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Gelatinated Buttermilk

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Cultured buttermilk, a delicious, palatable and healthful drink, has been proven by extensive use, experimentation and study to be:

1. High in food value.
2. A valuable source of easily digestible protein for the body.
3. A remedial agent in certain intestinal troubles and other diseases.
4. An aid to digestion.

Likewise gelatin, a palatable protein product, has been proven by similar extensive use, experimentation and study to be:

1. High in food value.
2. A sparer of protein in the body.
3. A remedial agent in certain specific intestinal troubles and other diseases.
4. An aid to digestion.

In addition, gelatin possesses the distinct characteristic of being an efficient emulsifying agent and of improving the body, texture and flavor of dairy products in which its use has become general.

It is not unreasonable to assume that a combination of two such desirable foods as gelatin and cultured buttermilk should produce a product of superior qualities.

A survey of opinions appearing in a recent publication (2) leaves the issue somewhat in doubt with health officers siding both pro and con. Those against, base their statements on the fact that aside from the use of gelatin being prohibited by some state laws, it is a product distinctly foreign to buttermilk.

On the other hand, many dairy authorities appear favorable on the assumption of improved food value and increased digestibility. However, disregarding various opinions, both groups closely agree on a requirement for adopting universal labeling of gelatinated buttermilk.

For information on the use of gelatin in buttermilk we must depend largely on a series of experiments by Yaxis (1) from which he drew the following conclusions:

"1. Churn of normal buttermilk will 'whey off,' regardless of whether it had been kept in warm or cold temperature. The addition of 0.25 to 0.5 percent gelatine remedies this 'whey off' condition and produces a smoother drink which is preferred by the consumer.

"2. In artificial buttermilk, where a higher acidity is developed, there is some danger of using too much gelatine. Gelatine, 0.25 per cent, is sufficient to prevent 'wheying off' for five days, provided the product is kept at a temperature of 40 to 45 degrees F.

"3. It was observed that the addition of gelatine to artificial buttermilk

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retarded the development of acidity in the product. This is important from an economic standpoint because most consumers prefer buttermilk with a fairly low amount of acid, about eight per cent."

M. Messcher (2), claiming to have performed a series of experiments, is quoted from a recently published letter as follows:

"I have run several experiments and find that the use of gelatine in buttermilk will be one of the main factors to make the public drink more buttermilk, for the gelatine improves the texture and especially the flavor of the buttermilk.

"I have given samples of buttermilk which contain gelatine to people who never liked buttermilk and after they tasted the gelatine buttermilk they wanted more and wished to know why they cannot buy buttermilk which has as pleasant a flavor. The only answer I could give was that the health department does not allow the use of gelatine in buttermilk.

"If the health departments of big cities would allow the manufacturing of commercial buttermilk containing gelatine, and have the can or package properly labelled, the public would drink more buttermilk; which is now in the flush season of the milk production, run into the sewer by thousands of pounds and is a big loss to creamerymen.

"You take, for example, the ice cream. If the health department would not allow the use of gelatine and sugar in ice cream, which is a daily by-product, what would there be left of the ice cream industry?

"I have made experiments on cultured buttermilk and used gelatine and sugar. This buttermilk was the most pleasant drink and if a milkman would put up a drink of this kind properly labelled, he would sell all of his surplus milk in the form of buttermilk, under a certain trade name, and the health department could not forbid the sale of such product for it will be a pure food and up to the standards of the pure food laws, for edible gelatine or sugar and gelatine added to buttermilk will be an industry, different than the regular creamery and be a separate department, as the ice cream industry is today."

A short time ago the author received a letter from a foreign country indicating a detrimental effect on flavor when gelatine was added to cream in an attempt to make a heavy bodied product. Criticism was offered of an abnormal flavor which investigation proved to be due to the gelatine.

On the basis of such differences of opinion it seemed advisable to conduct more extensive experiments on the use of gelatine in cultured buttermilk to determine:

1. The effect, if any, on flavor.
2. The effect on appearance.
3. The effect on viscosity.
4. The effect on wheying off.
5. The effect on keeping properties.

Experiments Conducted on Gelatinated Commercial Buttermilk

Gelatine used in each series of the experiment was of four grades each of the same brand obtained specifically for this work. According to the manufacturer it was all of fresh run and specified to be standardized as per data recorded in the table of results. Three-tenths per cent (0.3%) was used in each experiment this being the quantity deemed most desirable, all factors considered. The amount was accurately weighed on an analytical balance reading in grams to the third decimal place.

