

UNIVERSITY OF MISSOURI

COLLEGE OF AGRICULTURE

AGRICULTURAL EXPERIMENT STATION

Research Bulletin 213

The Relation of Dry Skim Milk to Several of the Physical and Chemical Properties of Cream Cheese

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(Publication Authorized June 28, 1934)



COLUMBIA, MISSOURI

JULY, 1934

SUMMARY

1. The most desirable quantity of dry skim milk to use in the manufacture of sweet cream cheese is 15 to 18 per cent when the butterfat content does not exceed 25 per cent.

2. As the dry skim milk content of cream cheese is increased above 10 per cent, the development of a desirable, typical cream cheese flavor is somewhat retarded.

3. The spreading, slicing and keeping qualities of cream cheese becomes more desirable as the dry skim milk content is increased to 18 per cent.

4. An excellent cream cheese for immediate consumption can be manufactured by using 20 per cent butterfat, 18 per cent dry skim milk and 3 per cent starter. A highly desirable cheese can be made by using 15 per cent dry skim milk, 20 per cent butterfat, 0.40 per cent gelatin and 3 per cent starter.

5. The amount of lactic acid produced and the rate at which the acid flavor is developed is dependent upon the amount and quality of the starter added, and the composition of the mix.

6. A desirable flavor can not be produced in cheese in which 20 per cent of dry skim milk is used, even though starter is added at the rate of 20 per cent, by weight.

7. When the fat content exceeds 25 per cent, the cheese becomes more resistant in body, sticky and gelatinous.

8. The higher butterfat content tends to submerge the desirable mild acid flavor developed by the lactic acid producing organisms and gives a rich, creamy flavor, which becomes rancid more quickly than does cream cheese with lower fat content.

9. Gelatin up to 0.40 per cent, seems to be the most desirable amount to use in cream cheese mix when the fat content is 20 to 25 per cent. Higher percentages of gelatin even with a low fat mix gives a curdled appearance to the cheese when it is spread.

10. Excess gelatin in the mix results in a spongy, very resistant, dry, cream cheese.

11. As the homogenization pressure is increased from 2000 to 3000 pounds, the texture of the cheese becomes closer and the body firmer due to the resulting increase in viscosity, surface tension and clumping of the fat.

ACKNOWLEDGMENT

The authors wish to express their appreciation to the American Dry Milk Institute, Chicago, Illinois, whose cooperation made this research project possible.

The Relation of Dry Skim Milk to Several of the Physical and Chemical Properties of Cream Cheese

W. H. E. REID AND H. R. ALLEY*

INTRODUCTION

The cream cheese industry had its origin in the eastern part of the United States but the popularity of this product has increased until it is now manufactured throughout the country. One of the principal difficulties in the way of its wider use has been that its life is relatively short under ordinary storage conditions. If some method could be developed so that it would be possible to manufacture this cheese during the season of flush milk production and then keep it in storage for several weeks or months without material injury, it could be manufactured and marketed with greater economy and its consumption would undoubtedly be markedly increased.

The purpose of this investigation was to study the influence of dry skim milk on several of the physical and chemical properties of sweet-cream cream cheese and to give special attention to the influence of varying percentages of fat on the quality of the cheese.

REVIEW OF LITERATURE

The literature contains very little information concerning the keeping qualities of cream cheese when held in storage.

Ellenberger (1919) found cream cheese developed a metallic and old fat or rancid flavor when it was held in cold storage.

Dahlberg (1927) states, "Increasing the percentage of fat of cream cheese caused increased firmness of body and decreased the amount of whey that would drain from the cheese; increasing the percentages of serum solids-not-fat reduced the rich fat flavor to a considerable degree and improved the body by making slightly firmer and less sticky. Homogenization pressures from 3500 to 4000 pounds per square inch produced a firmer bodied cheese with less stickiness and less drainage of whey than did the lower pressures."

*The data presented in this bulletin were taken from a paper submitted by the junior author in partial fulfillment of the requirements for the degree of Master of Arts in the Graduate School of the University of Missouri, 1933.

Marquardt (1931) reports that dry skim milk stored in sealed containers for many months made cream cheese of good quality but that it was not possible to make cream cheese from dry skim milk that had been stored unsealed for more than sixty days.

PROCEDURE

This investigation included a study of the influence of the following factors and combinations of variable factors upon the physical and chemical properties of sweet cream cheese:

- (1) The effect of variable increments of dry skim milk,
- (2) The effect of variable amounts of starter,
- (3) The effect of increasing the fat content when solids-not-fat was held constant,
- (4) The effect of variable increments of gelatin upon the cream cheese when the fat and solids-not-fat were held constant,
- (5) The effect of different homogenization pressures.

Only the highest quality of ingredients were used in the making of the cream cheese for this study. Fresh separated sweet cream was used as a source of fat and dry skim milk which was graded as "Extra" was used as the source of additional solids-not-fat. The gelatin used had a Bloom test of 250. Fresh skim milk from the same source as the cream was used in standardizing the cream to the desired butterfat. The percentages of all ingredients used were calculated by weight, based on the total weight of the finished mix.

The standardized cream for each individual lot was heated to 95 degrees Fahrenheit (21.5 degrees Centigrade) and at this temperature the dry skim milk and gelatin, after being thoroughly mixed, were added to the cream. The cream was agitated to facilitate the dissolving of the dry skim milk and the gelatin. The mix was then heated to 145 degrees Fahrenheit (62.8 degrees Centigrade) and held for thirty minutes. It was then cooled to 110 degrees Fahrenheit (43.3 degrees Centigrade) and at this temperature 0.75 per cent salt and starter as specified in each series were added. The mix was then homogenized at 3000 pounds pressure unless otherwise stated. Twelve ounce samples were placed in glass jars. The jars were capped immediately and placed in refrigeration at a temperature of 40 degrees Fahrenheit (4.4 degrees Centigrade) for a period of one hour for the purpose of reducing the temperature of the cream cheese mix to near 72 degrees Fahrenheit (22.2 degrees Centigrade), after which they were placed in the incubator at 72

degrees Fahrenheit for a period of twenty hours. The samples were then transferred to the cooler and held at a temperature of approximately 40 degrees Fahrenheit until the study of the physical properties of each respective series was completed.

The physical properties of the cheese were observed on the second, fifth and twelfth days and every seventh day thereafter.

A microphotographic study was made to show the effect of variable increments of dry skim milk and also of each series in which there was a variable factor other than that of starter.

An arbitrary standard was used for scoring all samples. Flavor was determined by the sense of taste. Body and texture were noted by observing the structure and constituency of the cheese. The slicing and spreading properties were determined by the drawing of a thin, steel spatula through the cheese and observing the ease or difficulty with which the cheese was worked into a smooth, lustrous, creamy spread of a medium firm surface.

EXPERIMENTAL DATA

The Effect of Varying the Solids-Not-Fat Upon the Physical Properties of the Cream Cheese

One series, of six lots, was made to determine the effect of varying the solids-not-fat content upon the physical properties of a cream cheese. These lots, one to six inclusive, contained from zero to 25 per cent of dry skim milk, respectively. The fat content was held constant at 20 per cent, gelatin at 0.4 per cent and the starter at one per cent. The salt content was held constant at 0.75 per cent throughout the entire experiment. Tables 1 to 6 inclusive, show the effect of increasing percentages of solids-not-fat.

It was found that the cheese of Lot 4 was the most desirable as it possessed a clean, pleasant flavor, good slicing properties; smooth, close texture; light cream color; a bright luster when

TABLE 1.—THE EFFECT OF NO DRY SKIM MILK UPON THE PHYSICAL PROPERTIES OF CREAM CHEESE,—LOT 1

Age Days	Flavor	Spreading Properties	Slicing Properties	Body	Color	Texture	Appearance
2	Flat, Lacking	Fair	Fair	Smooth, Medium Resistant	Light Cream	Close	Bright Luster
5	Mild Acid	Fair	Fair	Smooth, Medium Resistant	Light Cream	Close	Bright Luster
12	Mild Acid	Fair	Fair	Smooth, Medium Resistant	Light Cream	Close	Bright Luster

TABLE 2.—THE EFFECT OF FIVE PER CENT OF DRY SKIM MILK UPON THE PHYSICAL PROPERTIES OF CREAM CHEESE,—LOT 2

Age Days	Flavor	Spreading Properties	Slicing Properties	Body	Color	Texture	Appearance
2	Clean, Pleasant Acid	Fair +	Fair	Very Smooth	Cream	Slightly Coarse	Bright Luster
5	Clean, Pleasant Acid	Fair +	Fair	Very Smooth	Cream	Slightly Coarse	Bright Luster
12	Clean Slight Sour Acid	Fair +	Fair	Very Smooth	Cream	Slightly Coarse	Bright Luster

TABLE 3.—THE EFFECT OF TEN PER CENT OF DRY SKIM MILK UPON THE PHYSICAL PROPERTIES OF CREAM CHEESE,—LOT 3

Age Days	Flavor	Spreading Properties	Slicing Properties	Body	Color	Texture	Appearance
2	Clean, Desirable, Mild Acid	Good —	Fair +	Smooth, Medium Resistant	Light Cream	Slightly Coarse	Good Luster
5	Mild to Medium Acid	Good —	Good	Smooth, Medium Resistant	Light Cream	Slightly Coarse	Good Luster
12	Medium to High Acid Aftertaste	Good —	Good	Smooth, Medium Resistant	Light Cream	Slightly Coarse	Good Luster

TABLE 4.—THE EFFECT OF FIFTEEN PER CENT OF DRY SKIM MILK UPON THE PHYSICAL PROPERTIES OF CREAM CHEESE, LOT 4

Age Days	Flavor	Spreading Properties	Slicing Properties	Body	Color	Texture	Appearance
2	Clean, Pleasant, Sweet	Good +	Good —	Mellow, Medium Resistant	Light Cream	Very Close	Bright Luster
5	Clean, Very Mild, Acid	Good +	Good —	Mellow, Medium Resistant	Light Cream	Very Close	Bright Luster
12	Clean, Very Mild, Acid	Good +	Good —	Mellow, Medium Resistant	Light Cream	Very Close	Bright Luster

TABLE 5.—THE EFFECT OF TWENTY PER CENT OF DRY SKIM MILK UPON THE PHYSICAL PROPERTIES OF CREAM CHEESE,—LOT 5

Age Days	Flavor	Spreading Properties	Slicing Properties	Body	Color	Texture	Appearance
2	Clean, Very Sweet	Good +	Good	Mellow, Gelatinous	Dull Light Yellow	Very Close	Dead Luster
5	Clean, Very Sweet	Good +	Good	Mellow, Gelatinous	Dull Light Yellow	Very Close	Dead Luster
12	Clean, Very Sweet	Good +	Good	Mellow, Gelatinous	Dull Light Yellow	Very Close	Dead Luster

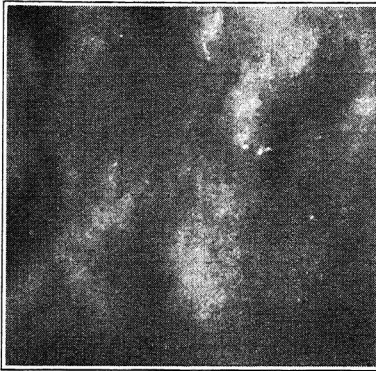
TABLE 6.—THE EFFECT OF TWENTY-FIVE PER CENT OF DRY SKIM MILK UPON THE PHYSICAL PROPERTIES OF CREAM CHEESE,—LOT 6

Age Days	Flavor	Spreading Properties	Slicing Properties	Body	Color	Texture	Appearance
2	Flat, Clean, Sweet	Good—	Good	Smooth, Very Resistant	Dull Light Yellow	Coarse	Dull Deep Yellow
5	Clean, Very Sweet	Good	Good	Smooth, Very Resistant	Dull Light Yellow	Coarse	Dull Deep Yellow
12	Clean Very Sweet	Good	Good	Smooth, Very Resistant	Dull Light Yellow	Coarse	Dull Deep Yellow

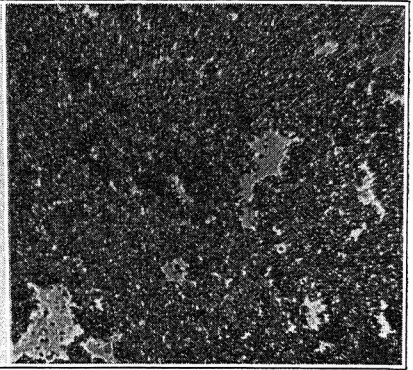
spread and a smooth medium resistant body. As the dry skim milk content was decreased below fifteen per cent, the body of the cheese became less resistant; texture more coarse; and the slicing and spreading properties less desirable. As the dry skim milk content was increased above 20 per cent, the body became very resistant; too firm for slicing and required much effort to break the cheese down into a smooth, even spread.

This series also shows the effect of high percentages of dry skim milk upon the development of a typical cream cheese flavor. A distinct dry milk flavor was never apparent, although a sweet flavor was noticed when the amount of dry skim milk added exceeded 15 per cent by weight. In Lot 4, a desirable flavor was not observed until the scoring on the fifth day. A desirable acid flavor never developed in Lots 5 and 6, while in Lots 2 and 3 a desirable acid flavor developed the second day.

