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Inflammatory response of feedlot cattle to clostridial vaccination: a comparison of 7-way bacterin-toxoid and C&D toxoid

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INFLAMMATORY RESPONSE OF FEEDLOT CATTLE TO CLOSTRIDIAL VACCINATION: A COMPARISON OF 7-WAY BACTERIN-TOXOID AND C&D TOXOID

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Summary

Twenty-four finishing steers (758 lb) were subcutaneously vaccinated and revaccinated 31 days later with 1) sterile saline, 2) a clostridial perfringens C&D toxoid, or 3) a 7-way clostridial bacterin-toxoid to evaluate the effects of vaccine type on inflammatory response in feedlot cattle. Injection site reactions were most severe ($P < .05$) and persistent for 7-way bacterin-toxoid and were accompanied by elevated ($P < .05$) blood haptoglobin levels indicative of acute inflammation. Revaccination with 7-way bacterin-toxoid reduced ($P < .05$) feed consumption for a 4-day period postvaccination. Although some reactions were severe, they appeared transient because blood parameters and volume of injection site reactions returned to baseline levels 25 to 60 days after injection. Performance over the entire feeding period was not significantly altered by treatment. We strongly recommend that clostridial products be used subcutaneously only, to minimize potential damage to carcass tissue from intramuscular injection.

(Key Words: Vaccination, Cattle, Injection Site.)

Introduction

Recent observations indicate that multiple clostridial bacterin-toxoids may contribute to localized inflammatory responses, depressed feed consumption postvaccination, and damage

to carcass tissue. In addition to heightened inflammation, the impact of depressed feed consumption can be direct, resulting in reduced gain, or indirect, through digestive upsets. Any factor that contributes to an unstable consumption pattern can increase bunk management problems and increase morbidity or mortality from bloat or other digestive disorders. Therefore, the purposes of this research were to: 1) evaluate injection site reactions resulting from clostridial vaccination; 2) examine the inflammatory response associated with clostridial vaccination; and 3) evaluate the impact on appetite associated with clostridial vaccination.

Experimental Procedures

Twenty four crossbred steers were selected for uniformity of size and conformation from a group of 108. All cattle were processed on January 20, 1992 using a 7-way clostridial product in combination with *Hemophilus somnus* (Ultrabac® 7/Somubac™, SmithKline Beecham Animal Health, Exton, PA). On June 20, the calves received a 7-way clostridial booster. The steers were delivered to the KSU Beef Research Unit on June 30. On July 1 (day 1 of the trial), they were individually weighed (758 lb average), ear tagged, and randomly allotted to immunization treatments to be administered on day 15. Treatments were: 1) 5cc of sterile saline; 2) a clostridial vaccine consisting of the antigens of *Clostridium perfringens* type C&D in a 2cc dose (C&D; Ultrabac ® CD, SmithKline Beecham

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Animal Health, Exton, PA); and 3) a clostridial vaccine consisting of the antigens of *Clostridium chauvoei*, *sordellii*, *septicum*, *novyi*, and *perfringens* type C&D in a 5cc dose (7-way, Ultrabac® 7).

On the last day of the 14-day feedlot acclimation period, the steers were weighed, blood was drawn, and any reactions from previous injections were noted. On the following day (day 15), the steers were vaccinated according to the random allotment they received on day 1.

All products were delivered subcutaneously using a skin tenting technique. Each animal was injected using a new, sterile, 16-gauge 3/4-inch needle. The hair over the injection site was clipped to identify the exact site of injection. The calves were weighed and bled on days 18, 21, 25, 30, and 40 and weighed again on days 46, 61, 136 and at slaughter. The second injection was given on day 46, on the left side of the neck. Blood analyses included cell counts and concentrations of aspartate amino-transferase, creatine phosphokinase, sorbitol dehydrogenase, gamma globulins, and haptoglobin. The length, width, and height of the injection site reactions were measured. Steers were individually fed a corn-based finishing diet formulated to contain 12% CP, 62 Mcal NEg, and 91 Mcal NEm/lb during the trial.

