
Technical Bulletin



Field Efficacy of J-VAC® Vaccines in the Prevention of Clinical Coliform Mastitis in Dairy Cattle

Investigators

Norman Habermehl, DVM, and Bruce Wren, DVM, Ph.D.

The Bottom Line

- Coliform mastitis has an average incidence rate of 15% to 20% in herds with low somatic cell counts (SCC), and is implicated in 30% to 40% of clinical cases. It is a common cause of fatal mastitis in cattle.¹
- Despite excellent management, coliform mastitis can be frustrating. Control should be focused on the prevention of new intramammary infections. J-VAC® is licensed for the vaccination of healthy cattle to aid in protection against mastitis caused by *Escherichia coli* (*E. coli*) and the effects of endotoxemia caused by *E. coli* and *Salmonella* Typhimurium.
- Cattle vaccinated with J-VAC had a significant reduction of 81% in clinical coliform mastitis ($P < 0.001$).
- J-VAC can be a cost-effective management tool when clinical coliform mastitis (CCM) rates are more than one case per 100 lactations (>1% lactational incidence rate).

Introduction

Coliform mastitis has been reported worldwide, the result of *E. coli*, *Klebsiella* spp. and other Gram-negative bacteria from the environment entering the mammary gland as opportunistic invaders. Eighty to 90 percent of these coliforms result in mild or moderate clinical mastitis, with 8% to 10% resulting in severe, systemic mastitis within the first weeks after calving.²

Fecal contamination of bedding has been associated with coliform mastitis caused by *E. coli*. Previously, coliform mastitis caused by *Klebsiella* spp. was associated with wet sawdust and wood shavings.¹ However, a recent study showed that *Klebsiella* spp. were isolated from 81% of bovine fecal samples,³ demonstrating fecal contamination of bedding as a potential source. Coliform mastitis has an average incidence rate of 15% to 20% in herds with low somatic cell counts (SCC), and is implicated in 30% to 40% of clinical cases. It is a common cause of fatal mastitis in cattle.¹

The control of coliform mastitis is difficult, unreliable and frustrating in spite of apparently excellent management. In the control of coliform mastitis, the emphasis is on the prevention of new infections. Vaccination of cows during the dry period and early lactation with an *E. coli* J5 vaccine has been demonstrated to be a practical management aid to reduce the incidence and severity of clinical coliform mastitis.¹

The objective of this field trial was to demonstrate the efficacy of a two-dose vaccination program with J-VAC[®] vaccine, a commercially available J5 *Escherichia coli* bacterin-toxoid, in controlling CCM in lactating dairy cattle.

The Field Trial

A total of 733 dairy cows from four well-managed commercial Holstein herds were used in this trial. Each animal was randomly assigned to either a group that was vaccinated with J-VAC vaccine or a placebo treatment group. The cows in this study were of various ages, parities and levels of milk production. Pre-partum heifers were also included in the study. Herd owners, individuals collecting milk samples, and the laboratories utilized for milk culturing were not aware of the treatment group of any animal until the completion of the trial.

A dry cow vaccination protocol was utilized in two herds involving a total of 203 cows. The cows received the initial dose of J-VAC or placebo at the beginning of the dry-off period, with the second dose being administered one to three weeks prior to calving. Heifers in these trials received an initial vaccination of J-VAC or placebo when estimated to be seven months in gestation, with the second injection being given one to three weeks prior to calving. The vaccines were administered according to label directions, and the trial was conducted over a period of 10 months in one herd and 12 months in the second.

A whole-herd vaccination protocol was utilized in two other herds, involving a total of 530 lactating dairy and late-gestational heifers. The initial J-VAC or placebo injection and subsequent second injection were given one month apart. These trials were conducted over a period of four-and-a-half months.

