Effect of Sour Colostrum on Survival of *Staphylococcus Aureus*

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Story in Brief

Staphylococcus aureus is a common cause of bovine mastitis. This preliminary study was designed to determine the effects of sour colostrum on the survival of this organism and factors which are responsible for its destruction.

Two strains of *Staphylococcus aureus*, isolated from cases of bovine mastitis, were inoculated into pooled colostrum of two heifers. The samples were incubated at 22, 30 and 37 C. Daily cultures and pH determinations were made.

Different lengths of time were required for the destruction of the *Staph. aureus* in the fermenting colostrum. Factors influencing their destruction were temperature of incubation, pH and probably antibacterial substances generated by the fermenting bacteria.

Given a sufficient period of time at a temperature permitting fermentation to occur, sour colostrum will destroy *Staph. aureus* and can be fed safely to calves.

Introduction

Feeding colostrum to calves after it has soured is a common practice on dairy farms. It is estimated that 35 to 61 kg (77 to 134 lb) of colostrum are produced by each freshening cow during the first six milkings (Keys, *et al.*, 1976). This is sufficient to feed a 40 kg (88 lb) calf for 11 to 19 days. This practice offers a substantial saving in feed costs.

Normal bacteria present in colostrum are responsible for the souring process. Undesirable pathogenic bacteria can be present in colostrum from infected udders or can gain entrance from the environment. Wray and Callow (1974) showed that *Salmonella typhimurium* and *S. dublin* survived in colostrum for various periods of time. A number of factors were responsible for their destruction. Storage temperature affected the length of survival. Survival time varied in the colostrum of different cows which the authors attributed to natural antibacterial substances. The fall in pH also contributed to the death of the Salmonellae, and antibacterial substances released by the fermenting bacteria exerted an additional killing effect. Salmonellae were completely destroyed at various periods of time during the fermenting process; however, *Escherichia coli* were not affected. They were viable throughout the 40 day experiment.

Contamination of colostrum from the environment with *Salmonella spp*, *E. coli* and other pathogens can be reasonably controlled by employing the same hygienic procedures as are used for collecting and storing grade A quality milk. However, this is not the case for colostrum from infected udders since the pathogenic organisms are already in the colostrum before it is removed from the cow.

There is little evidence that common mastitic organisms cause illness in calves. Schalm (1942) reported that *Streptococcus agalactiae* contaminated milk consumed by heifer calves may contribute to an increased incidence of *Strep. agalactiae* mastitis in these heifers when they freshen. No similar evidence has been reported for *Staph. aureus*. It is contrary to the principles of mastitis control and eradication programs to feed fresh

Table 1. Survival of *Staphylococcus aureus* in fermenting colostrum.

Days of Incubation	22°C pH			30°C pH			37°C pH		
	Control	Inoc.[1]	Culture[2]	Control	Inoc.	Culture	Control	Inoc.	Culture
0	6.36	6.36	+[3]	6.34	6.36	+	6.34	6.40	+
1	5.20	5.27	+	5.07	5.17	+	4.81	4.84	+
2	4.77	4.73	+	4.98	4.87	+	4.29	4.19	+
3	4.77	4.72	+	4.62	4.49	+	3.89	3.74	+
4	4.68	4.65	+	4.12	4.24	+	3.80	3.56	+
5	4.88	4.62	+	3.97	4.09	+	3.88	3.49	- -
6	4.65	4.76	+	4.08	3.96	- -	4.00	3.62	- -
7	4.71	4.43	- -[4]	4.37	3.94	- -	4.05	3.82	- -
8	5.12	4.52	- -	4.73	3.95	- -	4.29	3.94	- -

[1]*Staph. aureus*, strain N305 was inoculated to give a final concentration of 146,000 organisms per ml of colostrum.
[2]Brain heart infusion broth containing 6.5% NaCl was inoculated with 0.1 ml of colostrum, incubated 1 day then inoculated onto phenyl ethyl alcohol blood agar.
[3]+ = *Staph. aureus* was recovered.
[4]- -= *Staph. aureus* was not recovered.

