural" or d-alpha-tocopherol - The isomeric form of alpha-tocopherol found in foods is RRR-alpha-tocopherol (also referred to as "natural" or d-alpha-tocopherol).
- "Synthetic" or dl-alpha-tocopherol - Synthetic alpha-tocopherol, which is labeled all-rac- or dl-alpha-tocopherol, has only one-half the biological activity of RRR-alpha-tocopherol [but see potency, below].
- The amounts of α- and γ-tocopherol in mixed tocopherol supplements vary, so it is important to read the label to determine the amount of each tocopherol form present in a capsule. (For example, mixed tocopherols from soy sources normally contain approximately 15% alpha-tocopherol and the remaining 85% is from primarily gamma, delta, and beta-tocopherols.)

Types of Vitamin E

According to the University of Minnesota Equine Center Neuromuscular Diagnostic Laboratory, water dispersible and "micellized" vitamin E forms are six times more bioavailable relative to the synthetic (dl-) form. This is based on studies by Kentucky Equine Research (KER), which is also the manufacturer of two of the products studied (Nano-E and Elevate W.S.). The conclusion of the studies is these products [and likely the micellized Emcelle Tocopherol from Stuart Products also], because of the higher bioavailability, are beneficial where rapid increase of vitamin E levels are warranted (i.e. periods of stress) or when neurological disease is present.

For normal, healthy horses, either natural or synthetic forms are cost effective for maintenance. Horses with neuromuscular disorders may benefit from the costlier (but only slightly compared to "natural" oil based capsules) micellized or water dispersible products.
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Before beginning supplementation, testing the horse to determine if a deficiency exists is suggested (see Cornell links below).

The micellized and water dispersible products, which include Nano-E, Elevate W.S and Emcelle Tocopherol do not require added fat in the form of oil to be absorbed from the digestive tract. Powdered forms of vitamin E and glycerin based soft-gels which do not contain oil do require the addition of oil for absorption, while soft-gels already containing oil do not need additional oil added.

Cost

As cost is often a consideration, the products below are shown from low to high according to the cost of providing 2,000 IU of vitamin E. The natural vitamin E cost leaders include the oil-based soft-gels from Swanson and Puritan and Stuart Products' Emcelle Tocopherol. Next in line are Uckele's liquid E and Elevate Powder from KER. Oil-based synthetic (dl-) capsules, or synthetic powder with added fat may be adequate for many horses. Even though Costco's Kirkland brand is the lowest priced, there is some disagreement on how well glycerin-based soft-gels are absorbed.

It's impossible to compare every available vitamin E supplement here, and I have not included supplements which combine vitamin E with other vitamins or minerals. Keep in mind that "multi-vitamin/mineral" supplements often provide only 750 IU or less. Also, vitamin E is often added as a preservative to supplements and feeds and may be listed in the ingredients but likely will not provide an adequate amount of this important vitamin.

Importance of adding fat

Vitamin E requires fat for absorption. If using a powdered form of vitamin E (or soft gels which do not contain oil) and you are adding oil at the time of feeding to ensure absorption, choose a "good" oil. I have found the Mediterranean Blend from Costco to be an economical choice (a blend of expeller pressed canola, olive and grape seed oils). You can also consider avocado oil, olive oil, grape seed oil, or other salad dressing or dipping quality oils. Oils need to be kept in a controlled temperature environment to prevent them from becoming rancid.

There is some thought that because glycerin-based soft gels do not put the vitamin E directly into contact with the added fat/oil, it may not be completely or adequately absorbed. [See the Colorado State University links below.]

Potency vs bioavailability

The d-alpha tocopherol (natural) form of vitamin E is almost twice as potent as the dl-alpha-tocopherol (synthetic) form. This is accounted for when the amount of vitamin in milligrams (mg) is converted to International Units (IU). For example, if you want to give your horse 800 IU of vitamin E - you would give two 400 IU gelcaps, whether it is d-alpha tocopherol or dl-alpha-tocopherol. The natural gelcaps would contain 536,912 mg of d-alpha tocopherol, while the synthetic gelcaps would contain 727,273 mg of dl-alpha-tocopherol. But they both would provide 400 IU of vitamin E.
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If we go back to the KER studies, the d-alpha tocopherol forms of vitamin E arrived at peak levels more quickly than the dl-alpha-tocopherol, indicating greater bioavailability measured over time. But the peak values and change from baseline for natural in relation to synthetic were not considered significantly different. However, the peak values for the water dispersible types in relation to synthetic were significantly higher compared to the synthetic form, showing a distinct advantage.