Four different cultures were used and with the exception of the first or preliminary trial, each was tested with the four grades of gelatine thus eliminating possible error due to the use of each culture with but a single sample of gelatine.

Half gallon quantities of fresh skimmed milk were used for each lot of every series this quantity being accurately measured. Each lot was cultured with three per cent culture, measured with a scalded, buttermilk rinsed, ounce measure thus eliminating as far as possible, errors due to variable acidities.

The buttermilk was made after the usual factory manner employing a culturing temperature of 68-72°F. (Oklahoma Agri. Exp. Sta. Bul. 156).

Since occasional criticism has occurred regarding the method of adding gelatine to dairy products and the probable effect on quality and texture, it was decided to attempt elimination of this factor by the following procedure:

1. To Lot I each series granulated gelatine was added and the milk heated to 190° F. while continually agitated. It was then cooled immediately to 68° F. and cultured.
2. To Lot II gelatine was added after the milk had been heated and then cooled to 135° F. the gelatine in this case being dissolved in a portion of the milk at a temperature not to exceed 140° F. This procedure eliminated a possible high temperature injury to the gelatine. The batch was then cooled to 68° F. and cultured.
3. To Lot III gelatine was added after the buttermilk had been prepared and broken up. In this case the gelatine was dissolved in one-fourth pint of water at not to exceed 140° F. and added with thorough but not too vigorous stirring.
4. Lot IV, or the control, contained no gelatine.

DISCUSSION OF RESULTS

Acidity

The acidity of each lot was determined in duplicate by weighing nine gram samples into a beaker and titrating this against tenth normal alkali which had been originally standardized with fourteenth normal acid using methyl red as indicator. At the conclusion of the experiment the alkali was again standardized and found to be unchanged. Titrations were then made using the indicator, phenolphthalein. A conversion factor was calculated and the acidities changed into terms representing the use of phenolphthalein as is customary in milk plants. The above standardization which yielded a more dilute alkali resulted in titrations which were believed to be more accurate than if phenolphthalein had been originally employed.

Using data obtained, the following acidity tables were prepared.

TABLE I

Percent Acidity of the Four Different Grades of Gelatine Averaged Separately

Lot	Sample	Gelatine Grade			
		1	2	3	4
1	Gelatine added before heating	.868	.856	.846	.890
2	Gelatine added after cooling to 135	.858	.872	.834	.882
3	Gelatine added after making	.846	.816	.804	.850
4	Control	.880	.824	.806	.880

An examination of Table I shows:

1. No noticeable reduction of acidity due to the use of gelatine. In six cases the sample containing no gelatine was higher in acid and in six cases lower than the lots containing gelatine.

Continuing a study of acid development Table II was arranged showing the average per cent of acid when the various lots of each series were averaged disregarding the grade of gelatine used.

TABLE II

Average Per Cent Acidity of Various Lots of Each Series Disregarding the Grade of Gelatine Used

Culture	Series	LOTS			
		Gelatine added before heating	Gelatine added after cooling to 135° F.	Gelatine added after making	Control
A	1	.822	.810	.784	.782
B	2	.872	.878	.824	.854
C	3	.864	.866	.822	.854
D	4	.902	.892	.886	.90
General Average		.865	.8615	.829	.8475

A study of the table reveals the following facts:

1. In the various lots of each series the acidity is fairly uniform although considerable variation occurs between the different series. This is to be expected since different cultures were used. Other unavoidable factors may enter.

2. There appears to be no direct relation between the acidity of the samples containing gelatine and the control. In many cases the acidity of the gelatinated buttermilk was higher than that of the control. This fact brought out by tabulation of the sixty four different tests does not agree with the findings of Yaxis who reports on two samples a retarding effect of gelatine on acid development.

However, there is possibility of the acidity of gelatine having affected the results obtained. This is doubtful considering the small quantity used. In view of the sixty four tests tabulated in Tables I and II and the additional sixteen preliminary tests the conclusion is warranted that gelatine added in such small quantities as .3% did not bear a direct relation to the development of titrateable acidity in buttermilk when produced under conditions here reported. As a matter of fact, the grand average acidity of all samples of gelatinated buttermilk was .8518% as compared with .8475% for the control, a variation of .0043%, too slight to be detected by ordinary titrations for acidity.

Viscosity

The viscosity was determined as follows:

A clean piece of plate glass was set at an angle of 23°-40' and upon its surface were scratched two lines at a distance of twelve inches apart. A definite amount (2 cc) of the buttermilk was run onto the glass at the first mark and the time taken in seconds required for it to run to the second mark. If the product failed to flow from one mark to the other it was marked with the notation "too viscous" as per the tabulated results.

