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ORAL WATER-SOLUBLE VITAMIN E SUPPLEMENTATION OF THE MARE IN LATE GESTATION, ITS EFFECTS ON SERUM VITAMIN E LEVELS IN THE PRE- AND POSTPARTUM MARE AND THE NEONATE: A PRELIMINARY INVESTIGATION

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Introduction

Vitamin E, a fat-soluble vitamin, is recognized as an essential nutrient shown to affect equine immune response (Baalsrud and Øvernes, 1986). Few studies have been conducted to examine vitamin E status in the equine beyond those that established the levels in the blood (Schweigert and Gottwald, 1999). Serum vitamin E concentrations are reported to range from 1.6-7.5 µg/ml in normal horses (Butler and Blackmore, 1983). Gay et al. (2004) reported that vitamin E levels (measured as plasma beta tocopherol levels) decreased in mares after foaling (6.05 µg/ml to 5.0 µg/ml). The diffuse epitheliochorial placenta of the equine does not allow fat-soluble vitamins to cross in any appreciable amounts making neonates highly susceptible to vitamin E deficiency. Newborns therefore rely heavily on ingestion of colostrum as a source of vitamin E (Schweigert and Gottwald, 1999).

This study examined the effect of oral supplementation of pregnant mares with a water-soluble form of vitamin E (d-alpha tocopherol; Elevate®, KPP) from a natural source during the last two weeks of gestation. The effect of supplementation on serum vitamin E concentrations was investigated in mares prior to foaling and in mares and their foals following birth.

Method

Thoroughbred mares (n=18) were randomly selected one month before their expected foaling dates and placed on a standard diet: 4 kg haylage, 3 kg fortified stud concentrate, and 3-4 hours of daily turnout on average-quality grazing. The total diet was estimated to provide a daily intake of 872 IU vitamin E. The standard

diet was adequate in all nutrients (NRC, 1989). All mares were similarly housed and managed for the duration of the study. The mares (n=18) were later assigned to one of three diets. The groups consisted of a control group (standard diet, n=6), a low-dose (LD) group (standard diet supplemented with 1000 IU vitamin E, n=6) and a high-dose (HD) group (standard diet supplemented with 5000 IU vitamin E, n=6). The vitamin E was administered orally once a day before evening feeding. Blood samples (to determine serum vitamin E levels) from all mares were obtained on day 0 and treatment started on day 1, which was two weeks prior to the mares' predicted foaling dates. Subsequent blood samples were then taken on day 7 and 36 hours postpartum. Blood samples were also obtained from the foals at age 36 hours to determine serum vitamin E and IgG concentration. Colostrum quality (BRIX %) was measured using a handheld refractometer originally designed for the measurement of sugar concentration solutions, one hour post foaling.

Statistics

The data were analyzed to establish distribution structure (Kolmogorov-Smirnov Z statistic) and were tested for normality (skewness and kurtosis) (Zar, 1999). Results were subsequently analyzed using one-way analysis of variance (ANOVA) with additional post hoc tests Tukey Honest Significant Difference (Winer et al., 1991).

Results

The average number of days (before foaling) for the mares (both supplemented groups, n=12) receiving oral vitamin E supplementation was 23 days.

MARES

Measures of dispersions showed normality within all data sets. Mean serum vitamin E concentrations were not significantly different ($P>0.05$) between groups on day 0 (5.37 mg/l \pm 1.59). The increase in serum vitamin E concentrations seen on day 7 was significantly greater in the LD and HD supplemented groups compared to the controls (1.87 mg/l, 2.15 mg/l, and 0.85 mg/l) ($P<0.05$), respectively. Post hoc analysis showed no significance between the two supplemented diets. Mares in the LD and HD groups had significantly greater increases in serum vitamin E concentrations between day 0 and 36 hours post foaling levels when compared to the control mares (3.07 mg/l, 4.00 mg/l, and 1.06 mg/l) ($P<0.05$), respectively. Post hoc analysis showed no significant difference in the rise of serum vitamin E between day 0 and 36 hours post foaling between the LD and HD groups. Mares from both the LD and HD groups

produced higher quality colostrum compared to the control group (33%, 36%, and 26%, respectively) ($P < 0.05$). Post hoc analysis showed no significant difference between the LD and HD groups.

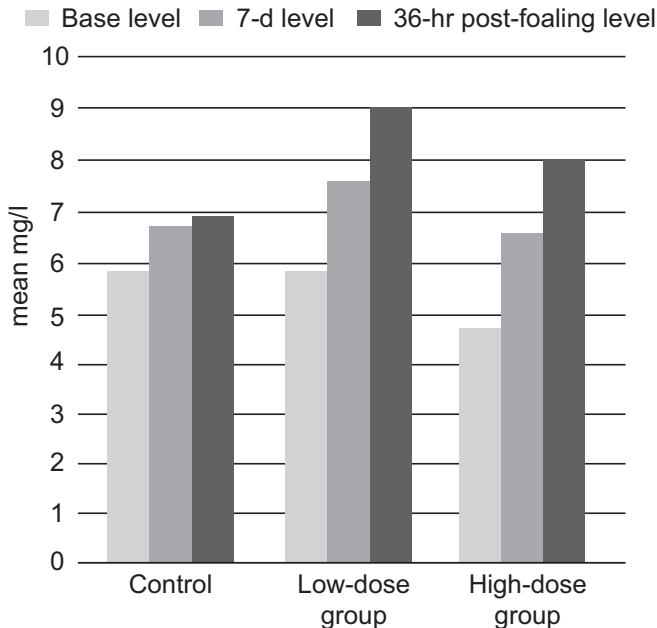


Figure 1. Effect of vitamin E supplementation on serum vitamin E concentration (mg/l) following 7 days of supplementation and 36 hours post partum.

FOALS

There were no significant differences between the control group and the supplemented groups with respect to foal serum vitamin E and IgG concentration ($P > 0.05$).

Discussion

The study indicates that serum vitamin E concentration was successfully increased through oral supplementation with a natural water-soluble vitamin E in late gestation. The study demonstrated that there was no significant difference in increases of serum vitamin E between the LD and HD groups (1000 IU or 5000 IU, respectively). This result is supported by Siciliano et al. (1997), who reported no benefit to serum vitamin E levels in exercising horses supplemented at 800 ppm compared to 300 ppm. The study indicated that vitamin E supplementation had no effect on serum vitamin E and IgG concentrations in the foals at 36 hours post partum. This finding has also

been reported in newborn calves where supplemental vitamin E in dams had no effect on serum vitamin E and IgG concentrations of calves (Bass et al., 2001). The study demonstrated that colostrum quality was better in the LD and HD mare groups, when compared to the control group. Colostrum vitamin E concentration has been shown to relate to maternal intake (Whiting and Loosli, 1948). It suggested vitamin E supplementation could have contributed to the increase in colostrum quality in the supplemented mare groups. Additionally, the colostrum quality appeared to be dependent upon the vitamin E status of the mare at day 7 of the supplementation period. This suggests a prior knowledge of a mare's vitamin E status and early supplementation may be an important management consideration. The effects and level of vitamin E supplementation need careful consideration if optimum management of the pre- and postpartum mare and neonate is to be affected.

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