Results and Discussion

Inflammatory response. White blood cell counts, segmented neutrophils, lymphocytes, and gammaglobulin levels all showed small increases in response to treatment, but remained within or close to normal limits. Plasma protein and fibrinogen levels also showed slight increases but remained well within normal limits. Blood haptoglobin levels were increased after injection in the C&D and 7-way treatment groups, whereas the sterile saline group showed no change over time (Table 1). The response to C&D

and 7-way injection was greatest on day 3 postinjection. An increase in haptoglobin level is indicative of an acute inflammatory response.

Injection site reactions. Injection site reactions were noted in 100% of the clostridial-vaccinated calves within 24 hours after administration. The injection reactions were raised above the skin surface and varied in shape among animals. By day 3 when the sites were measured, the average involvement was 219 cc in the 7-way group vs 78 cc in the C&D group (Table 2; $P < .05$). No calves in the saline group developed injection site reactions. At the time of slaughter, no significant palpable lesions remained in either clostridial group.

Performance. Calf feed consumption was not significantly impacted during the 4-day period after the first injection, although intake declined 1%, 2%, and 10% for the saline, C&D and 7-way groups, respectively (Table 3). Following the second injection, consumption of the saline group increased 4%, whereas that of the C&D and 7-way groups declined 8% and 20% ($P < .05$), respectively. Although steer gains were not significantly influenced by treatment, steers in the 7-way group were 14 lb lighter at slaughter than the saline-injected steers.

These data suggest that injection of feedlot cattle with clostridial vaccines can result in a transient, yet significant, inflammatory response. Subcutaneous injection-site reactions may persist for months. Injection with 5 ml of 7-way bacterin-toxoid resulted in a more severe, longer lasting reaction than injection with 2 ml of C&D toxoid. Whether the reaction severity in the 7-way group was from the antigens themselves, or from higher levels of potentially irritating vaccine adjuvants, is unknown. Using clostridial products subcutaneously is strongly advised to minimize potential damage to carcass tissue.

Table 1. Blood Haptoglobin Levels (mg/dl) over Time from Steers in Response to Injection with Sterile Saline, C&D Toxoid, or 7-Way Bacterin-Toxoid

Day of trial	Saline	C&D	7-Way
Preinjection:			
Day 0	15.4	12.5	19.8
Postinjection:			
Day 3	15.2 ^a	35.8 ^b	47.0 ^b
Day 6	12.8 ^a	14.5 ^a	26.6 ^b
Day 9	11.5	11.4	11.6
Day 15	15.4	11.4	11.7
Day 25	11.2	12.4	11.8

^{a,b}Means in a row with unlike superscripts differ ($P < .05$).

Table 2. Volume (cm³) of Injection Site Reactions over Time from Steers in Response to Injection with Sterile Saline, C&D Toxoid, and 7-Way Bacterin-Toxoid

Day of trial	Saline	C&D	7-Way
Postinjection:			
Day 3	0 ^a	78 ^b	219 ^c
Day 6	0 ^a	52 ^b	113 ^c
Day 9	0 ^a	31 ^b	72 ^c
Day 15	0 ^a	21 ^b	75 ^c
Day 25	0 ^a	21 ^b	49 ^c
Day 31	0 ^a	8 ^a	51 ^b
Day 61	0 ^a	2 ^a	21 ^b
Slaughter	0	0	0

^{a,b,c}Means in a row with unlike superscripts differ ($P < .05$).

Table 3. Average Daily Feed Consumption (lb as-fed) by Steers during the Four-Day Preinjection and Four-Day Postinjection Periods

Item	Saline	C&D	7-Way
First Injection:			
Preinjection	20.2 ± 3.3	22.4 ± 2.9	21.8 ± 2.9
Postinjection	20.0 ± 4.2	22.0 ± 3.5	19.8 ± 3.1
Second Injection:			
Preinjection	26.8 ± 2.9	26.8 ± 3.3	26.0 ^a ± 2.6
Postinjection	27.9 ± 3.1	24.6 ± 2.2	20.9 ^b ± 4.0

^{a,b}Means for a treatment within an injection period differ ($P < .05$).