The Viability of Certain Udder Infection Bacteria
In Butter Made from Raw Cream*

C. S. BRYAN AND P. S. BRYAN
Michigan Agricultural Experiment Station, East Lansing, Michigan

The major portion of the commercial butter in the United States is made from pasteurized cream, which insures the freedom of the butter from viable pathogens that may contaminate the cream. Because of the shortage of butter on the civilian market, increasing numbers of consumers are obtaining some or all of their butter directly from the farm producer. Very little of this "farm made" butter is manufactured from pasteurized cream.

Investigators concerned with the survival of human pathogens have inoculated butter with pathogenic organisms, stored it at 50° F., and then made periodic examinations for survival of the pathogens. Under such conditions, Berry (1) reported the survival time to be 212 days for paratyphoid B, 117 days for paratyphoid A, 7 days for the dysentery organisms, 17 days for *Streptococcus scarlatinæ*, and 22 to 110 days for different strains of *Eberthella typhosa*. Carpenter and Boak (2) reported that *Brucella abortus* survived 142 days in butter that was inoculated with the brucella and then stored at 46° F. More recently Fitch and Bishop (3) made sweet cream butter from naturally infected cream and reported that the brucella were isolated from the salted and unsalted butter and the buttermilk.

In all of these cases, except the latter, the butter was inoculated with the pathogen studied, while in farm practice certain pathogen bacteria, notably brucella, streptococci, and staphylococci, may cause udder infection, thus insuring their presence in the cream produced. This study was made to determine the fate of certain pathogens in butter made from raw cream containing pathogenic organisms of the bovine type that are transmissible to man.

Source of the Cream

To insure the presence of pathogens in the milk, a cow was infected with *Streptococcus agalactiae* in the right rear quarter, *Streptococcus pyogenes* in the right front quarter, a non-hemolytic *Staphylococcus aureus* in the left front quarter, and a hemolytic *Staphylococcus aureus* in the left rear quarter by injecting 10 ml. of a 24 hour broth culture of the proper organism into the respective quarters. During the time that the cream was saved repeated examinations were made of the milk from each quarter to be certain that udder infection had resulted.

All milk produced during a period of one week was used. The cream was allowed to separate by gravity and then skimmed off with a cup. The cream was stored in the icebox (40° F.), and each day's supply was added for one week, thus allowing the accumulation of sufficient cream for churning. At the end of the week the cream was further contaminated by the addition of 200 milliliters of a 48 hour broth culture of *Brucella abortus*. The presence of all of the pathogens in the cream was confirmed by appropriate cultural procedures.

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PREPARING THE CREAM FOR CHURNING

The cream was divided into two parts: one half was pasteurized in the laboratory by heating to 145° F. for 30 minutes and the other half was not pasteurized. Bacteriological examination of the pasteurized cream revealed destruction of all pathogens. The raw and the pasteurized cream was further divided into three portions. Portion one was immediately churned while the remaining two portions were held at 70° F. for varying periods before churning. Portion two was thus ripened for 6 days and portion three for 12 days.

Recently Trout, Devereux, and Bryan (4) presented a practical and effective means for the home pasteurization of milk or cream. This consists of heating the water in the bottom part of a kitchen double boiler to a vigorous boil, then putting in place for 10 minutes the top part containing the material to be pasteurized. It is important that the water be kept at a vigorous boil for the 10 minute period. Some contaminated cream was effectively pasteurized by this method.

MAKING AND STORAGE OF THE BUTTER

A small hand churn was used for making the butter. It was carefully washed and sanitized between churnings. One half of the butter made from each portion of cream was made without salt while to the other half, 2 percent of salt was added. All butter was shaped into patties (individual size) and separately wrapped in parch-

EXAMINATION OF THE BUTTER FOR PATHOGENS

The butter made from the pasteurized cream was examined with negative results, thus confirming the destruction of the pathogen by pasteurization of the cream prior to churning.

Twice weekly a patty of raw cream butter from each group was examined bacteriologically. Each patty was unwrapped and placed into a sterile 100 ml. flask in a 37° C. water bath to melt. Direct 0.3 ml. plantings were made into tryptose blood agar containing 0.05 percent of sodium azide for streptococcus isolation, into tryptose blood agar containing 1 to 200,000 gentian violet for staphylococcus isolation, and 0.3 ml. was plated on the surface of liver infusion agar containing 1-to-700,000 gentian violet for brucella isolation. The plates for staphylococcus and streptococcus isolation were incubated at 37° C. for 72 hours, while the plates for brucella isolation were placed into a 10 percent carbon dioxide atmosphere and incubated at 37° C. for 5 days. Typical colonies were picked and identified in each instance.

SURVIVAL OF THE PATHOGENS IN THE BUTTER

The results of survival of the pathogens are presented in Table 1. No pathogens were isolated from the butter made from the pasteurized cream. Brucella abortus persisted for 4 months in the salted and unsalted butter churned from the raw sweet

<table>
<thead>
<tr>
<th>Pathogen</th>
<th>Sweet Cream Salted</th>
<th>Unsalted</th>
<th>Ripened 6 days Salted</th>
<th>Unsalted</th>
<th>Ripened 12 days Salted</th>
<th>Unsalted</th>
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</thead>
<tbody>
<tr>
<td>Brucella</td>
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<td></td>
<td>3 3</td>
<td></td>
<td>3 3</td>
<td></td>
</tr>
<tr>
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<td></td>
<td>6 6</td>
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<tr>
<td>Staphylococci</td>
<td>6 6</td>
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TABLE 1
THE MONTHS OF SURVIVAL OF THE PATHOGEN IN BUTTER
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cream and for 3 months each in the butter made from the raw ripened cream. The animal and human streptococci, and the hemolytic and non-hemolytic staphylococci were recovered for 6 months from the salted and unsalted butter made from raw sweet cream, and cream ripened for either 6 or 12 days.

DISCUSSION

To simulate natural conditions of udder infection among dairy cattle, the quarters of a cow were infected with pathogens. The injection of the streptococci (Str. agalactiae, and Str. pyogenes) and staphylococci (an hemolytic and a non-hemolytic strain of Staph. aureus) into individual quarters of a cow resulted in udder infection; this assured the presence of these organisms in the milk.

Although some of the pathogens remained in the skim milk a large number were concentrated in the gravity separated cream. This naturally infected cream, further contaminated by the addition of Br. abortus, was used to make raw cream butter. The survival of the pathogens in this butter for a considerable period of time indicates a public health hazard. This hazard does not exist where the cream is pasteurized prior to churning, therefore the importance of pasteurizing cream for butter making is reemphasized by these results.

SUMMARY

Butter made from raw cream containing bovine pathogens transmissible to humans presents a health hazard because: (a) Brucella abortus remained viable for 4 months in raw sweet cream and ripened cream butter, and (b) Streptococcus agalactiae and Streptococcus pyogenes and both a hemolytic and a non-hemolytic strain of Staphylococcus aureus persisted for 6 months in raw sweet cream and in butter made from raw cream which was ripened prior to churning. The results were similar in butter made without salt and in butter made with 2 percent of salt added.

Pasteurization of the cream prior to churning removes this health hazard by destroying all of the pathogens tested. The effective methods of pasteurization studied were (a) heating to 145° F. for 30 minutes, and (b) the double boiler home pasteurization method.

LITERATURE CITED