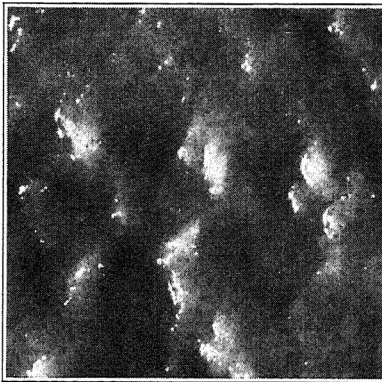
The microphotographs, Figures 1 and 2, taken of the cheese mix immediately after homogenization indicates the effect of increasing amounts of dry skim milk. They show that as the solids-not-fat content of the mix increases, there is clumping of the fat globules; the fat is more evenly distributed throughout the mix and the texture is more even. The macrophotographs, Figures 1 and 2, show the cheese to be close in texture and smooth in body until 20 per cent of dry skim milk is added when it tends to become gummy and sticky which we believe is because of the high lactose and solids-not-fat content. The macrophotographs were 11X and the microphotographs were 28X.



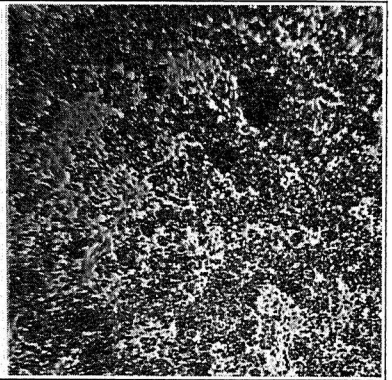
No Dry Skim Milk.



No Dry Skim Milk. Shows Clumping of Butter Fat.



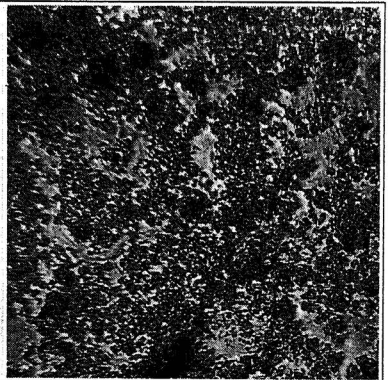
5 Per Cent of Dry Skim Milk.



5 Per Cent of Dry Skim Milk. Shows Clumping of Butter Fat.

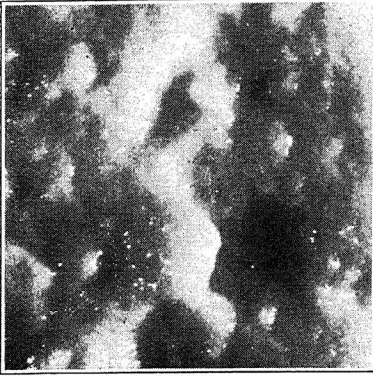


10 Per Cent of Dry Skim Milk.

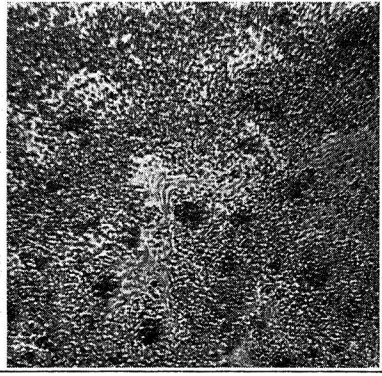


10 Per Cent of Dry Skim Milk. Shows Clumping of Butter Fat.

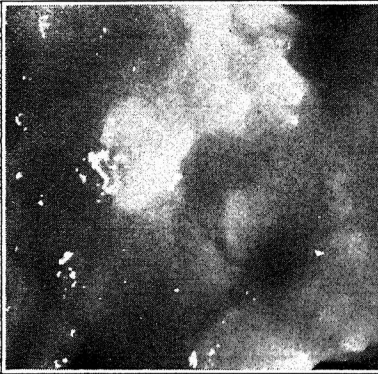
Figure 1.—Macrophotographs and Microphotographs Showing the Influence of Variable Increments of Dry Skim Milk Upon the Texture and Clumping of Butter Fat of Cream Cheese.



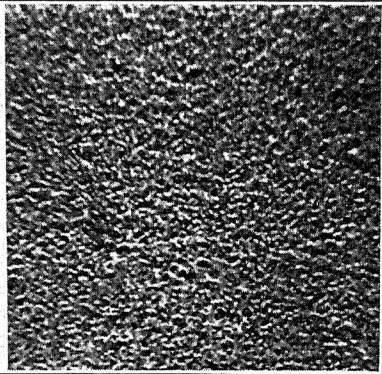
15 Per Cent of Dry Skim Milk.



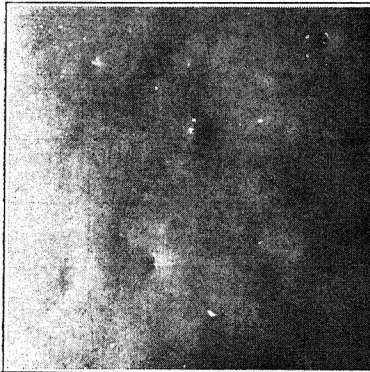
15 Per Cent of Dry Skim Milk. Shows Decreased Clumping.



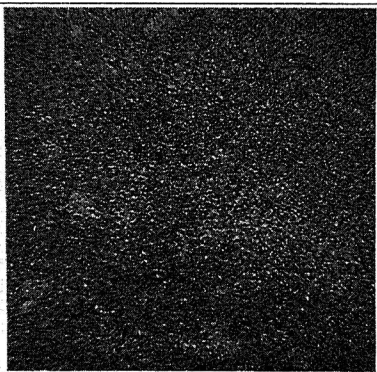
20 Per Cent of Dry Skim Milk.



20 Per Cent of Dry Skim Milk. Shows Decreased Clumping.



25 Per Cent of Dry Skim Milk.



25 Per Cent of Dry Skim Milk. Clumping Markedly Decreased.

Figure 2.—Macro photographs and Microphotographs Showing the Influence of Variable Increments of Dry Skim Milk Upon the Texture and Clumping of Butter Fat of Cream Cheese.

The Effect of Variable Increments of Inoculum When the Solids-Not-Fat Content is Varied

Because a desirable cream cheese flavor never developed in Lots 5 and 6 of the previous series, in which 20 and 25 per cent of dry skim milk and one per cent of starter or inoculum by weight were used, it was decided to determine the amount of starter or inoculum which would be required to produce a desirable flavor in cheese containing high percentages of solids-not-fat.

Six series of determinations were made to determine the amount of starter necessary to produce a desirable flavor.

In series one, Tables 7 to 11 inclusive, the starter content was varied from 1 to 5 per cent in Lots 1 to 5 respectively. The butterfat content was held constant at 20 per cent, the gelatin content at 0.4 per cent and dry skim milk at 5 per cent, by weight.

TABLE 7.—THE EFFECT OF ONE PER CENT OF STARTER UPON THE FLAVOR OF CREAM CHEESE,—LOT 1

Age Days	Flavor	Spreading Properties	Slicing Properties	Body	Color	Texture	Appearance
2	Clean, Pleasant, Mild Acid	Fair +	Good	Smooth	Cream	Slightly Coarse	Bright Luster
5	Clean, Pleasant, Mild Acid	Fair +	Good	Smooth	Cream	Slightly Coarse	Bright Luster
12	Clean, Pleasant, Mild Acid	Fair +	Good	Smooth	Cream	Slightly Coarse	Bright Luster
18	Medium to High Acid	Fair +	Good	Smooth	Cream	Slightly Coarse	Bright Luster

TABLE 8.—THE EFFECT OF TWO PER CENT OF STARTER UPON THE FLAVOR OF CREAM CHEESE,—LOT 2

Age Days	Flavor	Spreading Properties	Slicing Properties	Body	Color	Texture	Appearance
2	Clean, Medium Acid	Fair +	Good	Very Smooth	Cream	Slightly Coarse	Bright Luster
5	Clean, Medium Acid	Fair +	Good	Very Smooth	Cream	Slightly Coarse	Bright Luster
12	Clean, Medium Acid	Fair +	Good	Very Smooth	Cream	Slightly Coarse	Bright Luster
18	Medium to High Acid	Fair +	Good	Very Smooth	Cream	Slightly Coarse	Bright Luster

The data, Tables 7 to 11 inclusive, show that as the starter content was increased, a more pronounced acid flavor developed. A mild acid flavor was apparent in the cheese when 1 per cent of starter was used and a high acid flavor when the amount of starter

was increased to 5 per cent. The cheese in Lot 5 had an undesirable flavor on the eighteenth day while the flavor of the cheese in Lot 1, which contained only 1 per cent of starter, was considered

TABLE 9.—THE EFFECT OF THREE PER CENT OF STARTER UPON THE FLAVOR OF CREAM CHEESE,—LOT 3

Age Days	Flavor	Spreading Properties	Slicing Properties	Body	Color	Texture	Appearance
2	Clean, Medium to High Acid	Fair +	Good	Very Smooth	Cream	Slightly Coarse	Bright Luster
5	Clean, Medium to High Acid	Fair +	Good	Very Smooth	Cream	Slightly Coarse	Bright Luster
12	Clean, High Acid	Fair +	Good	Very Smooth	Cream	Slightly Coarse	Bright Luster
18	Clean, Very High Acid	Fair +	Good	Very Smooth	Cream	Slightly Coarse	Bright Luster

TABLE 10.—THE EFFECT OF FOUR PER CENT OF STARTER UPON THE FLAVOR OF CREAM CHEESE,—LOT 4

Age Days	Flavor	Spreading Properties	Slicing Properties	Body	Color	Texture	Appearance
2	Clean, Medium to High Acid	Fair +	Good	Very Smooth	Cream	Slightly Coarse	Bright Luster
5	Clean, Medium to High Acid	Fair +	Good	Very Smooth	Cream	Slightly Coarse	Bright Luster
12	Clean, High Acid Aftertaste	Fair +	Good	Very Smooth	Cream	Slightly Coarse	Bright Luster
18	Very High Acid	Fair +	Good	Very Smooth	Cream	Slightly Coarse	Bright Luster

TABLE 11.—THE EFFECT OF FIVE PER CENT OF STARTER UPON THE FLAVOR OF CREAM CHEESE,—LOT 5

Age Days	Flavor	Spreading Properties	Slicing Properties	Body	Color	Texture	Appearance
2	Clean, High Acid	Fair +	Good	Very Smooth	Cream	Slightly Coarse	Bright Luster
5	Clean, High Acid	Fair +	Good	Very Smooth	Cream	Slightly Coarse	Bright Luster
12	Very High Acid	Fair +	Good	Very Smooth	Cream	Slightly Coarse	Bright Luster
18	Undesirable	Fair +	Good	Very Smooth	Cream	Slightly Coarse	Bright Luster

desirable on the eighteenth day. In this series the larger amounts of starter added apparently did not improve the texture, slicing or spreading properties. This indicates that 1 per cent of starter is sufficient to produce a mild acid flavor in a mix such as this one.

The second series consisted of five lots, 6 to 10 inclusive, containing respectively from 1 to 5 per cent of starter. Other ingredients were held constant at 20 per cent butterfat, 10 per cent dry skim milk and 0.4 per cent gelatin. Tables 12 to 16 inclusive

TABLE 12.—THE EFFECT OF ONE PER CENT OF STARTER UPON THE FLAVOR OF CREAM CHEESE,—
LOT 6

Age Days	Flavor	Spreading Properties	Slicing Properties	Body	Color	Texture	Appearance
2	Clean, Mild Acid	Good	Good +	Smooth, Medium Resistant	Light Cream Cream	Close	Bright Luster
5	Medium Acid	Good	Good +	Smooth, Medium Resistant	Light Cream	Close	Bright Luster
21	Pungent, High Acid	Good	Good +	Smooth, Medium Resistant	Light Cream	Close	Bright Luster

show that 1 per cent of starter was sufficient to produce the most desirable cream cheese when lots of such composition were used. The amount of starter added did not influence any of the physical properties of the resulting cream cheese.

The third series, Tables 17 to 21 inclusive, consisted of five lots, 11 to 15 inclusive. The starter content varied from 1 to 5 per cent as in the previous series. The fat content was held constant at 20 per cent, dry skim milk at 15 per cent and gelatin 0.4 per cent.

In this series, as shown in Tables 11 and 12, it required from two to five days for the lactic acid producing organisms introduced into the cheese by the addition of the starter, to develop an acid flavor that was high enough to be detected by the sense of taste, but as the starter content was increased, the typical cream cheese acid flavor developed faster. By the nineteenth day the acidity in the cheese which originally had only 1 per cent of starter appeared to be the same as in the cheese which contained 5 per cent of starter. This may be explained by the fact that there is only a definite, yet the same, amount of carbohydrate material in each sample of cheese. It is known that the lactic acid producing organisms will not continue to grow in a media which has a pH concentration above a definite hydrogen ion concentration. Therefore, regardless of the amount of starter originally added to the cream cheese mix, the amount of acid produced in the cheese will be practically the same after a period of time. It would require 3 per cent of starter to produce a desirable flavor in cream cheese for immediate consumption provided the composition was the same as used in this series. If, however, the cheese is to be held in storage for a period of a week before being delivered to the consumer, 1 per cent of starter will be adequate.

