



The correlation between the organisms found microscopically in butter serum and the grade of cream from which the butter was made
by Theodore I Hedrick

A THESIS Submitted to the Graduate Committee in partial fulfillment of the requirements for the Degree of Master of Science in Dairy Industry at Montana State College
Montana State University
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Abstract:

A preliminary study of 130 samples of butter was made for the purpose of determining the microscopic appearance in the butter serum which was correlated with each of the four grades of cream from which the butter was made. The grades of cream studied were "excellent," 93 or above, "good," 91 1/2 to 92 1/2, "fair," 90 to 91, and "poor" below 90 In score* A total of 384 samples of butter were then studied and the grade of cream determined by a microscopic examination. Of the 524 samples studied 143 samples were of "excellent" grade cream, 125 samples of "good" cream, 159 of "fair" cream, and 97 samples of the "poor" cream# The number of samples graded accurately from the "excellent" cream group was 131 (91.6 per cent) and 12 samples were mls-graded.

In the group of "good" cream there were 125 samples. Seventy-three (58.4 per cent) were correctly graded and 52 were not. One hundred and fifty-nine samples of "fair" cream were examined. The grade was correctly given on 68 (42.7 per cent) while 91 samples were mls-graded# In the last group of 97 samples of "poor" cream studied 52 (53.6 per cent) were graded accurately and 45 incorrectly.

Under each of the four grades of cream, samples were held for varying lengths of time at 2 to 4.5°C. (36 to 40°F) — 1 to 3 days, 7 days, 14 days, and 30 days. Although the results varied some, the general deduction was that the determination of the grade of cream by the microscopic method varied but little for these holding periods. The presence of butter culture organisms did not affect the grade determination by the microscopic method.

The results on studies of "fair" cream indicated that samples from the laboratory procedure were slightly easier to grade correctly than those obtained from commercial churnings. This was apparently due to handling conditions.

The two apparent reasons for not determining the grade of cream correctly by microscopic examination of the butter serum were defects that resulted in low scoring cream were not always due to bacteriological action. They may be caused by chemical action or absorbed feed flavors. The second reason was contamination of organisms subsequent to pasteurization of the cream and during the churning of the butter.

THE CORRELATION BETWEEN THE ORGANISMS FOUND MICROSCOPICALLY IN BUTTER
SERUM AND THE GRADE OF CREAM FROM WHICH THE BUTTER WAS MADE

by

THEODORE I. HEDRICK

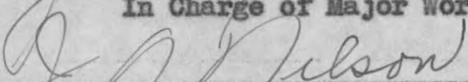
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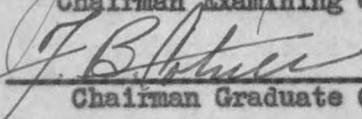
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INTRODUCTION

Butter is a dairy product which has been made for many centuries. However, in only relatively recent years has much actual bacteriological research been conducted on this product.

Quality in butter is becoming more and more important especially when surpluses exist on the market. Due to the fact that the quality of butter depends on the quality of cream, grades of cream are usually made in accordance with the grade of butter it will make. Cream grading is usually done entirely by the senses of taste and smell. The market grades of butter demand that cream of definite quality standards be used for each grade. Butter grading "special" must be made from clean, fresh, sweet cream. The "extra" grade of butter is made from sour but clean flavored cream that is free from objectionable odors or flavors. Butter grading as a "first" is manufactured from sour cream that may have some off flavors and odors. Cream grading below the above standards will make a "second" grade of butter. In this study it was attempted to determine the grade of cream used by a microscopic examination of the butter serum. If this could be accomplished it would be of use in the dairy laboratory to substantiate evidence used in the determination of the grade of cream from which butter was made.

It is known that certain micro-organisms may rapidly lower the grade of cream and also other specific micro-organisms enhance the grade of butter if used as a culture under controlled conditions.

To be sure not all deterioration of cream is bacteriological, so the grade may naturally be lower than the micro-organisms and their action would indicate. This would be the case with such flavors as weedy, metallic, briny, cooked, oily, wood, gasoline, neutralized, and other foreign and absorbed flavors. Furthermore, not much is known about the effects of enzymes on the grade of cream.

PURPOSE OF THE STUDY

The purpose of the study was to determine if a correlation exists between the bacteria, yeasts, and molds found microscopically and the grade of the cream from which the butter was made. It was also desired to study the effects that length of storage and culture organisms had on the microflora in the butter and determine if a relationship existed between specific flavor defects in the cream and certain micro-organisms in the butter.

PREVIOUS INVESTIGATIONS

Microscopic studies on butter and cream have been rather limited. This probably was due to the fact that it has been only in comparatively recent years that a satisfactory method for making microscopic slides of butter has been devised.

Nelson⁽¹⁾ studied microscopic slides of butter with the view of trying to predict its keeping quality during holding for 7 days at 21°C.

(70°F.) Type and number of rods in fresh butter were found to be an index to its keeping quality. Clumps of well stained thin rods were almost always a sure sign that deterioration would take place especially in unsalted butter. The keeping quality was correctly predicted on 96.4 per cent of the commercial salted samples, 79.6 per cent of the unsalted and 84.9 per cent of the exhibition butter.

Nelson and Hammer⁽²⁾ compared butter, salted and unsalted, at various storage temperatures by both the microscopic and the plate counts, paying particular attention to culture and non-culture organisms. These investigators found in general that in salted butter held at a favorable growth temperature, the butter culture Streptococci developed little or not at all. One of the citric acid Streptococci studied showed some development. Organisms other than Streptococci sometimes showed growth. The difference presumably was due to the variation in the species present. In unsalted butter at favorable temperature, butter culture organisms developed extensively as shown by both the microscopic and plate counts. Further evidence was the presence of long chains of Streptococci in the butter. Organisms other than Streptococci regularly showed extensive growth.

Macy, Coulter, and Combs⁽³⁾ studied the quantitative changes of the microflora in manufacturing and storing of butter. Counts of salted butter tended to decrease in 30 day storage periods; molds 66.7 per cent, yeasts 80 per cent, and 73.3 per cent for bacteria. The changes in the microflora of the butter did not follow any consistent pattern.

PROCEDURE

Cream was secured from the College herd, patrons delivering cream to the College Creamery, and from four local creameries in Bozeman. In order to derive wider variations in the samples of cream, some were allowed to sour and others to become stale before using. The cream was scored by two experienced judges in accordance with the kind of butter that could be made from it under good factory conditions. Cream scoring 93 was sweet and clean; cream scoring $91\frac{1}{2}$ to $92\frac{1}{2}$ was sour but clean and free from objectionable odors; cream grading 90 to 91 was sour and had some off flavors; and cream that had pronounced off flavors and was undesirable scored below 90. After scoring, a microscopic slide was prepared from each sample. The cream was collected in two quart mason glass jars and after the slides were prepared the samples were pasteurized in the jars at a temperature of 68 to 71°C. (155 to 160°F.) for 30 minutes, followed by cooling to 7°C. (45°F.). The cream was held over night in a cooler at 2° to 4.5°C. (36 to 40°F.) and churned the next morning in glass jars in a small experimental churn and the buttermilk drained, butter washed, salted and worked. Four ounce aluminum screw top sterile glass bottles were used to hold the samples. The butter was held at a temperature of 2° to 4.5°C. (36 to 40°F.) in storage until a slide was prepared. In order to obtain an idea of effect of pasteurization many slides were stained of the raw and the same cream pasteurized. A few slides of buttermilk were stained.

