AN EVALUATION OF AN INACTIVATED, LEUKOTOXIN-RICH, CELL-FREE *PASTEURELLA HEMOLYTICA* VACCINE FOR PREVENTION OF UNDIFFERENTIATED BOVINE RESPIRATORY DISEASE

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Story in Brief

Four hundred and fifty-nine mixed breed 414 pound calves were randomized into three treatments and transported 750 miles from Mississippi to Pawhuska, Oklahoma to observe the effect of a commercially prepared experimental *Pasteurella hemolytica* vaccine on morbidity, mortality, and average daily gain during a 28-day receiving period. The calves were received in four loads (trials) sequentially over a 106-day period. After arrival, all calves received daily prairie hay free choice plus 2 pounds of a 38% protein pellet. Treatment A was vaccinated pre-transit (Mississippi), Treatment B was vaccinated post-transit (Oklahoma), and Treatment C was not vaccinated. Treatments A and B were revaccinated seven days following arrival. Average daily gains of calves vaccinated post-transit were higher than for calves vaccinated pre-transit. Post-transit vaccinated calves tended to gain faster than non-vaccinated calves. Gains of sick calves in post-transit and non-vaccinated groups were higher than for sick calves vaccinated pre-transit. Morbidity was lower in pre-transit vaccinated calves than in post-transit vaccinated calves and, although not statistically significant, morbidity tended to be lower for pre-transit vaccinated than non-vaccinated calves. Mortality differences were not altered by treatment. The morbidity rates obtained were typical for stressed calves received at this research station. However, mortality rates were higher than usually observed.

(Key Words: *Pasteurella Hemolytica*, Morbidity, Stressed Calves.)

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Introduction

Undifferentiated bovine respiratory disease, "shipping fever", causes the loss of millions of dollars annually to the cattle industry. An effective and predictable vaccine for the prevention of this disease is desired.

The effect of undifferentiated bovine respiratory disease on individual animals varies. In general, it will elevate rectal temperature to beyond 104°F (Gill and Richey, 1982) when normal body temperatures are at a diurnal low point. Excessive nasal discharge will be present and labored breathing and coughing, lethargy, and a reluctance to eat will be observed. If left untreated, the disease often will result in death.

Pasteurella hemolytica has been the primary pathogen associated with undifferentiated bovine respiratory disease for many years (Carter, 1954; Gale and King, 1961). Martin et al. (1980) isolated the organism from the pneumonic lungs of feedlot cattle. It has been the most commonly isolated bacterial pathogen from the acutely affected bovine lung (Frank and Smith, 1983).

Research with *Pasteurella hemolytica* vaccine has met with mixed results. Smith (1983) reported an 89%, 77%, and 44% reduction in morbidity when a *Pasteurella hemolytica* vaccine was administered to commercial cattle, preconditioned cattle, and feedlot cattle, respectively. Smith et al. (1986), using 504 newly received steer and bull calves, reported an 18% decrease in the incidence of sickness when a live *Pasteurella hemolytica* vaccine was administered at processing. Daily gains were not affected.

The objective of this study was to determine the effectiveness of an inactivated, leukotoxin-rich, cell-free *Pasteurella hemolytica* vaccine in preventing undifferentiated bovine respiratory disease in calves under stress conditions.

Materials and Methods

Four truck loads (trials) of mixed breed calves were purchased by order buyers from auction markets in the southeastern United States over a 106-day period. The calves were assembled in Mississippi where they were weighed, ear tagged and assigned randomly to three treatments and two pen replications within each load. Treatment A received an inactivated, leukotoxin-rich, cell-free *Pasteurella hemolytica* vaccine pre-transit; Treatment B received the vaccine post-transit; and Treatment C received no *Pasteurella hemolytica* vaccine. All calves received a modified-live IBR-PI3-BRSV vaccination pre-transit in Mississippi. The calves were transported 750 miles to Pawhuska, OK. The arrival date and weight, number of head, in-transit shrink, and hours in-transit for each load are summarized in Table 1.

Table 1. Arrival date, number of head, in-transit shrink, and hours in-transit for each load.

Load	Arrival date	Number of head	Arrival wt, lb	Shrink, %	Transit, h
1	10-28-88	102	467	3.9	13
2	11-18-88	139	340	5.3	14
3	12-07-88	117	404	5.0	16
4	01-11-89	101	476	3.1	12.5

Upon arrival at Pawhuska, Oklahoma the calves were individually weighed off truck and allowed access to prairie hay and water. The morning following arrival, the calves were processed as follows:

1. Weighed individually.
2. Vaccinated with 7-way clostridial.
3. Injected with ivermectin.
4. Calves allocated to Treatment B received a *Pasteurella hemolytica* vaccination.
5. Calves were started on antibiotic treatment if clinical signs of illness were detected.
6. A hospital card was initiated for calves diagnosed as being sick, and each sick calf was placed in the hospital pen away from the healthy calves.
7. Calves were assigned randomly to one of two pens per treatment immediately following processing.
8. Seven days following arrival, all calves were revaccinated with modified live IBR-PI3.
9. Seven days following arrival in Oklahoma calves in Treatments A and B were revaccinated with the *Pasteurella hemolytica* vaccine.