The fourth series consisted of cheese having a composition of 20 per cent fat, 20 per cent dry skim milk and 0.4 per cent gelatin. The starter content varied from 1 to 5 per cent in Lots 16 to 20 inclusive.

TABLE 13.—THE EFFECT OF TWO PER CENT OF STARTER UPON THE FLAVOR OF CREAM CHEESE,—LOT 7

Age Days	Flavor	Spreading Properties	Slicing Properties	Body	Color	Texture	Appearance
2	Clean, Medium Acid	Good	Good +	Smooth, Medium Resistant	Light Cream	Close	Bright Luster
5	Clean, Medium Acid	Good	Good +	Smooth, Medium Resistant	Light Cream	Close	Bright Luster
21	Very High Acid	Good	Good +	Smooth, Medium Resistant	Light Cream	Close	Bright Luster

TABLE 14.—THE EFFECT OF THREE PER CENT OF STARTER UPON THE FLAVOR OF CREAM CHEESE,—LOT 8

Age Days	Flavor	Spreading Properties	Slicing Properties	Body	Color	Texture	Appearance
2	Clean, Medium to High Acid	Good	Good +	Smooth, Medium Resistant	Light Cream	Close	Bright Luster
5	High Acid	Good	Good +	Smooth, Medium Resistant	Light Cream	Close	Bright Luster
21	Bitter	Good	Good +	Smooth, Medium Resistant	Light Cream	Close	Bright Luster

TABLE 15.—THE EFFECT OF FOUR PER CENT OF STARTER UPON THE FLAVOR OF CREAM CHEESE,—LOT 9

Age Days	Flavor	Spreading Properties	Slicing Properties	Body	Color	Texture	Appearance
2	Clean, Medium to High Acid	Good	Good +	Smooth, Medium Resistant	Light Cream	Close	Bright Luster
5	High Acid	Good	Good +	Smooth, Medium Resistant	Light Cream	Close	Bright Luster
21	Undesirable	Good	Good +	Smooth, Medium Resistant	Light Cream	Close	Bright Luster

TABLE 16.—THE EFFECT OF FIVE PER CENT OF STARTER UPON THE FLAVOR OF CREAM CHEESE,—LOT 10

Age Days	Flavor	Spreading Properties	Slicing Properties	Body	Color	Texture	Appearance
2	Clean, Medium to High Acid	Good	Good +	Smooth, Medium Resistant	Light Cream	Close	Bright Luster
5	High Acid	Good	Good +	Smooth, Medium Resistant	Light Cream	Close	Bright Luster
21	Undesirable	Good	Good +	Smooth, Medium Resistant	Light Cream	Close	Bright Luster

TABLE 17.—THE EFFECT OF ONE PER CENT OF STARTER UPON THE FLAVOR OF CREAM CHEESE,—LOT 11

Age Days	Flavor	Spreading Properties	Slicing Properties	Body	Color	Texture	Appearance
2	Pleasant, Slightly Sweet	Good ++	Good +	Very Mellow	Light Cream	Very Close	Bright Luster
5	Pleasant, Slightly Mild Acid	Good ++	Good +	Very Mellow	Light Cream	Very Close	Bright Luster
12	Medium to High Acid	Good ++	Good +	Very Mellow	Light Cream	Very Close	Bright Luster
19	Clean, Sharp Acid Aftertaste	Good ++	Good +	Very Mellow	Light Cream	Very Close	Bright Luster
26	Strong Acid	Good ++	Good +	Very Mellow	Light Cream	Very Close	Bright Luster
33	High Acid Aftertaste	Good ++	Good +	Very Mellow	Light Cream	Very Close	Bright Luster
42	High Acid Aftertaste	Good ++	Good +	Very Mellow	Light Cream	Very Close	Bright Luster
48	Undesirable	Good ++	Good +	Very Mellow	Light Cream	Very Close	Bright Luster

TABLE 18.—THE EFFECT OF TWO PER CENT OF STARTER UPON THE FLAVOR OF CREAM CHEESE,—LOT 12

Age Days	Flavor	Spreading Properties	Slicing Properties	Body	Color	Texture	Appearance
2	Clean, Sweet	Good ++	Good +	Very Mellow	Light Cream	Very Close	Bright Luster
5	Clean, Medium Acid	Good ++	Good +	Very Mellow	Light Cream	Very Close	Bright Luster
12	Pronounced High Acid	Good ++	Good +	Very Mellow	Light Cream	Very Close	Bright Luster
19	Clean, Medium to High Acid	Good ++	Good +	Very Mellow	Light Cream	Very Close	Bright Luster
26	Undesirable	Good ++	Good +	Very Mellow	Light Cream	Very Close	Bright Luster

TABLE 19.—THE EFFECT OF THREE PER CENT OF STARTER UPON THE FLAVOR OF CREAM CHEESE,—LOT 13

Age Days	Flavor	Spreading Properties	Slicing Properties	Body	Color	Texture	Appearance
2	Mild Acid	Good ++	Good +	Very Mellow	Light Cream	Very Close	Bright Luster
5	Medium to High Acid	Good ++	Good +	Very Mellow	Light Cream	Very Close	Bright Luster
12	Pronounced Medium to High Acid	Good ++	Good +	Very Mellow	Light Cream	Very Close	Bright Luster
19	Pronounced Medium to High Acid	Good ++	Good +	Very Mellow	Light Cream	Very Close	Bright Luster
26	Undesirable	Good ++	Good +	Very Mellow	Light Cream	Very Close	Bright Luster

TABLE 20.—THE EFFECT OF FOUR PER CENT OF STARTER UPON THE FLAVOR OF CREAM CHEESE,—
LOT 14

Age Days	Flavor	Spreading Properties	Slicing Properties	Body	Color	Texture	Appearance
2	Medium Acid Aftertaste	Good ++	Good +	Very Mellow	Light Cream	Very Close	Bright Luster
5	Medium Acid	Good ++	Good +	Very Mellow	Light Cream	Very Close	Bright Luster
12	High Acid, Strong Acid Aftertaste	Good ++	Good +	Very Mellow	Light Cream	Very Close	Bright Luster
19	High Acid, Strong Acid Aftertaste	Good ++	Good +	Very Mellow	Light Cream	Very Close	Bright Luster
26	Undesirable	Good ++	Good +	Very Mellow	Light Cream	Very Close	Bright Luster

TABLE 21.—THE EFFECT OF FIVE PER CENT OF STARTER UPON THE FLAVOR OF CREAM CHEESE,—
LOT 15

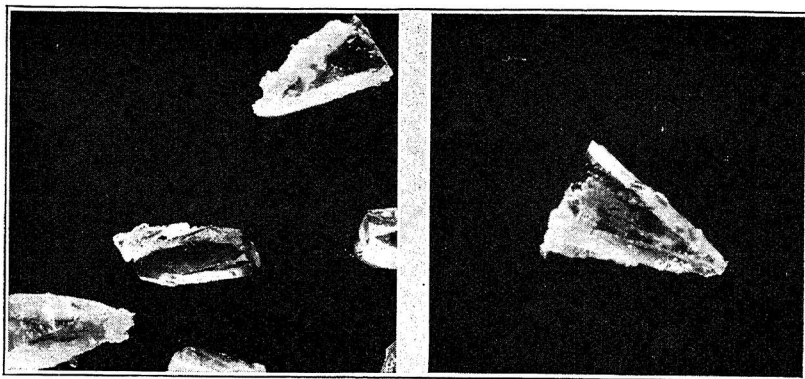
Age Days	Flavor	Spreading Properties	Slicing Properties	Body	Color	Texture	Appearance
2	Medium to High Acid	Good ++	Good ++	Very Mellow	Light Cream	Very Close	Bright Luster
5	High Acid	Good ++	Good ++	Very Mellow	Light Cream	Very Close	Bright Luster
12	Strong Acid Aftertaste	Good ++	Good ++	Very Mellow	Light Cream	Very Close	Bright Luster
26	Undesirable	Good ++	Good ++	Very Mellow	Light Cream	Very Close	Bright Luster

TABLE 22.—THE EFFECT OF ONE PER CENT OF STARTER UPON THE FLAVOR OF CREAM CHEESE,—
LOT 16

Age Days	Flavor	Spreading Properties	Slicing Properties	Body	Color	Texture	Appearance
2	Very Sweet	Good	Good	Smooth, Gelatinous	Dull Light Yellow	Very Close	Dull Luster
5	Very Sweet	Good	Good	Smooth, Gelatinous	Dull Light Yellow	Very Close	Dull Luster
12	Very Sweet	Good	Good	Smooth, Gelatinous	Dull Light Yellow	Very Close	Dull Luster
19	Very Sweet	Good	Good	Smooth, Gelatinous	Dull Light Yellow	Very Close	Dull Luster

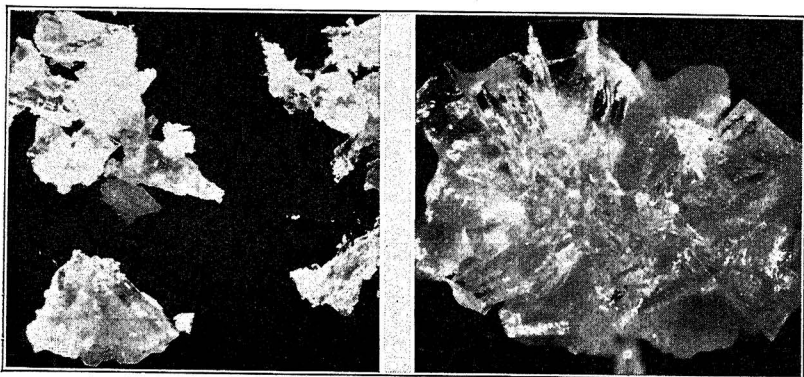
TABLE 23.—THE EFFECT OF TWO PER CENT OF STARTER UPON THE FLAVOR OF CREAM CHEESE,—
LOT 17

Age Days	Flavor	Spreading Properties	Slicing Properties	Body	Color	Texture	Appearance
2	Very Sweet	Good	Good	Mellow, Gelatinous	Dull Light Yellow	Very Close	Dull Luster
5	Very Sweet	Good	Good	Mellow, Gelatinous	Dull Light Yellow	Very Close	Dull Luster
12	Very Sweet	Good	Good	Mellow, Gelatinous	Dull Light Yellow	Very Close	Dull Luster
19	Slight Sweetness	Good	Good	Mellow, Gelatinous	Dull Light Yellow	Very Close	Dull Luster



Individual Lactose Crystals. X17.

Individual Lactose Crystals. X28.

Large Crystal Cluster Which Has Been
Partly Disintegrated. X17.

Cluster of Lactose Crystals. X28.

Figure 3.—Individual Lactose Crystals and Clusters of Crystals Taken From Cream Cheese Which Contained 25 Per Cent of Dry Skim Milk.

The data, Tables 22 to 26 inclusive, show that a typical cream cheese flavor did not develop before the cheese had acquired an undesirable flavor. For the first few days the cheese had a sweet flavor as did the cheese in Lots 11 and 12 in series three. This sweet flavor was due to the high lactose content of the dry skim milk.

As there was never sufficient acid developed to be detected by the sense of taste in the cheese of Lots 12 to 20, the starter content

TABLE 24.—THE EFFECT OF THREE PER CENT OF STARTER UPON THE FLAVOR OF CREAM CHEESE,—
LOT 18

Age Days	Flavor	Spreading Properties	Slicing Properties	Body	Color	Texture	Appearance
2	Very Sweet	Good	Good	Mellow, Gelatinous	Dull Light Yellow	Very Close	Dull Luster
5	Very Sweet	Good	Good	Mellow, Gelatinous	Dull Light Yellow	Very Close	Dull Luster
12	Very Sweet	Good	Good	Mellow, Gelatinous	Dull Light Yellow	Very Close	Dull Luster
19	Sweet Coating of Mouth	Good	Good	Mellow, Gelatinous	Dull Light Yellow	Very Close	Dull Luster

TABLE 25.—THE EFFECT OF FOUR PER CENT OF STARTER UPON THE FLAVOR OF CREAM CHEESE,—
LOT 19

Age Days	Flavor	Spreading Properties	Slicing Properties	Body	Color	Texture	Appearance
2	Very Sweet	Good	Good	Mellow, Gelatinous	Dull Light Yellow	Very Close	Dull Luster
5	Very Sweet	Good	Good	Mellow, Gelatinous	Dull Light Yellow	Very Close	Dull Luster
12	Very Sweet	Good	Good	Mellow, Gelatinous	Dull Light Yellow	Very Close	Dull Luster
19	Bitter	Good	Good	Mellow, Gelatinous	Dull Light Yellow	Very Close	Dull Luster

TABLE 26.—THE EFFECT OF FIVE PER CENT OF STARTER UPON THE FLAVOR OF CREAM CHEESE,—
LOT 20

Age Days	Flavor	Spreading Properties	Slicing Properties	Body	Color	Texture	Appearance
2	Very Sweet	Good	Good	Mellow, Gelatinous	Dull Light Yellow	Very Close	Dull Luster
5	Very Sweet	Good	Good	Mellow, Gelatinous	Dull Light Yellow	Very Close	Dull Luster
12	Very Sweet	Good	Good	Mellow, Gelatinous	Dull Light Yellow	Very Close	Dull Luster
19	Undesirable	Good	Good	Mellow, Gelatinous	Dull Light Yellow	Very Close	Dull Luster

was increased in the fifth series. Five lots, 21 to 25 inclusive, were as follows:

Lot 21, 1 per cent of starter;

Lot 22, 3 per cent of starter;

Lot 23, 5 per cent of starter;

Lot 24, 7 per cent of starter;

Lot 25, 9 per cent of starter.