Table 2. Survival of *Staphylococcus aureus* in fermenting colostrum.

Days of Incubation	22°C pH Control	22°C pH Inoc.[1]	22°C Culture[2]	30°C pH Control	30°C pH Inoc.	30°C Culture	37°C pH Control	37°C pH Inoc.	37°C Culture
0	6.20	6.26	+[3]	6.23	6.27	+	6.26	6.25	+
1	5.40	5.50	+	5.15	5.22	+	4.90	4.93	+
2	5.08	5.07	+	4.72	4.63	+	4.39	4.33	+
3	4.90	4.82	+	4.61	4.48	+	3.92	3.90	+
4	4.79	4.80	+	4.26	4.30	+	3.96	3.90	+
5	4.59	4.54	+	3.86	4.06	- -	3.67	3.77	- -
6	4.63	4.71	+	3.82	4.10	- -	3.56	3.81	- -
7	4.65	4.78	- -[4]	3.85	4.03	- -	3.78	3.98	- -

[1]*Staph. aureus* strain 563 was inoculated to give a final concentration of 244,000 organisms per ml of colostrum.
[2]Brain heart infusion broth containing 6.5% NaCl was inoculated with 0.1 ml of colostrum, incubated 1 day then inoculated onto phenyl ethyl alcohol blood agar.
[3]+ = *Staph. aureus* was recovered.
[4]- - = *Staph. aureus* was not recovered.

colostrum containing these mastitis organisms. The feeding of fresh colostrum from infected udders serves to contaminate utensils and equipment with these organisms which in turn may find their way to the udders of the milking herd.

This is a report on a preliminary study of the effect of sour (fermenting) colostrum on the viability of *Staphylococcus aureus*, a common udder pathogen.

Materials and Methods

Colostrum was collected from two heifers for the first six milkings. Quarter samples were collected and cultured. At the end of the collection, the pooled colostrum was cultured. All cultures were negative for *Staph. aureus* and the mastitis group of Streptococci.

The colostrum was thoroughly mixed and poured into clean plastic gallon containers and frozen. As needed a gallon was thawed and following mixing, 100 ml quantities were poured into sterile bottles and refrozen.

For each experiment, six bottles were thawed. Three were inoculated with *Staph. aureus* and three served as controls. Incubation temperatures were 22, 30 and 37 C. Daily pH readings were made on all the samples. Only the inoculated bottles were cultured.

Indirect culture procedures were employed which consisted of inoculating 0.1 ml of colostrum into 6 ml of heart infusion broth containing 6.5 percent NaCl. After 18 to 24 hr incubation, gram stains were made and tube coagulase tests were conducted to confirm the presence of *Staph. aureus*. All cultures were incubated at 37 C.

Results and Discussion

Tables 1 and 2 show the daily changes in pH and the results of culturing for *Staph. aureus*. No great differences in pH occurred between the inoculated sample and corresponding control. In previous experiments attempts to determine the numbers of *Staph. aureus* per ml of colostrum at various stages of incubation were unsuccessful. Additional experiments are necessary to determine if the inoculated *Staph. aureus* increase in numbers during incubation and if they influence the pH values.

Staph. aureus is not recoverable in sour colosturm after a given period of time. *Staph. aureus* survived for longer periods of time at the lower temperature of incubation than at the higher temperature. The pH of the colostrum also appears to have some destructive effect; however, these experiments did not indicate a pH value below which all the *Staph. aureus* would be killed.

The two mastitis strains of *Staph. aureus* had almost identical survival times for each of the three incubation temperatures, even though 40 percent more organisms of strain 563 were inoculated into the colostrum than strain N305.

The results of these experiments are similar to those of Wray and Callow (1974) who reported that the length of survival time of *Salmonella dublin* and *S. typhimurium* in fermenting colostrum was influenced by incubation temperature, pH and probably antibacterial substances generated by the fermenting organisms.

Literature Cited

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