Effect of Pasture Trace Mineral Supplementation on Liver Mineral Levels and Postweaning Health

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The development of healthy, immune competent beef animals during the cow/calf phase of production can be important for successful transition of weaned calves to the feedlot. The objectives of this trial were to determine if differences are present in liver mineral levels, feedlot morbidity and mortality, weaning weights, and serological titers of calves nursing dams supplemented with and having access to one of three mineral supplements: sulfate-based trace minerals, metal-complexed trace minerals, and a control mineral. An additional objective was to determine if differences in liver mineral levels are present in cows fed one of the three minerals on a free choice basis.

The large herd of cow/calf pairs were randomly allotted to one of nine pastures in which one of the three mineral supplements were available free choice. Liver biopsies were performed on a statistical sampling of cows in both spring and fall and a sample of calves in the fall at weaning. Consumption of minerals in forage, water, and mineral was monitored. Analysis of grass clippings at three intervals during the summer showed a range of 2.38-4.16 ppm copper. A total of 618 calves were weaned.

Results of liver biopsy analyses showed differences in values ($p<.05$) in both cows and calves. Additionally, 56 day morbidity data showed a difference ($p<.05$) in feedlot morbidity with metal-complex mineral calves showing improvement over sulfate-based mineral calves. There were no differences in viral serological titers. There were no differences in mortality during that period.

This trial demonstrated significant differences in liver mineral storage between groups as well as improved 56-day feedlot morbidity in metal-complex calves as compared to sulfate-based calves.

Comparison of Maternal Blood and Fetal Liver Selenium Concentrations in California Cattle

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Selenium (Se) concentrations were measured in paired maternal blood and fetal liver samples from a California slaughterhouse (SH) (beef=19, dairy=54) and from bovine abortions submitted to the California Veterinary Diagnostic Laboratory System (CVDLS) (beef=20, dairy=20).

Significant breed and location differences were noted ($P<0.001$). Of the SH samples, dairy maternal blood selenium contents were higher (mean $\pm$ sd; 0.22 ± 0.056 ug/ml) than the beef breeds (0.137 ± 0.082). The CVDLS mean maternal blood content of the 9 dairy breeds samples (0.192 ± 0.028) was similar to the SH dairy samples but greater than the SH beef samples. The SH mean fetal liver Se contents were also higher ($P<0.001$) for the dairy breeds (0.777 ± 0.408 ug/g) compared to beef (0.443 ± 0.038). Mean fetal liver Se content for SH samples were higher ($P<0.002$) than the CVDLS fetal liver samples (beef, 0.244 ± 0.149; dairy, 0.390 ± 0.165). The CVDLS dairy fetal liver content was greater ($P<0.001$) than those for beef breeds.

The average fetal liver to maternal blood Se content ratio was 3.53 ± 1.89 for SH dairy breeds ($r=0.38$),

2.11 ± 1.00 for CVDLS dairy breeds (r=0.31) and 3.43 ± 1.50 for beef breeds (r=0.58). Both the SH ratios were significantly greater than the CVDLS dairy breed ratio.

Based on these results, breed and source location should be taken into account when interpreting Se content. Fetal liver Se content should only be used as a screening test and combined with whole blood Se content to make judgements about herd Se status.

Pasteurella haemolytica Vaccines and Their Effectiveness

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Abstract

Pasteurella haemolytica **biotype A, serotype 1 (Ph1) bacterins and bacterin-toxoids formulated in oil adjuvants induce protective immune responses approaching those induced by virulent Ph1. In comparison, aluminum hydroxide based adjuvants induce lower protective and serological immune responses. Bacterin-toxoid vaccines formulated in water-in-oil adjuvants induced high levels of protective immunity against transthoracic and field challenge. Bacterin-toxoid with oil-in-water adjuvant induced high protective immunity against transthoracic challenge and was superior to Ph1 bacterin-toxoid with $Al(OH)_3$ adjuvant. Reactions at the point of inoculation vary with formulations, are usually inapparent if intramuscular, manageable if subcutaneous and disappear with time.**

Introduction

The effectiveness of Ph1 vaccines is determined by antigen content and the presentation of these antigens to the bovine immune system. Of the methods of antigen presentation for stimulating immune responses oil adjuvant formulations have been very effective. Here the effectiveness of oil adjuvants for stimulating protective immune responses to Ph1 will be presented with a discussion of available direct comparisons to other adjuvants.

The newer USDA licensed Ph1 vaccines induce protective immune responses in calves as demonstrated by experimental challenge. Consistent protection in field trials and in veterinary practice, however, has not always followed. Reasons for this lack of consistent protection in field challenge studies include herd variation in susceptibility, differences in potential pathogenic flora in source herds, superimposed infections by bacteria other than Ph1 and uncontrolled variations in stress levels. Also contributing to this inconsistency is the use of vaccines too late in the infection and disease process and use of vaccines that induce only marginal protection.

Inoculation of healthy animals with fully pathogenic Ph1 results in solid protective immunity and is typically the "gold standard" to which the immune responses to Ph1 vaccines are compared. Loan and Purdy reported on the effectiveness of Ph1 bacterin-toxoids with oil adjuvants for the prevention of *Pasteurella*-induced pneumonia and bovine respiratory disease complex (BRDC) in 1986.[1] Such bacterin toxoids gave significant protection in both experimental and field challenge studies. This led to a reevaluation of oil adjuvants in Ph1 vaccines and to additional reports on the effectiveness of water-in-oil adjuvant formulations.[2,3] In subsequent studies by Loan and Tigges[4] purified Ph1 capsular polysaccharide in oil adjuvant stimulated higher titers of IgG1 and IgG2 compared to the same antigen with $Al(OH)_3$ adjuvant, suggesting a possible mechanism for the enhanced stimulation of immunity by oil adjuvants. Other studies also indicated the superior enhancing effect of oil adjuvants compared to other commonly used adjuvants on the immune responses of calves to Ph1 antigens. Such antibody responses may be higher than those to fully virulent Ph1.[2]

In comparisons of Ph1 bacterins with oil adjuvants to live Ph1, bacterins induced protection approximately equivalent to that induced by high doses of attenuated live *P. haemolytica* vaccine[5]. In a broader comparison of vaccine efficacy,[2] bacterin with oil adjuvant had the same protective efficacy as live *P. haemolytica* when protection was measured by experimental challenge. In the same study, aluminum hydroxide in gel and trehalose dimycolate (in oil) did not stimulate protective immune responses. Oil adjuvants have been used also in combination bacterins containing Ph1[6].

Oil adjuvants have been studied in the bovine animal using antigens other than those of Ph1. Vaccines formulated with oil adjuvants stimulated higher antibody responses and significantly greater protection against foot and mouth disease when compared to the more traditional vaccines with alum and aluminum hydroxide with or without added saponin or quil A.[7,8]