Twenty per cent fat and 0.4 per cent gelatin plus 25 per cent of dry skim milk were used in all lots.

Tables 27 to 31, show that even with 9 per cent of starter in Lot 25, a definite acid flavor typical of cream cheese, never developed. These cheeses had a sweet flavor as in series four. When scored on the twelfth day, lactose crystals that were large enough to be seen by the naked eye were observed as shown in Figure 3.

The presence of lactose crystals in the cheese indicated that the maximum amount of dry skim milk that could be used in manufacturing cream cheese had been reached.

Tables 22-31 inclusive, show that as the solids-not-fat content is increased by the addition of dry skim milk, the cheese becomes mellow, gelatinous, resistant in body and darkened in color as was shown in the previous series. The slicing and spreading properties were not satisfactory. The color varied from a pale cream, when 20 per cent fat and 15 per cent dry skim milk were used, to a dull light yellow in mixes consisting of 20 per cent fat and 25 per cent dry skim milk.

It was thought important to determine whether a desirable cream cheese could be made by using 20 per cent of dry skim milk and increasing the starter content above 5 per cent. A sixth series was devised in an endeavor to solve this problem. This series consisted of six lots which were as follows:

Lot 26, 6 per cent of starter;

Lot 27, 7 per cent of starter;

Lot 28, 10 per cent of starter;

Lot 29, 13 per cent of starter;

Lot 30, 16 per cent of starter;

Lot 31, 20 per cent of starter.

To make the study comparative with Lots 16 to 20 inclusive, the composition of the cheese of the sixth series contained 10 per cent butterfat, 20 per cent of dry skim milk and salt and gelatin held constant as before. The data, Tables 32 to 37 inclusive, show that a desirable cream cheese could not be produced from the above

TABLE 27.—THE EFFECT OF ONE PER CENT OF STARTER UPON THE FLAVOR OF CREAM CHEESE,—LOT 21

Age Days	Flavor	Spreading Properties	Slicing Properties	Body	Color	Texture	Appearance
2	Flat, Sweet	Fair+ Sticky	Fair+ Gummy	Smooth, Resistant	Dull Yellow	Close, Pasty	Dull Deep Yellow
5	Flat, Sweet	Fair+ Sticky	Fair+ Gummy	Smooth, Resistant	Dull Yellow	Close, Pasty	Dull Deep Yellow
12	Sweet	Fair+ Sticky	Fair+ Gummy	Smooth, Resistant	Dull Yellow	Close, Pasty, Sandy	Dull Deep Yellow
19	Undesirable	Fair+ Sticky	Fair+ Gummy	Smooth, Resistant	Dull Yellow	Close, Pasty, Sandy	Dull Deep Yellow

TABLE 28.—THE EFFECT OF THREE PER CENT OF STARTER UPON THE FLAVOR OF CREAM CHEESE,—
LOT 22

Age Days	Flavor	Spreading Properties	Slicing Properties	Body	Color	Texture	Appearance
2	Flat, Sweet	Fair + Sticky	Fair + Gummy	Smooth, Resistant	Dull Yellow	Close, Pasty	Dull Deep Yellow
5	Flat, Sweet	Fair + Sticky	Fair + Gummy	Smooth, Resistant	Dull Yellow	Close Pasty	Dull Deep Yellow
12	Sweet	Fair + Sticky	Fair + Gummy	Smooth, Resistant	Dull Yellow	Close, Pasty, Sandy	Dull Deep Yellow
19	Undesirable	Fair + Sticky	Fair + Gummy	Smooth, Resistant	Dull Yellow	Close, Pasty, Sandy	Dull Deep Yellow

TABLE 29.—THE EFFECT OF FIVE PER CENT OF STARTER UPON THE FLAVOR OF CREAM CHEESE,—
LOT 23

Age Days	Flavor	Spreading Properties	Slicing Properties	Body	Color	Texture	Appearance
2	Distinctly Sweet	Fair + Sticky	Fair + Gummy	Smooth, Resistant	Dull Yellow	Close, Pasty	Dull Deep Yellow
5	Distinctly Sweet	Fair + Sticky	Fair + Gummy	Smooth Resistant	Dull Yellow	Close, Pasty	Dull Deep Yellow
12	Sweet	Fair + Sticky	Fair + Gummy	Smooth, Resistant	Dull Yellow	Close, Pasty, Sandy	Dull Deep Yellow
19	Bitter	Fair + Sticky	Fair + Gummy	Smooth, Resistant	Dull Yellow	Close, Pasty, Sandy	Dull Deep Yellow

TABLE 30.—THE EFFECT OF SEVEN PER CENT OF STARTER UPON THE FLAVOR OF CREAM CHEESE,—
LOT 24

Age Days	Flavor	Spreading Properties	Slicing Properties	Body	Color	Texture	Appearance
2	Sweet	Fair + Sticky, Resistant	Fair + Gummy	Smooth, Resistant	Dull Yellow	Close, Pasty	Dull Deep Yellow
5	Sweet	Fair + Sticky, Resistant	Fair + Gummy	Smooth, Resistant	Dull Yellow	Close, Pasty	Dull Deep Yellow
12	Sweet	Fair + Sticky, Resistant	Fair + Gummy	Smooth, Resistant	Dull Yellow	Close, Pasty, Sandy	Dull Deep Yellow
19	Bitter	Fair + Sticky, Resistant	Fair + Gummy	Smooth, Resistant	Dull Yellow	Close, Pasty, Sandy	Dull Deep Yellow

TABLE 31.—THE EFFECT OF NINE PER CENT OF STARTER UPON THE FLAVOR OF CREAM CHEESE,—
LOT 25

Age Days	Flavor	Spreading Properties	Slicing Properties	Body	Color	Texture	Appearance
2	Very Sweet Aftertaste	Fair + Sticky, Resistant	Fair + Gummy	Smooth, Resistant	Dull Yellow	Close, Pasty	Dull Deep Yellow
5	Very Sweet Aftertaste	Fair + Sticky, Resistant	Fair + Gummy	Smooth, Resistant	Dull Yellow	Close, Pasty	Dull Deep Yellow
12	Very Sweet Aftertaste	Fair + Sticky, Resistant	Fair + Gummy	Smooth, Resistant	Dull Yellow	Close, Pasty, Sandy	Dull Deep Yellow
19	Bitter	Fair + Sticky, Resistant	Fair + Gummy	Smooth, Resistant	Dull Yellow	Close, Pasty, Sandy	Dull Deep Yellow

TABLE 32.—THE EFFECT OF SIX PER CENT OF STARTER UPON THE FLAVOR OF CREAM CHEESE,—LOT 26

Age Days	Flavor	Spreading Properties	Slicing Properties	Body	Color	Texture	Appearance
2	Clean, Sweet	Poor, Soft	Poor	Very Weak	Dull Light Yellow	Cheese Not "Set-up"	Dull Luster
5	Sour Clabber Milk	Poor	Poor	Very Weak	Dull Light Yellow	Cheese Not "Set-up"	Dull Luster
12	Undesirable	Poor	Poor	Very Weak	Dull Light Yellow	Cheese Not "Set-up"	Dull Luster

TABLE 33.—THE EFFECT OF SEVEN PER CENT OF STARTER UPON THE FLAVOR OF CREAM CHEESE,—LOT 27

Age Days	Flavor	Spreading Properties	Slicing Properties	Body	Color	Texture	Appearance
2	Clean, Sweet	Poor, Soft	Poor	Very Weak	Dull Light Yellow	Cheese Not "Set-up"	Dull Luster
5	Slightly Sour	Poor, Soft	Poor	Very Weak	Dull Light Yellow	Cheese Not "Set-up"	Dull Luster
12	Undesirable	Poor, Soft	Poor	Very Weak	Dull Light Yellow	Cheese Not "Set-up"	Dull Luster

TABLE 34.—THE EFFECT OF TEN PER CENT OF STARTER UPON THE FLAVOR OF CREAM CHEESE,—LOT 28

Age Days	Flavor	Spreading Properties	Slicing Properties	Body	Color	Texture	Appearance
2	Clean, Sweet	Poor, Mushy	Poor	Very Weak	Dull Light Yellow	Cheese Not "Set-up"	Dull Luster
5	Acid Aftertaste	Poor, Mushy	Poor	Very Weak	Dull Light Yellow	Cheese Not "Set-up"	Dull Luster
12	Undesirable	Poor, Mushy	Poor	Very Weak	Dull Light Yellow	Cheese Not "Set-up"	Dull Luster

TABLE 35.—THE EFFECT OF THIRTEEN PER CENT OF STARTER UPON THE FLAVOR OF CREAM CHEESE,—LOT 29

Age Days	Flavor	Spreading Properties	Slicing Properties	Body	Color	Texture	Appearance
2	Clean, Sweet	Poor, Mushy	Poor	Very Weak	Dull Light Yellow	Cheese Not "Set-up"	Dull Luster
5	Pungent	Poor, Mushy	Poor	Very Weak	Dull Light Yellow	Cheese Not "Set-up"	Dull Luster
12	Undesirable	Poor, Mushy	Poor	Very Weak	Dull Light Yellow	Cheese Not "Set-up"	Dull Luster

TABLE 36.—THE EFFECT OF SIXTEEN PER CENT OF STARTER UPON THE FLAVOR OF CREAM CHEESE,—LOT 30

Age Days	Flavor	Spreading Properties	Slicing Properties	Body	Color	Texture	Appearance
2	Clean, Sweet	Poor, Soft	Poor	Very Weak	Dull Light Yellow	Cheese Not "Set-up"	Dull Luster
5	Fermented Milk	Poor, Soft	Poor	Very Weak	Dull Light Yellow	Cheese Not "Set-up"	Dull Luster
12	Undesirable	Poor, Soft	Poor	Very Weak	Dull Light Yellow	Cheese Not "Set-up"	Dull Luster

TABLE 37.—THE EFFECT OF TWENTY PER CENT OF STARTER UPON THE FLAVOR OF CREAM CHEESE,—
LOT 31

Age Days	Flavor	Spreading Properties	Slicing Properties	Body	Color	Texture	Appearance
2	Clean, Sweet	Poor, Soft	Poor	Very Weak	Dull Light Yellow	Cheese Not "Set-up"	Dull Luster
5	Bitter	Poor, Soft	Poor	Very Weak	Dull Light Yellow	Cheese Not "Set-up"	Dull Luster
12	Undesirable	Poor, Soft	Poor	Very Weak	Dull Light Yellow	Cheese Not "Set-up"	Dull Luster

mixes. The cheese did not set up during the twelve days storage period nor did a desirable, typical, cream cheese flavor develop. All samples of each lot had a sweet flavor when first scored and an off flavor or an undesirable flavor by the fifth day. It seems logical that factors other than the starter were responsible for the inferior qualities of cream cheese manufactured when using high percentages of dry skim milk (20 and 25 per cent). The failure to develop sufficient acid so it could be detected by tasting may have been due to various reasons. When dry skim milk is added at the rate of 20 per cent by weight, so much lactose and other constituents are introduced into the mix that they may tend to act as a "buffer" and submerge whatever avid flavor may have developed. As the saturation point of the lactose is reached, crystallization begins. The fact there is such a large amount of lactose in the cheese which contains 20 and 25 per cent of dry skim milk, it may be that the sugar tends to act as a preservative and inhibits the growth or changes that the *Streptococcus lacticus* organisms usually produce. It is also probable that insufficient moisture is present so that the organisms can carry on their normal metabolism.

Considering all of the thirty-one lots studied in establishing the amount of starter to use in making a cheese of a given composition, the data tend to show that the cheese having a composition of 15 per cent of dry skim milk had the best keeping, spreading, and slicing properties. It appears as though the dry skim milk tends to have a preservative influence upon the finished cream cheese which may be a valuable factor to consider when the cheese is to be held for a considerable period of time before being consumed.

The Effect of Variable Increments of Butterfat Upon the Physical Properties of Cream Cheese

Two series, of five lots each, were made to determine the best combination of fat with dry skim milk to give the most desirable cream cheese. In the first series, the fat content was varied from 15 to 35 per cent, holding the dry skim milk content constant at 10 per cent and the gelatin at 0.4 per cent. Starter and salt were held constant at one per cent and 0.75 per cent, respectively.