Does this mean you can use the less expensive dl-alpha-tocopherol? If your horse is experiencing any neuromuscular issues, or you have already tested your horses vitamin E levels and found them low, the micellized or water dispersible products are probably valuable. If tested vitamin E levels are good and your horse remains symptom-free but you are concerned because of a history of recurrence of symptoms, then maintaining vitamin E levels with either the micellized, water dispersible or oil-based natural gelcaps would make sense. If you horse is healthy and has no signs of neuromuscular issues or other concerns, then either the d-alpha tocopherol or the dl-alpha-tocopherol form makes economic sense, as long as you ensure there is added fat to ensure absorption.

In any case, if you have concerns or suspect your horse has neuromuscular issues, the best guidance is testing vitamin E (and selenium) blood levels. Adequate levels of vitamin E in a "symptomatic" horse may indicate a different problem which vitamin E may not have any effect on; without testing you can spend a considerable amount on expensive vitamin E forms with no improvement.

Comparing the Cost:

Kirkland Signature Vitamin E Soft-gels
http://www.costco.com/Kirkland-Signature™-Vitamin-E-400-IU%2c-500-Softgels.product.19954.html
dl-alpha tocopheryl acetate, Other ingredients: Gelatin, glycerin, water
$12.99, 400 IU, 500 Softgels
$ 0.13/2000 IU

Swanson Premium Vitamin E Soft-gels
http://www.swansonvitamins.com/swanson-premium-vitamin-e-400-iu-400-iu-60-sgels
dl-alpha tocopheryl acetate, Other ingredients: Soybean oil, gelatin, glycerin, purified water
$2.99, 400 IU, 60 Soft-gels
$ 0.25/2000 IU

Vitamin E powder (My Best Horse)
http://www.mybesthorse.com/productsorderhere.html
dl-alpha-tocopherol acetate
1,000 IU/2 grams  2000 IU/4 grams
$33.00/500 grams
$ 0.26/2000 IU

Vitamin E Gelcaps (My Best Horse)
http://www.mybesthorse.com/productinformation/vitamine.html
dl-alpha-tocopherol acetate. Other ingredients vegetable glycerine and soybean oil.
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400 IU/1 gelcap  2000 IU/5 gelcaps  
$30.00, 400 IU, 500 Soft-gels  
$ 0.30/2000 IU

Puritan's Pride Vitamin E 400 (soft-gels)  
d-alpha tocopheryl acetate, Other ingredients: Soybean oil, gelatin, glycerin  
$47.99, 400 IU, 750 Soft-gels (3x250 special offer)  
$ 0.32/2000 IU

Swanson Premium Natural Vitamin E Soft-gels  
d-alpha tocochromanol acetate, Other ingredients: Soybean oil, gelatin, glycerin, purified water  
$15.99, 400 IU, 250 Soft-gels  
$ 0.32/2000 IU

Emcelle Tocopherol (Stuart Products)  
d-alpha tocopherol liquid  500 IU/mL  
$89.98/1000 mL  at http://www.animalhealthusa.com/emtonviesu.html (order pump separately)  
$ 0.36/2000 IU  
order direct from Stuart Products  http://www.stuartproducts.com/index.php?option=com_content&view=article&id=75&Itemid=77

Liquid E 50 (Uckele)  
http://equine.uckele.com/vitamin-mineral/liquid-e.html  
Vitamin E from mixed tocopherol, vegetable oil blend  
2500 mg/teaspoon ≈ 2500 IU/5 mL of mixed tocopherols (see note on vitamin E forms above)  
$52.95/1 pint [470 mL] 80 day supply  
$89.95/1 quart [940 mL] 160 day supply  
$ 0.56/day [for ≈ 2500 IU mixed tocopherols providing approximately 559 IU alpha-tocopherol]

