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Selenium and Vit. E as Related to Growth and White Muscle Disease in Lambs.* (25674)

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Interest has been focused recently upon the effects of 2 dissimilar entities—selenium and Vit. E—in overcoming certain muscular dystrophies. Those dystrophies caused by feeding experimentally-compounded, Vit. E-deficient diets have been cured by addition of dietary Vit. E in rabbits(1), guinea pigs(2), mice(3), lambs(4) and chicks(5). Vit. E has also proven effective when added to dystrophogenic diets high in unsaturated fats(6). On the other hand, minute amounts of selenium have been found to protect chicks on torula yeast diets against exudative diathesis (7) and similarly-fed rats(8) and mice(3) against hepatic and multiple necroses, respectively. In Oregon, 0.1 part/million of selenium in dry matter of ewes' diet has protected lambs from white muscle disease (WMD) when their mothers were fed pre-partum on a "causative" ration(9). Some syndromes provide evidence that Vit. E and selenium may act in distinctly different ways. Thus, studies of Schwarz and associates showed that Factor 3-active selenium compounds were ineffective against rabbit muscular dystrophy on Vit. E-free diets(10) and inactive in rat resorption-gestation technic for Vit. E bioassay(11). Further, the Oregon workers showed that neither parenteral nor oral administration of Vit. E to ewes pre-partum would prevent WMD in their lambs, while oral selenium proved highly protective(9). Since previous studies suggest a growth stimulation in chicks(12,13) and in lambs(14) resulting from sub-toxic levels of selenium supplementation, it has become of interest to investigate the effects of Vit. E and selenium upon growth and dystrophy prevention simultaneously in sheep exposed to diets conducive to WMD. Additionally, it was desired to confirm and extend earlier findings as to control of WMD by administration of selenium. This paper reports on growth rate and incidence of WMD in lambs whose mothers received a dystrophogenic Ladino hay diet with and without selenium and Vit. E.

Materials and methods. Forty-eight mature, pregnant, crossbred ewes were randomly assigned to 4 lots housed in identical pens bedded with wood shavings. Lot 1 was fed the basal ration of 4 lb. Ladino clover hay and ¼ lb. ground oats per head daily. Lot 2 and Lot 3 ewes received the same basal ration; in addition the Lot 2 lambs received 1.40 mg Se, as aqueous Na_2SeO_3 inj. intramuscularly, while Lot 3 lambs were each given 2,000 IU Vit. E orally. Lot 4 ewes received the basal diet supplemented with 0.1 ppm selenium as Na_2SeO_3 calculated on basis of total ration dry matter and added to the ground oats. Diet treatments commenced about third month of gestation and continued until lambs were 6 weeks old. All groups received water and iodized salt, *ad lib.* Lambs in Lot 2 received selenium in 2 injections: the first, at 1 day of age, supplied 0.28 mg, while the second, at 14 days, supplied 1.12 mg Se. The sum of these doses was calculated to provide 0.2 ppm Se in estimated dry matter intake for the first 6 weeks of life. Vit. E was given in aqueous suspension, (Type "F-50" containing 50,000 IU Vit. E/lb, supplied by Distillation Products Industries, Rochester, N.Y.) in 2 equal doses at 1 and 4 days of age. The lambs were weighed at birth, 2 weeks and 6 weeks of

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TABLE I. Effects of Selenium and Vit. E on Incidence of WMD and Growth in Lambs.

Lot	Total lambs	Lambs with gross WMD lesions	Avg wt (lb) of lambs at Birth	2 wk	6 wk	Gain (lb), birth-6 wk
1	20	16	9.99	16.62	25.31	15.32
2	17	0	9.30	17.53	30.14	20.84*
3	18	0	9.07	16.40	26.40	17.33
4	10†	0	10.35	20.53	37.50	27.15*

* Significantly greater than Lot 1 ($P < .05$).

† In addition to those listed, 2 sets of triplet lambs were born in Lot 4 and lost due to difficulties at parturition. No lesions of WMD were apparent.

age. All surviving lambs were slaughtered at 6 weeks and examined for lesions.

Results. All treatments (Lots 2, 3, and 4) were effective in protection against clinical symptoms and gross lesions of WMD (Table I).

In this experiment oral Vit. E, given directly to lambs, was protective, whereas our earlier experiences showed that Vit. E given ewes pre-natally was not(9), suggesting possible difficulties in placental transfer of the vitamin. Growth of lambs receiving Vit. E, however, was not significantly different from that of untreated controls (Lot 1). On the other hand, growth of both lots of lambs receiving selenium was significantly greater than that of controls ($P<0.05$) and growth of those lambs whose mothers received oral selenium was significantly greater than that of lambs which received selenium by injection ($P<0.05$). This difference is interpreted as indicating that the ravages of WMD begin pre-natally and may be prevented by pre-natal administration of selenium to the ewe. Selenium given post-natally in amounts listed, however, while arresting the course of WMD, does not completely overcome growth interference.

Growth responses resulting from selenium administration in this study appear to be further confirmation of the role of selenium as an essential nutrient, *per se*, necessary for normal growth even in absence of WMD lesions.

Summary. 1) Selenium, given pre-natally *per os* to ewes or post-natally by injection to lambs, prevented WMD and resulted in increased growth of lambs as compared to untreated controls. 2) Growth response to selenium fed pre-natally was greater than that to selenium injected post-natally. 3) Massive doses of Vit. E at birth protected lambs from WMD, but did not result in improved growth. 4) Evidence suggests an essential role for selenium in supporting growth of lambs.

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