Research Note

Survival and Serum IgG Levels in Twin Born LambsSupplemented with Vitamin E Early in Life[1]

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Lamb mortality is a major factor limiting profitability in sheep operations. Estimates of pre-weaning losses range from 15 to 51% (Rook, 1997), with mortalities as high as 35% considered normal for large sheep operations (Rowland et al., 1990). Rowland et al. (1990) also reported that 50% of mortality occurs in the first 24 hours of life.

Supplemental vitamin E given orally to the ewe during late gestation has been shown to decrease lamb mortality (Kott et al., 1998). In addition, when lambs were injected with vitamin E shortly after birth, Gentry et al. (1992) noted an increase in lamb serum immunoglobulin G (IgG) concentration that could be indicative of enhanced immune function (Besser and Gay, 1994). However, no advantages in survival or lamb body weight gain were observed when supplemental vitamin E was given to lambs at birth (Gentry et al., 1992; Williamson et al., 1996).

Many studies assessing the role of vitamin E in immune function and/or survival in sheep lack sufficient numbers, and have not addressed pathological and/or environmental stresses common to Western sheep operations. Therefore, our objectives were to examine the effects of supplemental vitamin E to newborn twin lambs on lamb survival, serum vitamin E concentration, and serum IgG concentration. Sheep used in our study were part of a production lambing operation, thus the labor constraints and lambing environment used in this experiment were typical of a western sheep production system.

Twin born lambs (n = 960) were used in this 2-year study. Research was conducted at the Montana State University, Red Bluff Experimental Ranch located 50 km west of Bozeman, Montana. Ewes grazed dormant native range until 30 d before lambing when they were confined and fed approximately 2.5 kg·ewe^{-1}·day^{-1} grass hay and .14 kg·ewe^{-1}·day^{-1} of a grain-based supplement (20% CP). Ewes had ad libitum access to water and a trace mineral salt mix. Ewes were shed lambed in 1.5 m^2 individual pens starting April 11 in both 1997 and 1998. Lambs were ear tagged and tails docked approximately 24 hours after birth. Twin born lambs received one of three experimental treatments. Treatments were 1) one twin lamb assigned randomly to orally receive a single dose of 400 IU supplemental vitamin E within 1 hour of birth (1 g of Rovimix E-40%, 400 IU α--tocopherol acetate; Roche Vitamins, Parsippany, NJ), 2) the other twin lamb received no supplemental vitamin E, 3) of those lambs that received the single dose, half were randomly assigned to orally receive a second dose (400 IU) of vitamin E 16 to 24 hours after the first dose. Lambs and ewes remained in individual pens for approximately 24 hours and then moved to larger pens where they remained until turnout to summer range approximately 30 d post-lambing.

At 3 d post-partum, blood was collected from a total of 223 lambs via jugular venipuncture. Sera were frozen for later determination of serum α-tocopherol and IgG concentrations. Lamb sera were analyzed for α-tocopherol concentration at the Wyoming State Veterinary Laboratory using flourometric determination. Lamb sera was analyzed for IgG concen-

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Table 1. Effect of oral vitamin E supplementation to twin born lambs on serum vitamin E and immunglobulin G (IgG)[a]

	Supplemental vitamin E[b]			
	Control	Single	Double	SEM
N[c]	111	63	49	
Serum α-tocopherol, μg/mL	1.32[v]	3.48[w]	5.26[x]	.201
Serum IgG, μg/mL	8.77	7.72	9.69	.743
N[d]	480	258	222	
Body weight, kg[e]				
Turn out (avg age = 40 days)	11.2	11.0	11.3	.22
Weaning (avg age = 120 days)	26.2	26.0	27.2	.73
Body weight, kg[f]				
Turn out (avg age = 40 days)	12.6	12.8	2.5	.14
Weaning (avg age = 120 days)	30.2	30.1	30.5	.32
Mortality, %[g]	10.8	12.4	9.9	—