TABLE III

Viscosity of the Samples Containing the Different Grades of Gelatine

Series	Grade of Gelatine	Gelatine Added Before Heating		Gelatine Added After Cooling to 135° F.		Gelatine Added After Making		Control	
		Immediately After Breaking	After 24 Hours Storage	Immediately After Breaking	After 24 Hours Storage	Immediately After Breaking	After 24 Hours Storage	Immediately After Breaking	After 24 Hours Storage
1	1	250 190 264 145	278 300 Too viscous 305	172 105 710 75	417 120 Too viscous 160	98 74 116 65	185 135 408 150	165 75 143 90	152 105 187 100
2	2	Too viscous Too viscous Too viscous Too viscous	Too viscous Too viscous Too viscous Too viscous	Too viscous Too viscous Too viscous Too viscous	Too viscous Too viscous Too viscous Too viscous	Too viscous 80 Too viscous 140	Too viscous Too viscous Too viscous Too viscous	Too viscous Too viscous Too viscous Too viscous	Too viscous Too viscous Too viscous Too viscous
3	3	Too viscous 140 Too viscous 145	Too viscous Too viscous Too viscous Too viscous	130 Too viscous 130 Too viscous	Too viscous Too viscous 75 Too viscous	Too viscous 70 Too viscous 120	Too viscous Too viscous Too viscous Too viscous	Too viscous 110 Too viscous 300	Too viscous Too viscous Too viscous Too viscous
4	4	105 Too viscous 188 Too viscous	285 Too viscous 630 Too viscous	270 Too viscous 14 Too viscous	Too viscous Too viscous 75 Too viscous	255 360 188 240	Too viscous Too viscous 440 Too viscous	255 Too viscous Too viscous Too viscous	Too viscous Too viscous Too viscous Too viscous
Preliminary		33 111 197 130		22 170 118 150		155 Too viscous 38 350	308 20 140	70 216 311 163	

A study of the table shows:

1. A great variation in viscosity between different lots of the same series. This may be due to a number of factors such as bacteriological differences in the cultures and in the amounts of each used. the method of treatment, breaking up the curd, grades of gelatine, etc.

2. That the viscosity of the samples taken immediately upon breaking at the setting temperature is relatively low. After holding for 24 hours at 48° F. the viscosity of both the control and the gelatinated samples is greatly increased.

3. That the viscosity of the gelatinated samples after 24 hours storage was greater than that of the controls. This is especially well demonstrated by the results obtained in Series I. Although not figuratively represented in Series II, III and IV, the observation was made that the samples containing no gelatine generally flowed a greater distance over the glass plate than the gelatinated samples although both may have failed to reach the twelve inch mark and accordingly received the same notation of "too viscous." The conclusion is therefore warranted that the addition of gelatine increased the viscosity of cultured. buttermilk.

Breaking and Strength

In each series except the preliminary all lots were prepared in the same type and size container, thus eliminating any variation due to these factors. No especial effort was made to determine this data other than by ordinary observation. The strength was obtained by pressing on the surface and forcing a milk agitator through the curd while the east of breaking up was estimated by occular examination while agitating. Results are given in terms of numbers, 1 being the firmest and hardest to break while 3 indicates that which broke up the easiest.

An examination of the general tables indicates a variable difference, although as a rule the gelatinated samples broke up the easiest and the curd appeared softer. This is to be expected in view of the action of gelatine in preventing the formation of large curd particles in sour milk.

Wheying Off

With the exception of the preliminary series wheying off tests were made by placing quarter pint bottles of the control and gelatinated buttermilk in the storage room at a temperature of 48° F. Daily observations were made. In the preliminary test a second set of quarter pint bottles were placed in the laboratory at variable room temperatures and observations made.

An examination of the tables reveales the fact that gelatine prevents or retards wheying off. Attention should be called to the similarity in many cases between Lot 2 and the control. Close examination of the gelatinated buttermilk from Lot 2 showed that in some cases gelatine was not dissolved as thoroughly as expected although great care was used in attempting to affect complete solution. Had the gelatine been dissolved in water as was the case with Lot 3, complete observation on its solubility would have been possible and undoubtedly more effective results would have been obtained. However, a study of the tables show that:

1. Good quality buttermilk which will not whey off can be prepared without the use of gelatine. As a matter of fact, three pint bottles of the control from Series 2, 3 and 4 were set away at variable room temperatures for ten days and failed to whey off or show any signs of whey separation.