The data, Tables 38 to 42 inclusive, show that a high butterfat content was required to produce a cream cheese having desirable spreading and slicing properties when the solids-not-fat content was relatively low. This cheese, however, became less desirable within a few weeks, being too resistant to slice and spread well.

In the second series, Lots 6 to 10 inclusive, the dry skim milk content was increased to 15 per cent and all other factors held constant as in series one. Tables 43 to 47 inclusive, show the results of this series. The combination of 20 per cent butterfat and 15 per cent dry skim milk produced the most desirable cheese of the two series. Lot 7, possessed excellent spreading properties and very good slicing properties. The cheese tended to improve slightly by aging as it became more firm, the serum of the mix being absorbed by the dry milk and the complete solidification of the gelatin.

TABLE 38.—THE EFFECT OF FIFTEEN PER CENT BUTTER-FAT AND TEN PER CENT DRY SKIM MILK UPON THE PHYSICAL PROPERTIES OF CREAM CHEESE,—LOT 1

Age Days	Flavor	Spreading Properties	Slicing Properties	Body	Color	Texture	Appearance
2	Mild Acid, Starter Aftertaste	Poor, Too Soft	Poor, Mushy		Nearly White	Very Close	Dead Luster
5	Milk Acid, Milky	Poor, Too Soft	Poor	Weak	Nearly White	Very Close	Dead Luster
12	Medium to High Acid	Poor	Poor	Weak	Nearly White	Very Close	Dead Luster
19	Medium to High Acid	Poor	Poor	Weak	Nearly White	Very Close	Dead Luster
26	Medium to High Acid	Poor	Poor	Weak	Nearly White	Very Close	Dead Luster
33	Medium to High Acid	Poor	Poor	Weak	Nearly White	Very Close	Dead Luster
40	Medium to High Acid	Poor	Poor	Weak	Nearly White	Very Close	Dead Luster
47	Undesirable	Poor	Poor	Weak	Nearly White	Very Close	Dead Luster

TABLE 39.—THE EFFECT OF TWENTY PER CENT BUTTER-FAT AND TEN PER CENT DRY SKIM MILK UPON THE PHYSICAL PROPERTIES OF CREAM CHEESE,—LOT 2

Age Days	Flavor	Spreading Properties	Slicing Properties	Body	Color	Texture	Appearance
2	Mild Acid	Fair, Little Clumping	Good	Mellow, Medium Resistant	Light Cream	Very Close	Good Luster
5	Mild Acid	Fair, Little Clumping	Good	Mellow, Medium Resistant	Light Cream	Very Close	Good Luster
12	Medium to High Acid	Fair, Little Clumping	Good	Mellow, Medium Resistant	Light Cream	Very Close	Good Luster
19	Medium to High Acid	Fair, Little Clumping	Good	Mellow, Medium Resistant	Light Cream	Very Close	Good Luster
26	Medium to High Acid	Fair, Little Clumping	Good	Mellow, Medium Resistant	Light Cream	Very Close	Good Luster
33	High Acid	Fair, Little Clumping	Good +	Mellow Medium Resistant	Light Cream	Very Close	Good Luster
40	High Acid	Fair, Little Clumping	Good + More Firm	Mellow, Medium Resistant	Light Cream	Very Close	Good Luster
47	High Acid	Poor, Soft	Good, Sticky	Mellow, Medium Resistant	Light Cream	Very Close	Good Luster
54	Undesirable	Poor, Rough	Good —, Sticky	Mellow, Medium Resistant	Light Cream	Very Close	Good Luster

TABLE 40.—THE EFFECT OF TWENTY-FIVE PER CENT BUTTER-FAT AND TEN PER CENT DRY SKIM MILK UPON THE PHYSICAL PROPERTIES OF CREAM CHEESE,—LOT 3

Age Days	Flavor	Spreading Properties	Slicing Properties	Body	Color	Texture	Appearance
2	Mild Acid, Cream	Good + +	Good —, Soft	Smooth	Cream	Very Close	Bright Luster
5	Mild Acid, Cream	Good + +	Good, More Firm	Smooth	Cream	Very Close	Bright Luster
12	Mild Acid, Cream	Good + +	Good	Smooth	Cream	Very Close	Bright Luster
19	Medium Acid	Good + +	Good + + More Firm	Smooth Smooth	Cream Cream	Very Close	Bright Luster
26	Slightly High Acid	Good + +	Good + +	Smooth	Cream	Very Close	Bright Luster
33	High Acid	Good + +	Good + +	Smooth	Cream	Very Close	Bright Luster
40	High Acid	Good +, Resistant Dry	Good +, Resistant	Smooth	Cream	Very Close	Bright Luster
47	High Acid	Good +	Good +	Smooth	Cream	Very Close	Bright Luster
54	Undesirable	Good +	Good +	Smooth	Cream	Very Close	Bright Luster

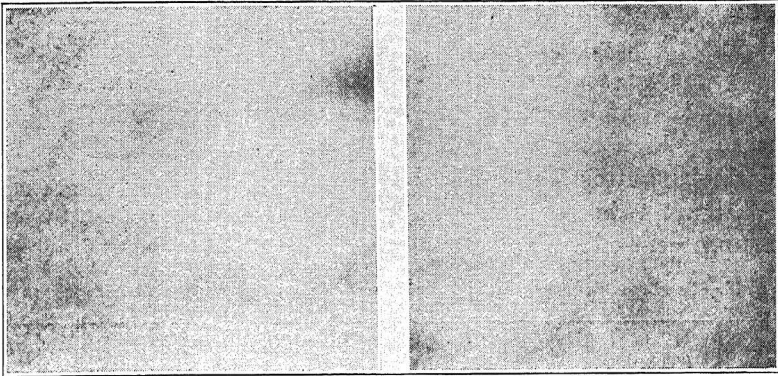
TABLE 41.—THE EFFECT OF THIRTY PER CENT BUTTER-FAT AND TEN PER CENT DRY SKIM MILK UPON THE PHYSICAL PROPERTIES OF CREAM CHEESE,—LOT 4

Age Days	Flavor	Spreading Properties	Slicing Properties	Body	Color	Texture	Appearance
2	Very Mild Acid, Creamy	Good+++	Good++	Smooth, Medium Resistant	Deep Rich Cream	Very Close	Slight Dull Luster
5	Mild Acid, Rich, Creamy	Good+++	Good++	Smooth, Medium Resistant	Deep Rich Cream	Very Close	Slight Dull Luster
12	Mild Acid, Rich, Creamy	Good+++	Good++	Smooth, Medium Resistant	Deep Rich Cream	Very Close	Slight Dull Luster
19	Creamy, Medium Acid	Good+++	Good++	Smooth, Medium Resistant	Deep Rich Cream	Very Close	Slight Dull Luster
26	Slight Old Cream	Good+++	Good+ Too Firm	Smooth, Medium Resistant	Deep Rich Cream	Very Close	Slight Dull Luster
33	Mild Acid	Good+, Too Firm	Good+	Smooth, Medium Resistant	Deep Rich Cream	Very Close	Slight Dull Luster
40	High Acid Aftertaste	Good+	Good+	Smooth, Medium Resistant	Deep Rich Cream	Very Close	Slight Dull Luster
47	High Acid	Good+	Good+	Smooth, Medium Resistant	Deep Rich Cream	Very Close	Slight Dull Luster
54	Undesirable	Good+	Good+	Smooth Resistant	Deep Rich Cream	Very Close	Slight Dull Luster

TABLE 42.—THE EFFECT OF THIRTY-FIVE PER CENT BUTTER-FAT AND TEN PER CENT DRY SKIM MILK UPON THE PHYSICAL PROPERTIES OF CREAM CHEESE,—LOT 5

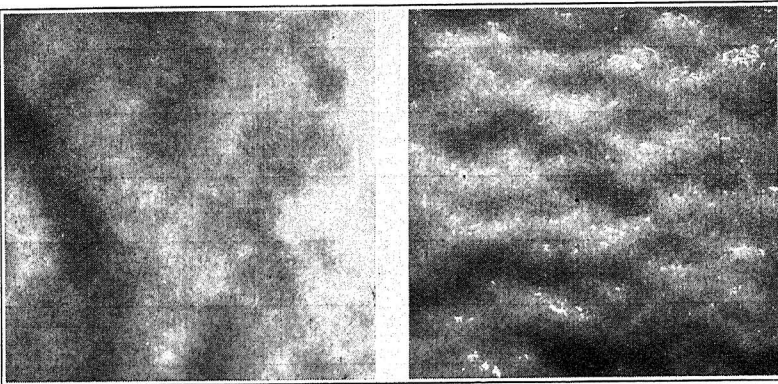
Age Days	Flavor	Spreading Properties	Slicing Properties	Body	Color	Texture	Appearance
2	Buttery, Very Rich, Sweet	Fair, Sticky	Fair, Gummy	Mellow, Medium Resistant	Dull Yellow	Slightly Coarse	Slight Dull Luster
5	Very Rich, Slight Mild Acid	Fair	Fair	Mellow, Medium Resistant	Dull Yellow	Slightly Coarse	Slight Dull Luster
12	Sweet Cream, Yeasty	Fair+, Less Sticky	Fair	Mellow, Medium Resistant	Dull Yellow	Slightly Coarse	Slight Dull Luster
19	Sweet Cream, Yeasty	Good, More Firm	Fair	Mellow, Medium Resistant	Dull Yellow	Slightly Coarse	Slight Dull Luster
26	Sour, Old Cream	Fair, Too Resistant	Fair	Mellow, Medium Resistant	Dull Yellow	Slightly Coarse	Slight Dull Luster
33	Undesirable	Fair, Too Firm	Fair	Resistant	Dull Yellow	Slightly Coarse	Slight Dull Luster

It was apparent in both series that the high butterfat content of the cheese submerged the acid flavor. The cheese of Lots 42, 46 and 47 became undesirable more quickly than did the cheese containing lower percentages of butterfat. It is also noticeable that the cheese of Lots 44 and 45 contained apparently less acid



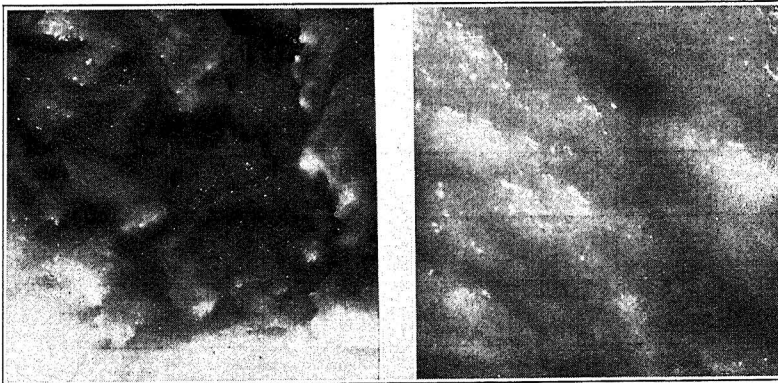
20 Per Cent Butter Fat and 10 Per Cent Dry Skim Milk. X11.

25 Per Cent Butter Fat and 10 Per Cent Dry Skim Milk. X11.



30 Per Cent Butter Fat and 10 Per Cent Dry Skim Milk. X11.

15 Per Cent Butter Fat and 10 Per Cent Dry Skim Milk. X11.



30 Per Cent Butter Fat and 15 Per Cent Dry Skim Milk. X11.

35 Per Cent Butter Fat and 15 Per Cent Dry Skim Milk. X3.

Figure 4.—The Effect of Variable Increments of Butter Fat and Dry Skim Milk Upon the Texture of Cream Cheese.

as detected by tasting than did the cheese in Lots 39 and 40 up to the fortieth day.

There was an insufficient amount of serum solids in the cheese of Lots 1, 2, and 6 to produce desirable spreading qualities. The cheese of high butterfat content showed excessive rigidity and a gelatinous, butter condition, as in the case of Lot 10.

