

## 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  $\alpha$ - and  $\gamma$ -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.

## COMPARING THE COST TO PROVIDE VITAMIN E FOR OUR HORSES

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.*

## COMPARING THE COST TO PROVIDE VITAMIN E FOR OUR HORSES

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 your 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)**

<http://www.puritan.com/e-vitamins-024/vitamin-e-400-iu-100-percent-natural-000543#tab-2>  
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**

<https://www.swansonvitamins.com/swanson-premium-natural-vitamin-e-400-iu-500-sgels>  
d-alpha tocopheryl acetate, Other ingredients: Soybean oil, gelatin, glycerin, purified water  
\$15.99, 400 IU, 250 Soft-gels  
**\$ 0.32/2000 IU**

### **Emcelle Tocopherol (Stuart Products)**

[http://www.stuartproducts.com/index.php?option=com\\_content&view=article&id=46&Itemid=53](http://www.stuartproducts.com/index.php?option=com_content&view=article&id=46&Itemid=53)  
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](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 tocopherols, 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)

[https://www.valleyvet.com/ct\\_detail.html?pgguid=58b12256-0d61-4ecb-b480-40ad852fbf47&gas=elevate%20vitamin%20e](https://www.valleyvet.com/ct_detail.html?pgguid=58b12256-0d61-4ecb-b480-40ad852fbf47&gas=elevate%20vitamin%20e)

**\$ 0.82/2000 IU**

### **Elevate W.S. (sold through veterinarians) (Kentucky Performance Products)**

[http://kppusa.com/all-products/elevate-ws/recommended/#begin\\_content](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)

\$56.99 at <http://www.allivet.com/p-727-elevate-ws-natural-vitamin-e.aspx>

**\$ 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)**

<http://purebulk.com/vitamin-e-powder-700iu.html>

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&Test\\_Name=vitamin%20e&TstTyp=&WebDisc=](https://ahdc.vet.cornell.edu/test/list.aspx?Species=7&Test_Name=vitamin%20e&TstTyp=&WebDisc=)

**Cornell Animal Health Diagnostic Center - selenium** [https://ahdc.vet.cornell.edu/test/list.aspx?Species=7&Test\\_Name=selenium&TstTyp=&WebDisc=](https://ahdc.vet.cornell.edu/test/list.aspx?Species=7&Test_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>

## COMPARING THE COST TO PROVIDE VITAMIN E FOR OUR HORSES

### **Kentucky Equine Research: *Form of $\alpha$ -tocopherol affects vitamin E bioavailability in Thoroughbred horses***

J.D. Pagan, M. Lennox, L. Perry, L. Wood, L.J. Martin, C. Whitehouse, and J. Lange

*Kentucky Equine Research, Versailles, Kentucky 40383, USA*

<http://shop.kerx.com/blogs/research-separates-the-innovator-from-the-imitator/10970589-nano-e-research>

**Robert Forbes and Associates (RFA) Vitamin Converter** <http://www.robert-forbes.com/vitamin-converter>

### **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](http://www.stuartproducts.com/index.php?option=com_content&view=article&id=75&Itemid=77)

Pipestone Veterinary Clinic [http://www.pipevet.com/pc\\_product\\_detail.asp?key=4E992AB9D16C4A67B38420D8B281CBC7](http://www.pipevet.com/pc_product_detail.asp?key=4E992AB9D16C4A67B38420D8B281CBC7) \$99.50

VetPro <http://www.vetprovisions.com/emcelle-tocopherol-1000ml> \$90.00

### **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/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](http://www.vivo.colostate.edu/hbooks/pathphys/digestion/smallgut/absorb_lipids.html)