2. Gelatine prevents wheying off in buttermilk which without it might show this defect.

Effect on Flavor

As compared with the control samples, the gelatinated product showed a slight alteration in flavor.

After preparation, the buttermilk was judged by persons who were unfamiliar with the method of labeling the samples. The buttermilk was then placed in the ice box at 48° F. for 24 hours and again sampled. In all cases no less than two judges and frequently from five to seven sampled the product. Where a possible doubt might occur, a tie was given the placing. Unless otherwise marked, the figures represent an unquestioned ranking of first, second, third or fourth place.

A study of the tables show the control sample to have been placed first, nineteen times; seconod, eight times; third, once. It tied for a first, second, third or fourth place eight times. The sample to which gelatine was added after making, placed first three times; second, six times; third, twelve times and fourth, nine times, with four ties for third and fourth places. The sample to which gelatin was added after heating ranked first four times; second, seven imes; third, eight times and fourth thirteen times, with no ties. The sample to which gelatin was added before heating placed first five times; second, nine times; third, eight times and fourth eight times, with four ties for first, second and third places, the ties being equally distributed between these placings.

A summary of these results is shown in Table IV.

The general average of all placings on flavor shows the control sample to have placed first almost four times as often as any one of the gelatinated samples.

In all fairness to the gelatinated samples notation should be made that while the average consumer probably would fail to note the flavor variation when sampling only the gelatinated product he did observe the distinction when the control in comparison was likewise sampled, as brought out in the table of results.

A number of samples were set away for periods longer than 24 hours and then tasted for flavor with the resulting observation that the longer the gelatinated samples were held over the 24 hour storage period the greater the distinction between them and the control.

These results are contrary to what had been expected and may have been due to a number of factors of chemical, physical or bacteriological nature which yet remain to be solved. However, under the conditions of this experiment the conclusion must be drawn that gelatine produces a slight alteration of flavor.

TABLE IV
General Summary of Placings on Flavor

Sample	RANKING OF SAMPLES												SUMMARY			
	First Place			Second Place			Third Place			Fourth Place			Total Unquestioned Placings			
	Old	Fresh	Tie	Old	Fresh	Tie	Old	Fresh	Tie	Old	Fresh	Tie	1sts	2nds	3rds	4ths
Control	9	10	1	4	4	2	1	0	3	0	0	2	19	8	1	0
Gelatine added after making	2	1	0	4	2	0	3	9	2	6	3	2	3	6	12	9
Gelatine added after heating	2	2	0	5	2	0	4	4	0	5	8	0	4	7	8	13
Gelatine added before heating	2	3	1	2	7	2	6	2	1	5	3	0	5	9	8	8

SUMMARY

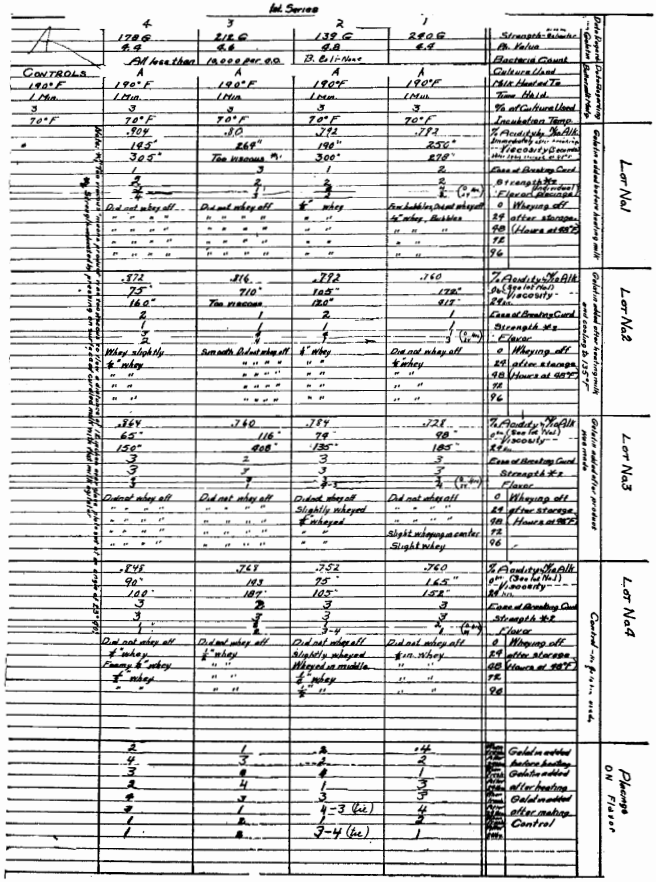
From the results obtained the following conclusions are warranted:

1. Gelatine added to cultured buttermilk before or after making increases the viscosity of the product.
2. Gelatine added to buttermilk before or after making prevents or retards wheying off.
3. No noticeable effect on acidity was observed that might be attributed to the gelatine. Variations were probably due to some other factors such as bacteriological or cultural differences.
4. In the majority of cases the addition of 0.3% of gelatine produced an alteration in the flavor of cultured buttermilk.
5. The longer the gelatinated samples are stored over 24 hours the greater becomes the variation between their flavor and that of the control.