Figure 4 shows that as the fat content is increased, the cheese becomes very coarse and sticky which is not true when 25 per cent

TABLE 43.—THE EFFECT OF FIFTEEN PER CENT BUTTER-FAT AND FIFTEEN PER CENT DRY SKIM MILK UPON THE PHYSICAL PROPERTIES OF CREAM CHEESE,—LOT 6

Age Days	Flavor	Spreading Properties	Slicing Properties	Body	Color	Texture	Appearance
2	Very Mild Acid, Milky	Fair	Fair +	Smooth, Weak	Light Cream	Close, Curdled	Bright Luster
5	Mild Acid	Fair	Good +, More Firm	Smooth Slightly Weak	Light Cream	Close, Curdled	Bright Luster
12	High Acid	Fair +, More Firm	Good +	Smooth Slightly Weak	Light Cream	Close, Curdled	Bright Luster
19	High Acid	Good, More Firm	Good +	Smooth, Slightly Weak	Light Cream	Close, Curdled	Bright Luster
26	High Acid	Good ++, More Firm	Good ++, More Firm	Smooth, Slightly Weak	Light Cream	Close, Curdled	Bright Luster
33	High Acid	Good +++	Good ++	Smooth, Slightly Weak	Light Cream	Close, Curdled	Bright Luster
				Smooth, Slightly Weak	Light Cream	Close, Curdled	Bright Luster

TABLE 44.—THE EFFECT OF TWENTY PER CENT BUTTER-FAT AND FIFTEEN PER CENT DRY SKIM MILK UPON THE PHYSICAL PROPERTIES OF CREAM CHEESE,—LOT 7

Age Days	Flavor	Spreading Properties	Slicing Properties	Body	Color	Texture	Appearance
2	Very Slight Acid	Good +++	Good +	Smooth, Medium Resistant	Cream	Very Fine	Bright Luster
5	Mild Acid	Excellent	Good ++, More Firm	Smooth, Medium Resistant	Cream	Very Fine	Bright Luster
12	Medium to High Acid	Excellent	Good ++	Smooth Medium Resistant	Cream	Very Fine	Bright Luster
19	Medium to High Acid	Excellent	Good ++	Smooth, Medium Resistant	Cream	Very Fine	Bright Luster
26	Medium To High Acid	Good +++ Slightly Resistant	Good ++	Smooth, Medium Resistant	Cream	Very Fine	Bright Luster
33	Medium To High Acid	Good +++	Good ++	Smooth, Medium Resistant	Cream	Very Fine	Bright Luster
40	High Acid	Good +++	Good ++	Smooth, Medium Resistant	Cream	Very Fine	Bright Luster

TABLE 45.—THE EFFECT OF TWENTY-FIVE PER CENT AND FIFTEEN PER CENT DRY SKIM MILK UPON THE PHYSICAL PROPERTIES OF CREAM CHEESE,—LOT 8

Age Days	Flavor	Spreading Properties	Slicing Properties	Body	Color	Texture	Appearance
2	Sweet	Poor, Too Soft	Poor, Sticky	Weak	Rich Cream	Cheese Not "Set-up"	Slight Dull Luster
5	Sweet	Good —, More Firm	Fair +, More Firm	Weak	Rich Cream	Close	Slight Dull Luster
12	Medium Acid	Good, Firmer	Good, Firmer	Smooth, Medium Resistant	Rich Cream	Close	Slight Dull Luster
19	Medium Acid	Good	Good +, More Firm	Smooth, Medium Resistant	Rich Cream	Close	Slight Dull Luster
26	Medium Acid	Good + +, More Firm	Good +	Smooth, Medium Resistant	Rich Cream	Close	Slight Dull Luster
33	Medium Acid	Good + +	Good +	Smooth, Resistant	Rich Cream	Close	Slight Dull Luster
40	Bitter	Good, Too Firm	Good, Too Hard	Smooth, Resistant	Rich Cream	Close	Slight Dull Luster

TABLE 46.—THE EFFECT OF THIRTY PER CENT BUTTER-FAT AND FIFTEEN PER CENT DRY SKIM MILK UPON THE PHYSICAL PROPERTIES OF CREAM CHEESE,—LOT 9

Age Days	Flavor	Spreading Properties	Slicing Properties	Body	Color	Texture	Appearance
2	Slight Acid	Good + + +	Good +, Sticky	Smooth, Mellow	Rich Cream	Very Fine	Slight Dull Luster
5	Mild Acid	Good + +, Too Firm	Good +	Smooth, Mellow	Rich Cream	Very Fine	Slight Dull Luster
12	Mild Acid	Good + +	Good, Too Compact	Smooth, Mellow	Rich Cream	Very Fine	Slight Dull Luster
19	Medium Acid	Good + +	Good	Smooth, Medium Resistant	Rich Cream	Very Fine	Slight Dull Luster
26	Medium Acid	Good + +	Good	Smooth, Medium Resistant	Rich Cream	Very Fine	Slight Dull Luster
33	Undesirable	Good —, Resistant	Good	Smooth, Resistant	Rich Cream	Very Fine	Slight Dull Luster

TABLE 47.—THE EFFECT OF THIRTY-FIVE PER CENT BUTTER-FAT AND FIFTEEN PER CENT DRY SKIM MILK UPON THE PHYSICAL PROPERTIES OF CREAM CHEESE,—LOT 10

Age Days	Flavor	Spreading Properties	Slicing Properties	Body	Color	Texture	Appearance
2	Sweet	Good +	Poor, Soggy	Weak, Smooth	Dull Yellow	Very Fine	Dull Luster
5	Sweet, Rich Cream	Good, Buttery	Fair, Sticky	Weak, Smooth	Dull Yellow	Very Fine	Dull Luster
12	Old Cream	Good	Fair	Smooth, Resistant	Dull Yellow	Very Fine	Dull Luster
19	Creamy, Medium to High Acid	Good	Fair, Resistant	Smooth, Very Resistant	Dull Yellow	Very Fine	Dull Luster
26	Creamy, Medium to High Acid	Fair + Too Resistant	Fair	Smooth, Very Resistant	Dull Yellow	Very Fine	Dull Luster
33	Undesirable	Fair, Resistant, Sticky	Fair	Smooth, Very Resistant	Dull Yellow	Very Fine	Dull Luster

butterfat and 10 per cent of dry skim milk is used. It was also noticed that as the fat content increased the cheese became drier. By homogenizing the mix containing a high percentage of butterfat, the fat was changed from a dispersed emulsion phase to a continuous phase, hence the buttery condition existed in the spreading property of the cheese containing 30 and especially 35 per cent butterfat.

The Effect of Variable Increments of Gelatin Upon the Physical Properties of Cream Cheese

Cheese for this study contained 15 per cent of butterfat and 15 per cent of dry skim milk, starter content was held constant at one per cent and the salt content remained the same as in all previous lots. The gelatin content was varied from zero, 0.25 per cent, 0.50 per cent and 0.75 per cent in Lots 1 to 4 respectively.

Tables 48 to 51 inclusive, show that best results were obtained when one-half of one per cent of gelatin of 250 Bloom strength was added to a mix as stated above. There was an insufficient amount of serum solids in the mix containing no gelatin to give the cheese a firm body. This cheese also deteriorated more rapidly than did the cheese containing gelatin, which may be explained by the fact that, with the addition of sufficient gelatin, the gel served as a protecting film around the serum particles, thus retarding the rate of fermentation by the organisms introduced into the mix through the addition of starter.

As the gelatin content was increased, the body of the cheese became smoother with a finer, closer texture, but this improvement reached its optimum in the cheese as represented by Lot 3. This cheese was considered the best of the series, possessing the most desirable body, close texture, excellent slicing properties, good color and spreading properties. However, this cheese when aged

TABLE 48.—THE EFFECT OF NO GELATIN UPON THE PHYSICAL PROPERTIES OF CREAM CHEESE,—LOT I

Age Days	Flavor	Spreading Properties	Slicing Properties	Body	Color	Texture	Appearance
2	Clabber Milk	Poor, Soft, Runs	Poor, Mushy	Weak	Very Pale Cream	Cheese Not "Set-up"	Bright Luster
5	Milky, Mild Acid	Poor	Poor	Weak	Very Pale Cream	Cheese Not "Set-up"	Bright Luster
12	Milky, Mild Acid	Poor	Poor	Weak	Very Pale Cream	Cheese Not "Set-up"	Bright Luster
19	High Acid	Poor	Poor	Weak	Very Pale Cream	Cheese Not "Set-up"	Bright Luster
26	Undesirable	Poor	Poor	Weak	Very Pale Cream	Cheese Not "Set-up"	Bright Luster

TABLE 49.—THE EFFECT OF 0.25 OF ONE PER CENT GELATIN UPON THE PHYSICAL PROPERTIES OF CREAM CHEESE,—LOT 2

Age Days	Flavor	Spreading Properties	Slicing Properties	Body	Color	Texture	Appearance
2	Slightly Sweet	Fair, Soft	Good, Lacks Firmness	Smooth, Weak	Very Light Cream	Very Close	Bright Luster
5	Mild Acid	Fair	Good	Smooth, Weak	Very Light Cream	Very Close	Bright Luster
12	Mild Acid	Fair	Good	Smooth, Weak	Very Light Cream	Very Close	Bright Luster
19	Medium Acid	Good —, More Firm	Good	Smooth, Weak	Very light Cream	Very Close	Bright Luster
26	High Acid	Good —	Good + More Firm	Smooth, Weak	Very light Cream	Very Close	Bright Luster
33	Undesirable	Good, More Firm	Good + + Firmer	Smooth, Weak	Very Light Cream	Very Close	Bright Luster

TABLE 50.—THE EFFECT OF 0.5 OF ONE PER CENT GELATIN UPON THE PHYSICAL PROPERTIES OF CREAM CHEESE,—LOT 3

Age Days	Flavor	Spreading Properties	Slicing Properties	Body	Color	Texture	Appearance
2	Slightly Acid	Good + +	Excellent	Smooth, Medium Resistant	Light Cream	Very Close	Bright Luster
5	Very Mild Acid	Good + Slightly Too Firm	Excellent	Smooth, Medium Resistant	Light Cream	Very Close	Bright Luster
12	Mild Acid	Good, Too Firm	Excellent	Smooth, Resistant	Light Cream	Very Close	Bright Luster
19	Mild Acid	Good	Excellent	Smooth, Resistant	Light Cream	Very Close	Bright Luster
26	High Acid	Good	Excellent	Smooth Resistant	Light Cream	Close Curdled	Bright Luster
33	Undesirable	Good	Excellent	Smooth, Resistant	Light Cream	Close Curdled	Bright Luster

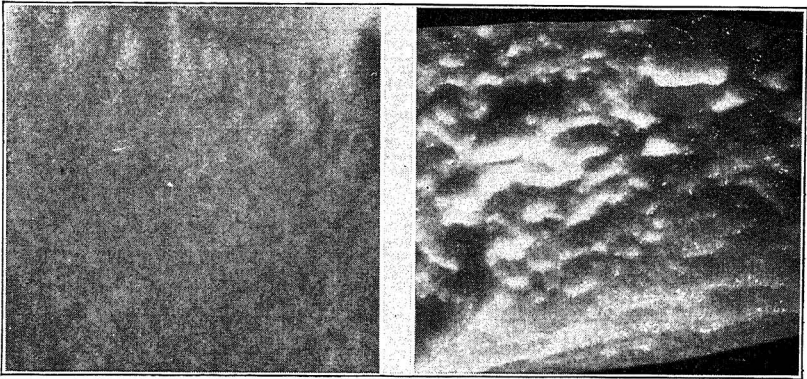
TABLE 51.—THE EFFECT OF 0.75 OF ONE PER CENT GELATIN UPON THE PHYSICAL PROPERTIES OF CREAM CHEESE,—LOT 4

Age Days	Flavor	Spreading Properties	Slicing Properties	Body	Color	Texture	Appearance
2	Sweet	Fair + +, Gelatinous	Excellent	Smooth, Resistant	Light Cream	Close, Curdled	Bright Luster
5	Mild Acid	Fair, Too Firm	Excellent	Smooth, Resistant	Light Cream	Close, Curdled	Bright Luster
12	Sharp Acid Aftertaste	Fair	Fair + +, Too Firm	Smooth Very Resistant	Light Cream	Close, Curdled	Bright Luster
19	Sharp Acid Aftertaste	Fair	Fair + +	Very Resistant	Light Cream	Close Curdled	Bright Luster
26	High Acid	Fair, Spongy	Fair + +	Very Resistant	Light Cream	Close, Curdled	Bright Luster
33	Undesirable	Poor	Fair + +	Very Resistant	Light Cream	Close, Curdled	Bright Luster

became too resistant in body and had a curdled appearance when spread which was undesirable. The proper amount of gelatin to use will depend upon its strength.

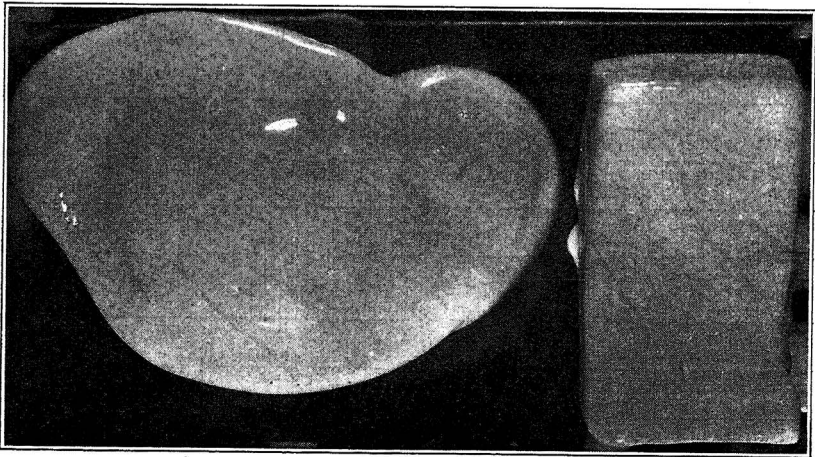
Figure 5 with 3X magnification, shows the increasing rigidity of the cheese and the coarse texture which is due to the higher gelatin content. Figure 5 also shows that the close, fine texture and smooth body of the cheese was most apparent in Lot 3. Lots 1 and 2 were so soft and lacking in rigidity that only a smooth surface exposure was obtainable.