[a] No supplement x year interactions (P > 0.30).
[b] Control = no supplemental vitamin E; Single = 400 IU supplemental vitamin E within 6 hours of birth; Double = Two doses of 400 IU of supplemental vitamin E. The first within 6 hours of birth, the second dose of 400 IU of supplemental vitamin E within 10 to 18 hours after the first dose.
[c] Observations for serum α-tocopherol and IgG data
[d] Observations for bodyweight and mortality data.
[e] Body weight means calculated with a '0' for lambs that died, thus values represent weight of lambs weaned/treatment.
[f] Bodyweight means calculated with 'no entry' for lambs that died, thus values represent live animal performance.
[g] Mortality observed at turnout.
[vwx] Within Supplemental Vitamin E treatment, means without a common superscript letter differ (P < .01).

tration using an ELISA procedure (Daniels et al., 2000).

Lambs were weighed at birth, approximately 30 d post-partum (turnout to summer range) and at 120 d post-partum (weaning). Percent lamb mortality at turnout was also recorded. Lamb was the experimental unit. Lamb BW, and serum IgG, and α-tocopherol concentration were analyzed using the GLM procedure of SAS (1993). The model included treatment, sex, year, and all possible interactions. Lamb birth weight and birth date were included in the model as covariates. Lamb mortality was analyzed using Chi square procedure of SAS (1993).

Supplemental vitamin E x year interactions were not detected (P > .30). In addition, lamb sex did not impact (P > .50) percentage mortality, serum α-tocopherol, or serum IgG concentrations. Similar to results reported by Jneru et al. (1994), serum α-tocopherol was greater (P< .01) for lambs receiving two doses of supplemental vitamine E compared to those given one dose, which was greater (P< .01) than for lambs receiving no supplemental vitamin E (Table 1).

Afzal et al. (1984) and Ritacco et al. (1986) reported positive impacts of supplemental vitamin E on the ability of older animals to mount an immune response. Serum or plasma IgG levels in newborn ruminants have been reported to be good indicators of an animal's ability to mount an immune response (Besser and Gay, 1994). In our study, serum IgG concentrations did not differ (P > .50) among treatments (Table 1). These results are counter to the findings of Gentry et al. (1992) who noted an increase in lamb serum IgG when lambs were injected with vitamin E shortly after birth. Increased serum α-tocopherol in newborn lambs may not always affect survival and IgG levels. Potential explanations for the different results in these studies include the method of administering vitamin E, colostral vitamin E concentration, a lack of exposure to environmental or pathogenic stress sufficient to elicit an immune or production response, and the different breeds of sheep used in each study.

Hidiroglou and Karpinski (1987) examined the route of administration of supplemental vitamin E and its effect on uptake of vitamin E by sheep and found that oral administration of vitamin E via gelatin capsules resulted in decreased bioavailability compared to either intramuscular, or intravenous administration. Gentry et al. (1992) reported mean serum α-tocopherol concentrations of 43.9 μg/mL at 1 day of age for lambs injected with 1500 IU of α-tocopherol at birth.

This value is 8 times greater than the serum concentration in lambs given an oral double dose (5.26 μg/mL, Table 1) in our study.

Gentry et al. (1992) used Suffolk sheep while we used western white face range breeds. Since Bradley et al. (1972) reported higher mortality in Suffolk compared to Targhee sheep it may be reasonable to speculate that the ability of supplemental vitamin E to influence immunocompetence would be more pronounced in a less vigorous breed such as Suffolk that may be more susceptible to environmental and pathogenic stress.

Lamb body weight and survival did not differ ($P > .40$) among vitamin E supplemental treatments (Table 1). Kott et al. (1998) evaluated the effects of supplemental vitamin E to the ewe on lamb survival. These authors reported that mortality was decreased by vitamin E supplementation over the 3-yr study period. The reasons for differences noted between studies in which supplemental vitamin E was given to the late gestating ewe or the newborn lamb are not clear. Possibly, supplemental vitamin E may havemore benefit as an agent of positive physiological change in the dam rather than as a nutrient provided directly to the neonate.

Implications

Although supplemental vitamin E given to the lamb at birth will increase lamb serum a-tocopherol levels, this practice does not appear to be effective in reducing lamb mortality, increasing lamb performance, or improving indices of immunocapacity (such as IgG levels) in a production environment typical of the Western United States using white face sheep.

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