E-5000 (HorseTech)  
http://horsetech.com/equine-supplements/selenium-vitamin-e-antioxidants/e-5000  
dl-alpha-tocopherol acetate (natural vitamin E) Milled Flaxseed, Yeast Culture, natural flavoring  
5000 IU/1 oz  
$103.95 5 lbs  (80 1 oz servings,160 1/2 oz servings providing 2500 IU)  
$ 0.65/2500 IU

Natural E-5000 (HorseTech)  
http://www.horsetech.com/natural-e-5000.html  
d-alpha-tocopherol acetate (natural vitamin E) Milled Flaxseed, Yeast Culture, natural flavoring  
5000 IU/1 oz  
$115.95 5 lbs  (80 1 oz servings,160 1/2 oz servings providing 2500 IU)  
$ 0.72/2500 IU

Elevate Maintenance Powder (Kentucky Performance Products)

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http://kppusa.com/all-products/elevate-maintenance-powder/
d-alpha-tocopherol acetate (natural vitamin E) and dextrose
1000 IU/7 grams  2000 IU/14 grams
$52.95/ 2 lbs at Valley Vet (65 days at 14 gram servings)
$ 0.82/2000 IU

Elevate W.S. (sold through veterinarians)) (Kentucky Performance Products)
http://kppusa.com/all-products/elevate-ws/recommended/#begin_content
Vitamin E as d-alpha-tocopherol, polyethoxylated castor oil, water and n-propyl-alcohol
236 mL = 118 days at 1000 IU or 59 days at 2000 IU (500 IU/mL)
$ 0.97/2000 IU

Nano-E (KER)
http://shop.kerx.com/products/nano-e
Contains 250 IU d-alpha tocopherol per 1 mL
$77.95/450 mL
8mL serving = 2000 IU
$1.39/2000 IU

Vitamin E powder (Pure Bulk.com)
700 IU/gram  d-alpha acetate, cornstarch
2000 IU/6 grams
$124.00/500 grams
$ 1.48/2000 IU

LINKS and Further Reading:

Micellization is a method of taking a fat soluble substance and dispersing it into "micelles" which can be suspended in an aqueous (water-based) solution. See https://en.wikipedia.org/w/index.php?title=Micelle&redirect=no for more than you ever wanted to know about micelles.

Cornell Animal Health Diagnostic Center - vitamin E https://ahdc.vet.cornell.edu/test/list.aspx?Species=7&Tst_Name=vitamin%20e&TstTyp=&WebDisc=
Cornell Animal Health Diagnostic Center - selenium https://ahdc.vet.cornell.edu/test/list.aspx?Species=7&Tst_Name=selenium&TstTyp=&WebDisc=

Linus Pauling Institute, Vitamin E http://lpi.oregonstate.edu/infocenter/vitamins/vitaminE/#supplement and http://lpi.oregonstate.edu/feature-story/mechanism-outlined-which-inadequate-vitamin-e-can-cause-brain-damage

University of Minnesota Equine Center, Neuromuscular Diagnostic Laboratory, Selecting a Vitamin E Supplement http://www.cvm.umn.edu/umec/lab/vitE/home.html

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Kentucky Equine Research: \textit{Form of $\alpha$-tocopherol affects vitamin E bioavailability in Thoroughbred horses}
Kentucky Equine Research, Versailles, Kentucky 40383, USA

\textbf{Robert Forbes and Associates (RFA) Vitamin Converter} http://www.robert-forbes.com/vitamin-converter

\textbf{Emcelle from Stuart Products also available at:}
order direct from Stuart Products http://www.stuartproducts.com/index.php?option=com_content&view=article&id=75&Itemid=77
VetPro http://www.vetprovisions.com/emcelle-tocopherol-1000ml $90.00

\textbf{Colorado State - Vitamin E, Bile Acids, Absorption of Lipids}
http://www.vivo.colostate.edu/hbooks/pathphys/misc_topics/vitamine.html
http://www.vivo.colostate.edu/hbooks/pathphys/digestion/liver/bile.html
http://www.vivo.colostate.edu/hbooks/pathphys/digestion/smallgut/absorb_lipids.html