The cheese of Lot 2 showed a marked improvement over Lot 1 and although the amount of gelatin present was not of sufficient



Texture of Cream Cheese Containing
0.5 of One Per Cent Gelatin.

Texture of Cream Cheese Containing
0.75 of One Per Cent Gelatin.



Rigidity of Cream Cheese.

(at left) No Gelatin.

(at right) 0.25 of One Per Cent Gelatin.

Figure 5.—The Effect of Variable Increments of Gelatin Upon the Rigidity and Texture of Cream Cheese.

quantity to produce a firm body, it did act as an emulsifying agent. The gelatin tended to produce a viscous film around the fat globules which kept them from coalescing, thus giving a smoother, homogeneous body.

Lots 4 shows that a high gelatin content results in a cheese that possesses a rather dry, rough body with a coarse texture due to the absorption of part of the serum by the gelatin as shown in Figure 4. The cheese was too resistant to spread, was spongy and had a curdled appearing texture.

The Effect of Different Homogenization Pressures Upon the Physical Properties of Cream Cheese

As all cream cheese made by this method must be homogenized, it is important to know how much pressure must be exerted by the homogenizer or viscolizer to produce the most desirable viscosity and finished product.

Two series of cheese for this study were made. The first series consisted of a mix containing 15 per cent of butterfat and 15 per cent of dry skim milk, with 0.25 per cent gelatin and one per cent starter. Samples of cheese were taken from the homogenizer at 2000, 3000 and 4000 pounds pressure per square inch on the single stage. Results of this series are recorded in Tables 52 to 54 inclusive; Lots 1 to 3 inclusive. The second series differed from the first only in gelatin content. The cheese mix of this series, Lots 4 to 6 inclusive, as shown in Tables 55 to 57 inclusive, contained 0.50 per cent of gelatin.

A comparison of the data, Tables 52 to 54 and Tables 55 to 57 inclusive, show that with low butterfat and solids-not-fat content,

TABLE 52.—THE EFFECT OF HOMOGENIZATION PRESSURE OF 2000 POUNDS UPON THE PHYSICAL PROPERTIES OF CREAM CHEESE,—LOT 1

Age Days	Flavor	Spreading Properties	Slicing Properties	Body	Color	Texture	Appearance
2	Slight Buttermilk	Poor, Very Soft	Poor, Soft	Weak	Pale Cream	Cheese Not "Set-up"	Bright Luster
5	Slight Buttermilk	Poor	Poor	Weak	Pale Cream	Cheese Not "Set-up"	Bright Luster
12	High Acid	Good + Firmer	Good + +, Firmer	Smooth, Weak	Pale Cream	Cheese "Set-up" Close	Bright Luster
19	Sour Acid	Good +	Good + +	Smooth, Weak	Pale Cream	Very Close	Bright Luster
26	Slightly Bitter	Good +	Good + +	Smooth Weak	Pale Cream	Very Close	Bright Luster
33	Undesirable	Good, Lumpy	Good + +	Smooth, Weak	Pale Cream	Very Close	Bright Luster

TABLE 53.—THE EFFECT OF HOMOGENIZATION PRESSURE OF 3000 POUNDS UPON THE PHYSICAL PROPERTIES OF CREAM CHEESE,—LOT 2

Age Days	Flavor	Spreading Properties	Slicing Properties	Body	Color	Texture	Appearance
2	Milky	Poor, Very Soft	Poor,	Weak	Pale Cream	Cheese Not "Set-up"	Bright Luster
5	Milky	Poor	Poor	Weak	Pale Cream	Cheese Not "Set-up"	Bright Luster
12	Milk Acid	Good +, Firmer	Good + +, Firmer	Smooth, Weak	Pale Cream	Cheese "Set-up" Close	Bright Luster
19	Sour Acid	Good + + +, Firmer	Good + +	Smooth, Weak	Pale Cream	Very Close	Bright Luster
26	Undesirable	Good + Soft	Good +, Soft	Smooth, Weak	Pale Cream	Very Close	Bright Luster
33	Undesirable	Good +	Good +	Smooth, Weak	Pale Cream	Very Close	Bright Luster

TABLE 54.—THE EFFECT OF HOMOGENIZATION PRESSURE OF 4000 POUNDS UPON THE PHYSICAL PROPERTIES OF CREAM CHEESE,—LOT 3

Age Days	Flavor	Spreading Properties	Slicing Properties	Body	Color	Texture	Appearance
2	Sweet, Milky	Poor, Very Soft	Poor, Soft	Weak	Pale Cream	Cheese Not "Set-up"	Bright Luster
5	Sweet, Milky	Poor	Poor	Weak	Pale Cream	Cheese Not "Set-up"	Bright Luster
12	Slight Acid	Poor, Soggy	Poor	Weak	Pale Cream	Cheese Not "Set-up"	Bright Luster
19	Medium Acid	Poor	Poor	Weak	Pale Cream	Cheese Not "Set-up"	Bright Luster
26	High Acid	Good -, Firmer	Poor	Weak	Pale Cream	Cheese Not "Set-up"	Bright Luster
33	Undesirable	Good, Firmer	Poor	Medium Résistant	Pale Cream	Cheese "Set-up" Close	Bright Luster

TABLE 55.—THE EFFECT OF HOMOGENIZATION PRESSURE OF 2000 POUNDS UPON THE PHYSICAL PROPERTIES OF CREAM CHEESE,—LOT 4

Age Days	Flavor	Spreading Properties	Slicing Properties	Body	Color	Texture	Appearance
2	Sweet	Poor, Soft	Poor	Weak	Pale Cream	Cheese Not "Set-up"	Bright Luster
5	Sweet	Poor	Poor	Weak	Pale Cream	Cheese Not "Set-up"	Bright Luster
12	Slight Acid	Good + +, Firmer	Good + +, Firmer	Smooth, Medium Résistant	Pale Cream	Very Close	Bright Luster
19	Medium to High Acid	Good + +	Good + +	Smooth, Medium Résistant	Pale Cream	Very Close	Bright Luster
26	High Acid	Good -, Too Firm	Good, Résistant	Résistant	Pale Cream	Very Close	Bright Luster
33	Undesirable	Good -	Good -, Too Firm	Résistant	Pale Cream	Very Close, Curdled	Bright Luster

even though a high homogenization pressure was used, a desirable, firm, close textured cream creese could not be obtained when using only 0.25 per cent gelatin. Higher homogenization pressures produced a firmer cheese. When the gelatin content was increas-

TABLE 56.—THE EFFECT OF HOMOGENIZATION PRESSURE OF 3000 POUNDS UPON THE PHYSICAL PROPERTIES OF CREAM CHEESE,—LOT 5

Age Days	Flavor	Spreading Properties	Slicing Properties	Body	Color	Texture	Appearance
2	Sweet	Poor, Mushy	Poor	Weak	Pale Cream	Cheese Not "Set-up"	Bright Luster
5	Sweet	Fair, Firmer	Fair, Firmer	Weak	Pale Cream	Close	Bright Luster
12	Slight Acid	Good +, Firmer	Good, Firmer	Medium Resistant	Pale Cream	Close	Bright Luster
19	Medium to High Acid	Fair, Too Firm	Good —, Too Firm	Resistant	Pale Cream	Close	Bright Luster
26	High Acid	Fair	Good —	Very Resistant	Pale Cream	Close	Bright Luster
33	Undesirable	Fair	Good	Very Resistant	Pale Cream	Close	Bright Luster

TABLE 57.—THE EFFECT OF HOMOGENIZATION PRESSURE OF 4000 POUNDS UPON THE PHYSICAL PROPERTIES OF CREAM CHEESE,—LOT 6

Age Days	Flavor	Spreading Properties	Slicing Properties	Body	Color	Texture	Appearance
2	Sweet	Fair + + +, Slightly Soft	Fair + + +, Still Soft	Smooth, Weak	Pale Cream	Very Close	Bright Luster
5	Sweet	Fair + + +	Fair + + +	Smooth, Weak	Pale Cream	Very Close	Bright Luster
12	Slight Acid	Good —, Too Resistant	Good, More Firm	Mellow, Medium Resistant	Pale Cream	Very Close	Bright Luster
19	Medium to High Acid	Poor, Very Resistant	Fair, Too Firm	Very Resistant	Pale Cream	Very Close	Bright Luster
26	High Acid	Poor	Fair	Very Resistant	Pale Cream	Very Close, Curdled	Bright Luster
33	Undesirable	Poor	Fair	Very Resistant	Pale Cream	Very Close, Curdled	Bright Luster

ed to 0.50 per cent, the cheese after aging was too resistant to slice and spread well indicating that 0.50 per cent gelatin with a Bloom strength of 250 was too high. The gelatin played a greater part in controlling the firmness of the cheese than did the homogenization pressures.

The high pressures gave a smoother, more resistant and closer texture to the cheese. By increasing the pressure to 4000 pounds a more viscous mix than the one processed at 2000 was obtained. The butterfat particles started clumping soon after homogenization and continued to clump for a considerable period. Extremely high pressures produced a tough, doughy cheese while low pressures gave a weak body, coarse texture and less desirable finished product.

From results obtained in previous studies and the data recorded in Tables 52 to 57 inclusive, it is believed to be more desirable to process the mix at a pressure near 3000 pounds per square inch.

on the single stage homogenizer. This may vary, however, with different homogenizers.

In the first series, the cheese consisted of too low butterfat and gelatin content to give a highly desirable cream cheese; however, it is apparent that the cheese of Lot 53 possessed more desirable slicing and spreading properties than did the cheese of Lots 52 and 54. The cheese of the second series was also too low in butterfat and too high in gelatin content to give a desirable product. Because of the insufficient amount of 1 per cent of starter added, undesirable fermentation occurred thus giving flavors which would not develop if sufficient gelatin, butterfat and slightly more starter had been used in the mix.

The Selection of the Best Cream Cheese Mix to Give the Most Desirable Finished Product

This series of six lots consisted of the most desirable cheese mixes of all previous series.

The cheese mixes were of the following composition:

Lot 1. 15 per cent dry skim milk; 15 per cent butterfat and 0.50 per cent gelatin;

Lot 2. 18 per cent dry skim milk, 15 per cent butterfat and 0.50 per cent gelatin;

Lot 3. 15 per cent dry skim milk, 20 per cent butterfat and 0.40 per cent gelatin;

Lot 4. 18 per cent dry skim milk, 20 per cent butterfat and 0.40 per cent gelatin;

Lot 5. 15 per cent dry skim milk, 25 per cent butterfat and 0.40 per cent gelatin;

Lot. 6. 18 per cent dry skim milk, 25 per cent butterfat and 0.40 per cent gelatin.

Three per cent of starter and 0.75 per cent salt were used in all of the mixes. Each lot was homogenized at 3000 pounds pressure. The results of this series are presented in Table 58 to 63 inclusive.

It was evident that the cheese of Lots 3, 4 and 5 was far superior to Lots 3 and 5. The cheese of Lot 4 possessed excellent slicing and spreading properties, a very desirable body and slightly better keeping quality. Although the cheese became more resistant toward the end of the scoring period, it still was superior to that of other lots.

