

Effect of Vitamin E and Selenium Injections on Scours, Plasma Copper Concentration, and Immune Status of Newborn Beef Calves.

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SUMMARY

Objectives of this study were to study the effect of vitamin E and Se treatments on: 1) scours, 2) plasma immunoglobulin (Ig) concentration, and 3) plasma mineral concentrations. Within each treatment, calves that experienced scours had decreased plasma vitamin E when compared to healthy calves. Immunoglobulin mu (IgM) was not affected by scours or treatment. Immunoglobulin gamma (IgG) concentrations were decreased in calves with scours. Scours increased plasma copper (Cu) over time, when compared to unaffected calves.

INTRODUCTION

Scours, like the common cold, is not initiated by any one factor. Several microorganisms are responsible for scours. Several other factors promote the onset of scours, most notably weather, and may be beyond the control of ranchers who calve their cows on muddy wet feeding grounds. In Oregon it is estimated that scours cost cattlemen an average of 10 million dollars annually, and in peak scour years such as 1989 this figure can be five to six times higher. Thus, studies have been underway to investigate factors influencing the incidence and severity of scours.

Much research has been done with vitamin E and selenium (Se) and their effect on the immune system. The importance of Se and vitamin E in disease resistance has been shown in many studies. This research project is attempting to bolster the immune system of calves to alleviate scours. This is particularly important for beef producers whose cows calve within a short time frame, where calves are confined to small areas. Bolstering the immune system may reduce the incidence or duration of the illness thus reducing costly drugs administered to afflicted calves. This investigation conducted during the winter of 1993 is part of a continuing study on the effect of vitamin E and Se on scours. Previous work with the experimental herd at Eastern Oregon Agriculture Research Center (EOARC) has shown plasma vitamin E to be decreased ($P < .01$) and copper (Cu) elevated ($P < .05$) in calves with scours. Objectives of this study were to determine the effect of vitamin E, Se, or the combination treatment on scours incidence and plasma concentration of vitamin E, Se, Cu, IgG, and IgM in newborn beef calves.

Results of this study will hopefully lead to recommendations for cattle producers that will alleviate some problems with calf hood maladies during the calving season. This would be particularly beneficial to those animals calving in the severe climates of eastern Oregon.

MATERIALS AND METHODS

The facilities of EOARC at Union were used for this study, with cows from both

Union and Burns stations. Hereford x Simmental cattle were utilized from Union and consisted of 49 first-calf heifers and 160 cows. One-hundred-sixty Hereford x Angus cows from Burns were also utilized. Thirty days prior to expected calving of the first animal within the calving group, cattle were assigned to one of four treatments, in a 2x2 factorial arrangement, using a randomized block design with calving date used as the blocking factor. Treatments consisted of a controlled release Se bolus that provided 3 mg per day, and an intramuscular injection of 10,000 IU of α -tocopherol (+vit +Se), vitamin E injection alone (+vit), Se bolus alone (+Se), and no vitamin E or Se supplementation (**control**). Treatments for calves consisted of intramuscular injections of Se based on birth weight (0.027 mg/lb) at birth and 2 weeks of age and vitamin E at birth (1500 IU), 2 and 4 weeks of age (750 IU). Calves were on the treatment regimen corresponding to their dams.

Calves were bled at birth and at weekly intervals for 4 weeks. Blood was collected into 10 ml Na-EDTA tubes, and centrifuged to obtain plasma. Plasma was frozen at -20 °C until analyzed. Plasma vitamin E was extracted in heptane and concentrated in methanol and concentrations were determined by liquid chromatography. Cu plasma levels were determined via Perkin-Elmer Atomic Absorption/Flame Emission Spectrometer (Perkin-Elmer Corp. Norwalk, CT.). Healthy calves were pooled for plasma Se analysis. Plasma Se determined with a Perkin-Elmer 3030 instrument (Perkin-Elmer Corp., Norwalk, CT) equipped with an electrode-less discharge lamp and automatic Zeeman-effect background correction. IgG and IgM determinations were performed using a commercial radial immunodiffusion kit (VMRD, Inc., Pullman, WA). Incidence of scours was scaled from 0 (no scours) to 4 (severe dehydration and requiring I.V. electrolytes).

Statistical analysis was performed using Statistical Analysis Systems (SAS ver. 6.08). The GLM procedure was used in all analysis with repeated measures used in analysis over time (age of calf). Analysis was performed as a completely randomized design, as the effect of the blocking factor (calving date) was inefficient. The three factors considered were vitamin E, Se, and scours.

RESULTS AND DISCUSSION

Plasma vitamin E concentrations of calves was increased ($P < .001$) by intramuscular injections of vitamin E. Treatment of calves with vitamin E decreased ($P < .003$) plasma Se levels across all treatments. Plasma Se was increased ($P = .001$) by treatment with intramuscular injections of Se. These data indicate that injections of vitamin E and Se were effective in raising plasma levels of vitamin E and Se. Calves affected with scours had lower ($P < .05$) plasma vitamin E than unaffected calves within the same treatment, consistent with previous research on this herd. Scours incidence, maximum value, and duration were not responsive to treatment; however incidence and severity of scours was minimal.

Cu concentrations in the plasma was not affected by treatment of calves with either vitamin E, Se, or the combination of the two; however, plasma Cu increased ($P < .001$) with age. Scours, over the sample dates, increased ($P < .005$) plasma Cu concentrations when compared to unaffected calves. Cu concentration is known to increase with viral and bacterial challenges in cattle; therefore plasma Cu is expected to increase in calves with scours.

Total plasma IgG concentrations decreased ($P = .0001$) from birth to the fourth week of age. This decrease in total IgG is representative of the loss of passively acquired colostral antibodies with time, before the immune system of the calf is fully functional. Calves

affected with scours had decreased ($P<.02$) IgG concentrations, compared to unaffected calves, across all treatments. IgG concentrations tended to be affected ($P<.06$) by Se with a scours interaction, when averaged over all time points. Se directly affected total IgG concentration dependent upon age of calf ($P<.01$) and vitamin E treatment ($P<.01$). Scours did not decrease total plasma IgG concentration in Se treated groups, while IgG concentration decreased with scours in control and vitamin E treatment groups. IgM concentrations were low with high variability; therefore, total plasma IgM was not found to be affected by scours or either of the vitamin E and Se treatments.

Calving interval was decreased in first-calf heifer's with vitamin E injections. Calves from the heifers injected with Se were heavier at weaning than those not injected. The mature cow herds did not exhibit any differences on calving interval, weaning weight, or average daily gain due to treatments.

This data suggests that the immune system is enhanced with Se and vitamin E injections. Differences in morbidity and mortality were not seen; however, differences were observed with the more sensitive measures of the immune system. Difference in morbidity may be observable with increased incidence and severity of scours.

CONCLUSIONS

Calves that experience scours have lower vitamin E plasma levels, but more research is needed to determine if decreases in plasma vitamin E are a cause or an effect of the scours. Vitamin E injections decreased the calving interval for first-calf heifers, which allows an earlier breed back after calving and increased weaning weights of their calves. Immune system tests have shown vitamin E and Se to enhance the immune system. Morbidity and mortality differences may need more severe weather conditions or a higher level of challenge from disease organisms before differences are apparent. Further work is being conducted on the relationship between scours and vitamin E. Vitamin E is now being fed on a daily basis as opposed to the injections in this trial.