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Tocopherol form affects vitamin E

Three studies have been conducted to assess the effects of different forms of vitamin E on vitamin E status. Results from these studies indicate that the source of vitamin E significantly affects vitamin E status in exercised and unexercised horses.

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VITAMIN E functions as a biological antioxidant, preventing the oxidation of unsaturated lipid materials within cellular and subcellular membranes by neutralizing production of free radicals.

It is a critically important nutrient for all horses, but is especially important for exercise, reproduction and for horses at risk of certain neurological diseases.

Mayhew et al. (1987) found that supplementing mares with 1,500 IU of vitamin E per day decreased the incidence of equine degenerative myeloencephalopathy (EDM) from 40 to 10% in foals born to these mares.

Blythe and Craig (1993) found that young foals showing signs of incoordination and ataxia appeared normal by two years of age when supplemented with 6,000 IU of vitamin E.

Vitamin E can be obtained from natural or synthetic sources, but the chemical structure of each is different. Natural vitamin E is composed of one isomer (d-alpha-tocopherol [RRR alpha-tocopherol]), while synthetic vitamin E is a mixture of eight isomers (dl-alpha-tocopherol [all-rac-alpha-tocopherol]), only one (12.5%) of which is identical to the natural isomer.

For vitamin E to be included in equine feeds without a loss of potency, esters are added to form stable acetates. In order for vitamin E acetates to be utilized in the body, two steps are necessary: The ester has to be removed, and the alpha-tocopherol has to be made water soluble by the action of bile salts in a process known as micellization.

Kentucky Equine Research has conducted three studies to assess the effects of different forms of vitamin E on vitamin E status. Vitamin E treatments used in these studies included synthetic vitamin E (dl-alpha-tocopherol acetate, or SYN), natural-source vitamin E (d-alpha-tocopherol acetate, or NAT; KER Equine Ester) and micellized natural vitamin E (d-alpha-tocopherol, or WS; Elevate WS).

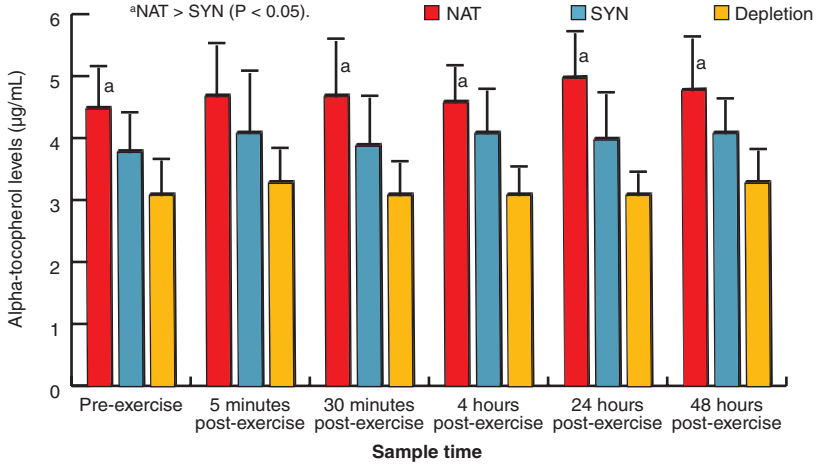
In each of these studies, vitamin E status was assessed by measuring plasma levels of alpha-tocopherol by reversed-phase, high-performance liquid chromatography (HPLC; Sowell et al., 1994).

Study 1

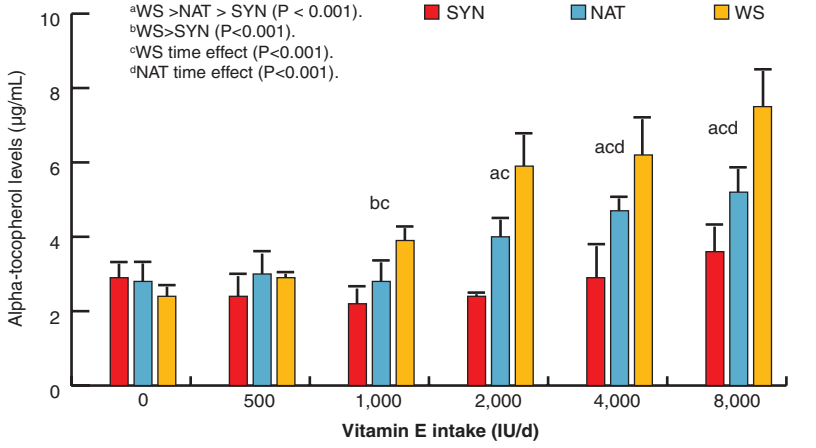
In study 1, SYN and NAT were assessed in exercised horses (four Arabian and four Thoroughbred geldings). Each of these horses had been in a regular training program for several months prior to commencement of the study and were considered physically fit.