TABLE 58.—CREAM CHEESE CONTAINING A LOW PERCENTAGE OF BUTTER-FAT AND FIFTEEN PER CENT DRY SKIM MILK,—LOT 1

Age Days	Flavor	Spreading Properties	Slicing Properties	Body	Color	Texture	Appearance
2	Medium Acid	Good +, Little Weak	Good +++	Smooth, Slightly Weak	Pale Cream	Very Close	Bright Luster
5	Medium Acid	Good +	Good +++	Smooth, Slightly Weak	Pale Cream	Very Close	Bright Luster
12	Medium To High Acid	Good -, Curdled, Weak	Excellent Firmer	Smooth, Slightly Weak	Pale Cream	Very Close	Bright Luster
19	Medium To High Acid	Fair, Rough Spread	Good ++, Some Whey	Smooth, Slightly Weak	Pale Cream	Very Close	Bright Luster
26	Medium To High Acid	Fair	Good ++	Smooth, Slightly Weak	Pale Cream	Very Close	Bright Luster
33	Bitter	Fair	Good ++	Smooth, Medium Resistant	Pale Cream	Very Close	Bright Luster
40	Undesirable	Fair	Good ++	Smooth, Medium Resistant	Pale Cream	Very Close	Bright Luster

TABLE 59.—CREAM CHEESE CONTAINING LOW PERCENTAGE OF BUTTER-FAT AND HIGH PERCENTAGE OF DRY SKIM MILK,—LOT 2

Age Days	Flavor	Spreading Properties	Slicing Properties	Body	Color	Texture	Appearance
2	Medium Acid	Good ++ More Firm	Good +, Little Sticky	Smooth, Medium Resistant	Yellow Tint	Very Close	Slight Dull Luster
5	Medium Acid	Good ++	Good, Pasty	Smooth, Medium Resistant	Yellow Tint	Very Close	Slight Dull Luster
12	Medium To High Acid	Good, Sticky	Good	Smooth, Medium Resistant	Yellow Tint	Very Close	Slight Dull Luster
19	High Acid	Good -, Sticky, Resistant	Good -, Pasty, Sticky	Smooth, Resistant	Yellow Tint	Very Close	Slight Dull Luster
26	High Acid	Fair +, More Resistant	Good -	Smooth, Resistant	Yellow Tint	Very Close	Slight Dull Luster
33	Undesirable Aftertaste	Fair +	Good -	Smooth, Resistant	Yellow Tint	Very Close	Slight Dull Luster
40	Undesirable	Fair +	Good -	Smooth, Resistant	Yellow Tint	Very Close	Slight Dull Luster

The cheese of Lots 1 and 2 was much inferior to that of Lot 3 in that it had a curdled appearance when spread due to the low butterfat and high gelatin content. The cheese containing the low butterfat and high percentage of dry skim milk was pasty, sticky and less desirable in color as was the case with the cheese of Lot 6 which had a less desirable appearance, sticky and gummy slicing and spreading properties, and a resistant body. As the data

TABLE 60.—CREAM CHEESE CONTAINING OPTIMUM PERCENTAGE OF BUTTER-FAT AND FIFTEEN PER CENT DRY SKIM MILK,—LOT 3

Age Days	Flavor	Spreading Properties	Slicing Properties	Body	Color	Texture	Appearance
2	Mild To Medium Acid	Excellent	Good + + +	Smooth, Medium Resistant	Light Cream	Very Close	Bright Luster
5	Medium Acid	Excellent	Good + + +	Smooth, Medium Resistant	Light Cream	Very Close	Bright Luster
12	Medium Acid	Excellent	Excellent Firmer	Smooth, Medium Resistant	Light Cream	Very Close	Bright Luster
19	Medium Acid	Excellent	Excellent	Smooth, Medium Resistant	Light Cream	Very Close	Bright Luster
26	High Acid	Good + +, Slightly Sticky	Good + + + Little Sticky	Smooth, Medium Resistant	Light Cream	Very Close	Bright Luster
33	Bitter Aftertaste	Good + +	Good + + Resistant	Smooth, Medium Resistant	Light Cream	Very Close	Bright Luster
40	Undesirable	Good + +	Good + +	Smooth, Medium Resistant	Light Cream	Very Close	Bright Luster

TABLE 61.—AN IDEAL CREAM CHEESE CONTAINING A COMPARATIVELY LOW PERCENTAGE OF BUTTER-FAT AND A HIGH PERCENTAGE OF DRY SKIM MILK,—LOT 4

Age Days	Flavor	Spreading Properties	Slicing Properties	Body	Color	Texture	Appearance
2	Mild Acid	Excellent	Excellent	Smooth, Medium Resistant	Light Cream	Very Close	Slight Dull Luster
5	Medium Acid	Excellent	Excellent	Smooth, Medium Resistant	Light Cream	Very Close	Slight Dull Luster
12	Medium Acid	Excellent	Excellent	Smooth, Medium Resistant	Light Cream	Very Close	Slight Dull Luster
19	Slight High Acid	Excellent	Excellent	Smooth, Medium Resistant	Light Cream	Very Close	Slight Dull Luster
26	Slight High Acid	Excellent	Excellent	Smooth, Medium Resistant	Light Cream	Very Close	Slight Dull Luster
33	Slight High Acid	Excellent	Excellent	Smooth, Slightly Firmer	Light Cream	Very Close	Slight Dull Luster
40	Undesirable	Good + + + Resistant	Good + + + Resistant	Smooth, More Resistant	Light Cream	Very Close	Slight Dull Luster

in previous series show, cheese of low butterfat content and containing 0.40 per cent of gelatin still has an undesirable curdled appearance when spread.

A manufacturer wishing to make sweet cream cheese can select the best mix from the three lots of cheese, Lots 3, 4 and 5, to more nearly meet the conditions under which he is operating.

TABLE 62.—CREAM CHEESE CONTAINING A HIGH PERCENTAGE OF BUTTER-FAT AND FIFTEEN PER CENT DRY SKIM MILK,—LOT 5

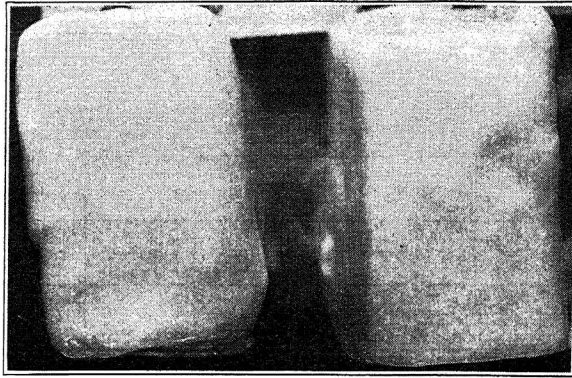
Age Days	Flavor	Spreading Properties	Slicing Properties	Body	Color	Texture	Appearance
2	Sweet	Excellent	Excellent	Smooth, Medium Resistant	Light Cream	Very Close	Bright Luster
5	Mild Acid	Excellent	Excellent	Smooth, Medium Resistant	Light Cream	Very Close	Bright Luster
12	Mild Acid	Excellent	Excellent	Smooth, Medium Resistant	Light Cream	Very Close	Bright Luster
19	Mild Acid	Excellent	Good + + + Little Sticky	Smooth, Medium Resistant	Light Cream	Very Close	Bright Luster
26	Medium Acid	Good + + + Little Too Firm	Good + + Little Too Firm	Smooth, Resistant	Light Cream	Very Close	Bright Luster
33	Slightly Bitter Aftertaste	Good + +, More Resistant	Good + +	Smooth, Resistant	Light Cream	Very Close	Bright Luster
40	Undesirable	Good + +	Good +, Resistant	Smooth, Resistant	Light Cream	Very Close	Bright Luster

TABLE 63.—CREAM CHEESE CONTAINING A HIGH PERCENTAGE OF BUTTER-FAT AND DRY SKIM MILK,—LOT 6

Age Days	Flavor	Spreading Properties	Slicing Properties	Body	Color	Texture	Appearance
2	Sweet Cream	Good -, Resistant	Good +, Little Sticky	Smooth, Gummy	Light Cream	Very Close	Slight Dull Luster
5	Mild Acid	Good -	Good +	Smooth, Gummy	Light Cream	Very Close	Slight Dull Luster
12	Mild Acid	Fair, Resistant, Gummy	Good +	Smooth, Resistant	Light Cream	Very Close	Slight Dull Luster
19	Medium Acid	Fair	Good -, Sticky, Firm	Smooth, Resistant	Light Cream	Very Close	Slight Dull Luster
26	High Acid	Fair	Good -	Smooth, Resistant	Light Cream	Very Close	Slight Dull Luster
33	Undesirable	Fair	Good -	Very Resistant	Light Cream	Very Close	Slight Dull Luster
40	Undesirable	Fair	Good -	Very Resistant	Light Cream	Very Close	Slight Dull Luster

All three of these mixes produce a very desirable finished product when high quality of ingredients are used. With a low supply of butterfat and an adequate supply of high quality dry skim milk, a cheese of 20 per cent butterfat and 18 per cent dry skim milk will be just as desirable if not more desirable than cheese consisting of 25 per cent butterfat and 15 per cent dry skim milk.

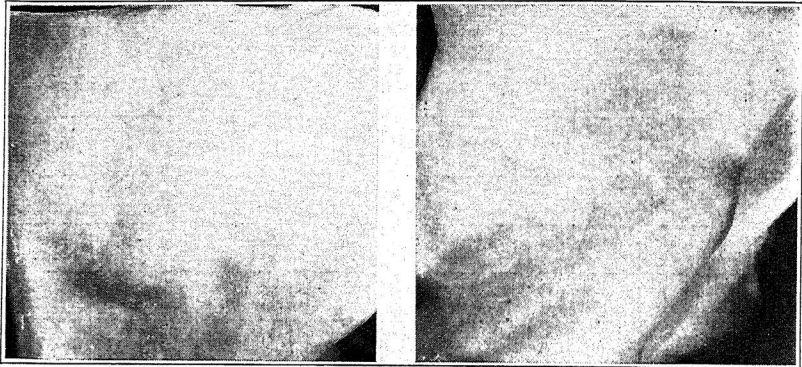
It is important to note that the butterfat content of each individual batch of cheese is calculated to give the specified butterfat content in the finished mix and not the butterfat content of the original cream. The addition of the dry skim milk, starter and other solid ingredients therefore reduced the butterfat content of



Lot 3

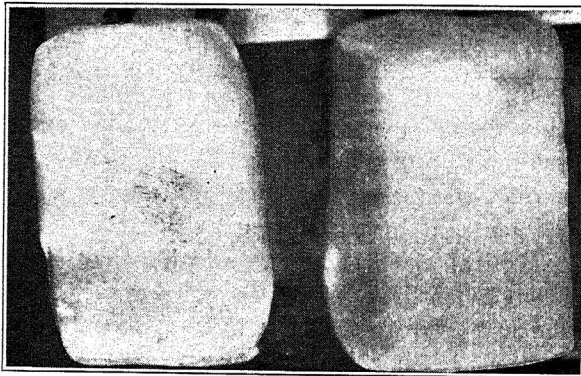
Prior to Exposure.

Lot 4



Lot 3, Showing Texture.

Lot 4, Showing Texture.

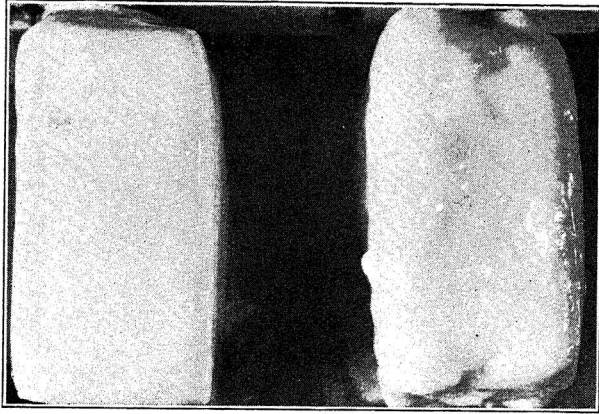


Lot 3

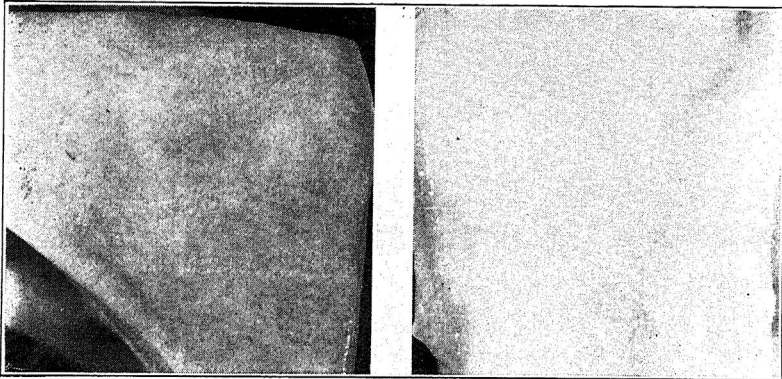
After 30 Minutes Exposure at 80°F.

Lot 4

Figure 6.—The Effect of Temperature on the Stability and Texture of High Quality Cream Cheese.

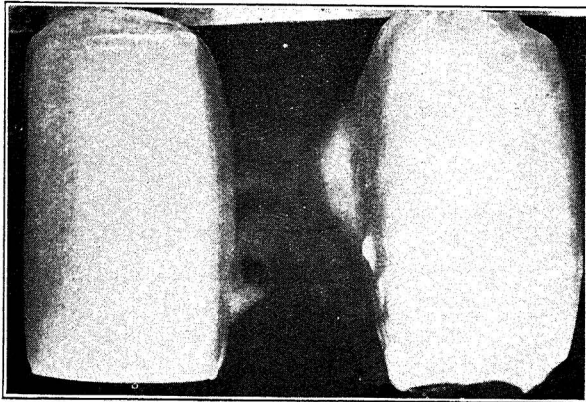


Lot 5 Prior to Exposure. Lot 6



Lot 5, Showing Texture.

Lot 6, Showing Texture.



Lot 5 After 30 Minutes Exposure at 80°F. Lot 6

Figure 7.—The Effect of Temperature on the Stability and Texture of High Quality Cream Cheese.

the original cream used and an allowance for the reduction of fat must be made to give the desired butterfat content in the finished cheese.

Figures 6 and 7 show the texture and rigidity of the cheese from Lots 3, 4, 5 and 6. The specimens prepared for rigidity and stability determinations were subjected to a temperature of 80 degrees Fahrenheit (26.7 degrees Centigrade) for a period of 30 minutes. It is apparent that the texture of the cheese of Lots 3, 4 and 5 is very similar and desirable while that of Lot 6 is more gelatinous or buttery and is considered less desirable. The highly desirable cheese of Lots 3, 4 and 5 was very stable toward heat.

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