Upon entering their home pen, the calves had ad libitum access to prairie hay and water. Once daily the calves were offered 2 lb of a 38% protein pellet (Table 2).

Calves were checked twice daily for signs of bovine respiratory disease throughout the 28-day period. Signs used to diagnose the disease were excessive nasal discharge, coughing, labored breathing, lethargy, reluctance to eat, and a rectal temperature exceeding 104°F. Calves diagnosed as being sick were treated with antibiotics and put in the hospital pen. Postmortem

Table 2. Composition of 38% protein supplement.

Ingredient	As fed, %
Cottonseed meal	5.00
Soybean meal	88.99
Salt	3.00
Vitamin A-30	.11
Bovatec	.15
Dicalcium phosphate	2.75

inspections were performed by the Oklahoma Animal Disease Diagnostic Laboratory on all animals that died.

At the end of the 28-day period, the cattle were held overnight without feed or water, weighed individually the following morning, castrated and horns were tipped as necessary.

Least squares analysis of variance was performed on data for all response criteria using the General Linear Model of the Statistical Analysis System (SAS). The initial models across all cattle for weight gains, sick days, and mortality included load, pen, treatment, initial weight, and all two way interactions. In all models sources of variation with observed significance levels greater than .25 were removed. Treatment remained in all models.

Results and Discussion

Calves receiving vaccination pre-transit had a lower (P<.10) morbidity rate (60.32%) than those vaccinated post-transit (72.29%). Compared to those not vaccinated, calves vaccinated pre-transit tended to have lower morbidity. Morbidity rates of non- and post-transit vaccinates were similar (Table 3).

No statistical differences in mortality (Table 3) were detected although pre-transit vaccination tended to reduce mortality rate. Typically, differences in mortality or proportions are difficult to detect with such small numbers of observations.

Average daily gain of healthy calves in this trial was not altered by vaccination. However, gains of all calves (healthy plus sick) were higher (P<.10) in the post-transit than in the pre-transit vaccinates. Among sick calves, those in the post-transit vaccinated group had average daily gains higher than those vaccinated pre-transit (P<.01) but similar to those not vaccinated (Table 3).

Table 3. Effect of *Pasteurella hemolytica* vaccine on morbidity, mortality, and average daily gains in stressed calves.

	Time of vaccination		
	Pre-transit	Post-transit	None
Calves	147	160	152
Pens	8	8	8
Daily gain, lb[a]			
All calves	1.25[b]	1.52[c]	1.36[bc]
Healthy calves	1.98	2.09	2.11
Sick calves	.732[d]	1.34[e]	1.07[de]
Morbidity, %[a]	60.32[b]	72.19[c]	71.77[bc]
Mortality, %[a]	4.54	8.84	7.00

[a] Expressed as least squares means based on pen data.
[b,c] Means in the same row with different superscripts differ (P<.10).
[d,e] Means in the same row with different superscripts differ (P<.01).

The highly stressed calves in this study experienced most of their respiratory disease early in the receiving period. The vaccine manufacturer recommends that the inactivatied *Pasteurella hemolytica* vaccine be administered 2 to 3 weeks prior to shipment and that two doses be given. Although not studied in this trial, perhaps the time interval between administration of the vaccine and the onset of illness was insufficient to allow those calves to develop full immunity.

Literature Cited

Carter, G.R. 1954. Observations on the pathology and bacteriology of shipping fever in Canada. Can. J. Comp. Med. 18:359.

Frank, G.H. and P.C. Smith. 1983. Prevalence of *Pasteurella hemolytica* in transported calves. Am. J. Vet. Res. 44:981.

Gale, C. and N.B. King. 1961. Isolation of a virus from clinical shipping fever in cattle. J. Am. Vet. Med. Assoc. 138:235.

Gill, D.R. and E.J. Richey. 1982. Health nutrition and management of new cattle. Okla. Cattle Feeders Seminar, p BB-1.

Martin, S.W. et al. 1982. Factors associated with mortality and treatment costs in feedlot calves: The Bruce County beef project, years 1978, 1979, 1980. Can. J. Comp. Med. 46:341.

Smith, C.K. 1983. The use of live *Pasteurella hemolytica* vaccine to prevent bovine respiratory disease. In: R.W. Loan (Ed.). Bovine Respiratory Disease, A Symposium. Texas A&M Univ. Press, p 470 (Abstr.).

Smith, R.A. et al. 1986. The effect of live *Pasteurella hemolytica* vaccine on health and performance of newly received stocker cattle. Okla. Agr. Exp. Sta. Res. Rep. MP-118:244.