The study consisted of four periods:

1. Plasma vitamin E levels pre- and post-exercise



2. Plasma vitamin E following 14-day intervals of increasing levels of vitamin E supplementation



period 1 was a four-week depletion, period 2 a six-week repletion, period 3 a four-week depletion and period 4 a six-week repletion.

The study utilized a switchback design with a supplementation level of 1,000 mg per day. Horses were maintained on a diet of grass hay and unfortified sweet feed in a 60:40 ratio. A vitamin and mineral premix that contained no vitamin E was also fed. Horses wore muzzles during turnout to prevent grazing.

At the end of each period, horses underwent a standardized exercise test on the treadmill. Blood samples for measurement of vitamin E content were taken immediately before exercise and at 5 and 30 minutes and 4, 24 and 48 hours post-exercise.

Plasma tocopherol levels were significantly higher ($P < 0.05$) in the SYN and NAT groups compared to depletion levels, except in the pre-exercise blood sample, where the levels in the SYN group were not significantly higher than depletion levels. Horses supplemented with NAT exhibited higher plasma tocopherol levels before and after exercise compared to those supplemented with SYN ($P < 0.05$; Figure 1).

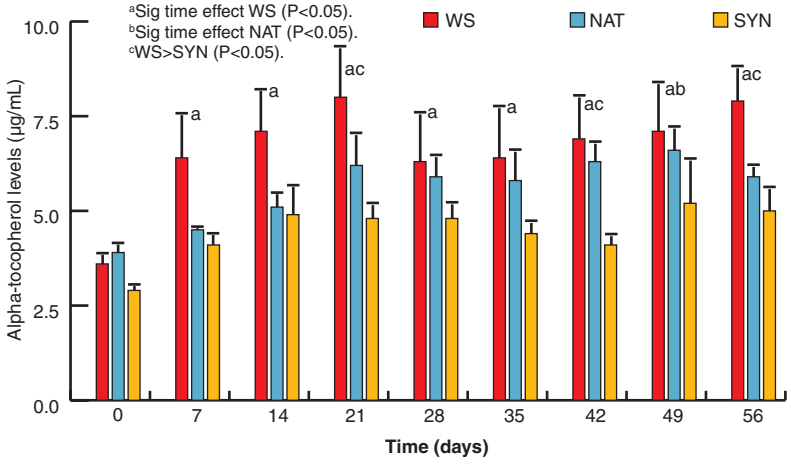
Study 2

In study 2, nine mature, unexercised Thoroughbred geldings were divided into three groups and supplemented with SYN, NAT or WS. Horses were maintained on a diet of unfortified sweet feed and grass hay and wore muzzles during turnout to prevent grazing.

Baseline blood samples were taken following 14 days of no supplementation. Horses were then supplemented with 500 IU of vitamin E from the assigned treatment source for 14 days. The dose rate of vitamin E was doubled at 14-day increments up to 8,000 IU. Plasma tocopherol levels were measured at the end of each 14-day period.

Plasma tocopherol levels were significantly elevated from the baseline in the WS and NAT groups at 1,000-8,000 IU and 4,000-8,000 IU ($P < 0.001$), respectively. No significant difference was recorded in the SYN group as dose rate was increased. Significant differences among groups ($P < 0.001$; Figure 2) were recorded at 1,000 IU (WS > SYN), 2,000 IU (WS > NAT > SYN), 4,000 IU (WS > NAT > SYN) and 8,000 IU (WS > NAT > SYN).

3. Plasma vitamin E concentrations with 5,000 IU of vitamin E supplementation



Study 3

In study 3, nine unexercised Thoroughbred geldings were supplemented for 56 days with 5,000 IU of vitamin E as SYN, NAT or WS. Horses were maintained on the same basal diet as study 2 and wore muzzles during turnout to prevent grazing.

Horses had not received any form of vitamin E supplementation for six weeks prior to commencement of the study. Baseline blood samples were taken prior to supplementation and at weekly intervals during the supplementation period for measurement of plasma tocopherol levels.

No significant differences were evident in the SYN group over time. A significant time effect was recorded in the WS group on days 7-56 and in the NAT group on day 49 ($P < 0.05$). Plasma tocopherol levels were raised significantly in the WS group compared to the SYN group ($P < 0.05$) on days 21, 42 and 56 (Figure 3).

Conclusion

Results from these studies indicate that the source of vitamin E significantly affects vitamin E status in exercised and unexercised horses. Synthetic vitamin E (dl-alpha-tocopherol acetate) was less effective at elevating plasma tocopherol levels than natural source vitamin E, and a micellized form of vitamin E was superior at elevating plasma tocopherol during short-term administration.

References

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*Dr. Joe D. Pagan is president and founder of Kentucky Equine Research Inc., which, through consultation and research, aims to bridge the gap that may exist between basic research and horse production.