Throughout the trials, all cases of clinical mastitis (identified by the milkers/herd managers) were defined by the presence of abnormal milk and/or udder inflammation. Prior to treatment, milk samples were aseptically collected, refrigerated or frozen, and submitted to a bacteriology laboratory for culture and identification. All bacterial isolates from the clinical mastitis cases were identified through standard bacteriological methods. A quarter was diagnosed as having CCM because a pure culture of a coliform organism (*E. coli*, *Klebsiella* spp., *Enterobacter* spp., *Serratia* spp.) was isolated and identified from milk samples collected from clinical cases of mastitis.

Overall Results

Prior to initial vaccination and booster injections, no abnormal local or systemic adverse responses to vaccination were recorded in any of the animals involved in this trial.

The clinical mastitis data from these trials were pooled and analyzed. There were 64 cases of clinical mastitis during this trial, representing a clinical-mastitis incidence rate of 8.73% (Table 1).

Coliform bacteria were isolated and identified from 24 clinical mastitis cases (37.5%). The aggregate CCM incidence rate was 3.27%. The group of 374 animals vaccinated with J-VAC® experienced four CCM cases (1.07% incidence rate). The cattle vaccinated with J-VAC had a significant reduction of 81% in the incidence of clinical mastitis attributable to coliform bacteria ($P < 0.001$).

Table 1: Overall Results

Group	Number	Number of Herds	Protocol	CCM	Incidence Rate	Preventive Fraction	P-value
Total	733	4	dry cow and whole-herd	24	3.27%	81%	$P < 0.001$
J-VAC	374	4		1.07%			
Placebo	359	20		5.57%			

Table 2: Effect Against *E. coli*

Group	Number	<i>E. coli</i>	Incidence Rate	Preventive Fraction	P-value
Total	733	12	1.64%	81%	$P < 0.02$
J-VAC	374	2	0.53%		
Placebo	359	10	2.79%		

E. coli was isolated from 12 cases of CCM during the trial, two from the 374 head vaccinated with J-VAC, and 10 from the 359-head, placebo-injected group (Table 2). The incidence rate was 0.53% and 2.79%, respectively. The data clearly demonstrate a significant reduction of 81 percent in the incidence of CCM caused by *E. coli* intramammary infections ($P < 0.02$).

Dry Cow Protocol Results

In total, 109 of 203 head were vaccinated with J-VAC following a dry cow vaccination protocol. None of the 109 animals vaccinated with J-VAC developed clinical coliform mastitis, while seven of the 94 placebo-injected animals developed CCM during the trial. All of the coliform isolates were identified as *E. coli*.

These data demonstrate that a dry cow protocol administered at, or near, dry-off, and boosted one to three weeks prior to calving, significantly reduced the incidence of CCM ($P < 0.005$).

Whole-Herd Protocol Results

A whole-herd vaccination protocol was used on 530 head. Three of 265 animals vaccinated with J-VAC and 13 of 265 placebo-injected animals developed CCM during the trial. These data demonstrate that a whole-herd vaccination protocol significantly reduced the overall incidence of CCM by 76.9% ($P < 0.025$).

Discussion

In this trial, two herds were vaccinated with a “dry cow” vaccination program, and two herds were vaccinated with a “whole-herd” vaccination program. Both programs effectively, and significantly, reduced the incidence of clinical coliform mastitis in lactating dairy cattle (>80% and 76.9%, respectively).

The overall reduction in incidence of CCM is consistent with previous reports in the scientific literature. An independent economic analysis, based upon reported literature results, concluded that implementation of J5 bacterin-toxoid vaccination programs would be cost-effective whenever herds experienced clinical coliform mastitis at rates above 1% of lactations.⁴

A two-dose vaccination program offers considerable advantages to dairy producers by reducing the number of vaccinations required, and eliminating the need for vaccinating post-calving dairy cows that are immunosuppressed.

Conclusions

J-VAC® is a cost-effective management tool that will greatly benefit mastitis-control efforts in dairy herds that experience, or are likely to experience, CCM rates greater than one cow per 100 (1% lactational incidence rate).

J-VAC is licensed for the vaccination of healthy cattle to aid in protection against mastitis caused by *E. coli* and the effects of endotoxemia caused by *E. coli* and *S. Typhimurium*.

References

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