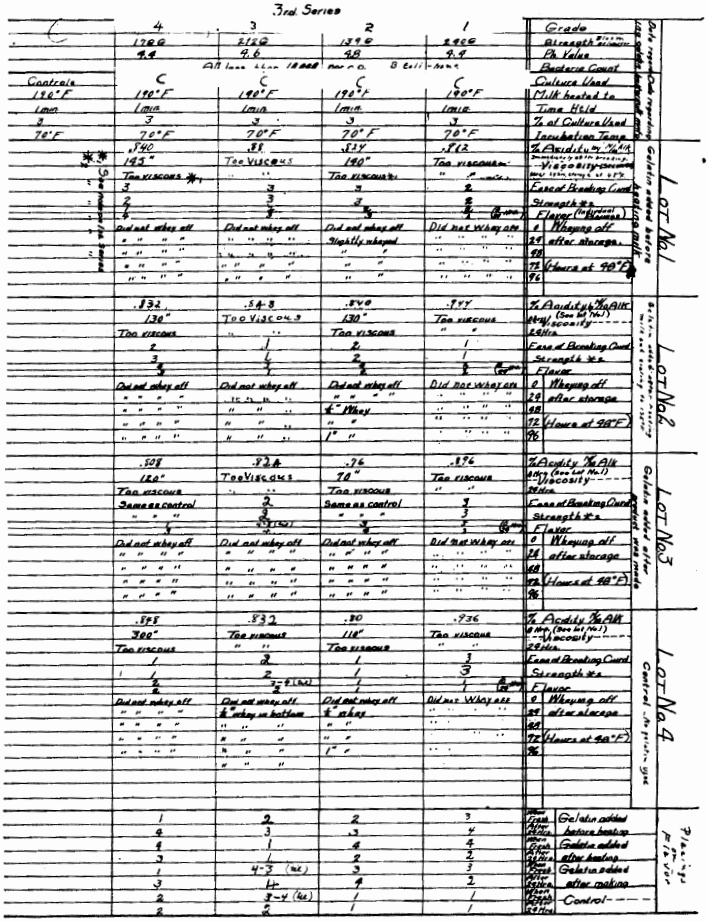
BIBLIOGRAPHY

1. The use of Gelatin in Buttermilk; Milk Dealer, July, 1925; T. G. Yaxis.
2. The Use of Gelatin in Buttermilk; Milk Dealer, February, 1927; M. Messcher.

APPENDIX




2nd Series
Lot No 1
Lot No 2
Lot No 3
Lot No 4
Control
Grade
Strength
Ph Value
Bacteria Count
Culture Used
Milk heated to
Time Held
% of Culture Used
Incubation Temp
Acidity % Alk
Viscosity
Ease of Breaking Curd
Strength
Flavor
Whey off
after storage
Hours at 98°F
Gelatin added before heating
Gelatin added after heating
Gelatin added after making
Control


3rd Series
Lot No 1
Lot No 2
Lot No 3
Lot No 4
Control

4th Series

Controls	4	3	2	1	Item	
	4	3	2	1	Grade	Data regarding gelatin
	178 G	212 G	139 G	240 G	Strength (Bloom gelometer)	
	4.9	4.6	4.8	4.4	Ph Value	
		All less than	10,000 per cc.	B. Coli None	Bacteria Count	
Controls	D	D	D	D	Culture Used	Data regarding Buttermilk Making
190°F	190°F	190°F	190°F	190°F	Milk Heated to	
1 min	1 min.	1 min.	1 min.	1 min	Time Held	
3	3	3	3	3	% Culture Used	
70°F	70°F	70°F	70°F	70°F	Incubation Temp.	
	.912	.888	.92	.888	% Acidity by % Alk.	LOT No. 1 — Gelatin added before heating milk
*1 See note on 1st Series	Too viscous *1	188"	Too viscous	105"	Viscosity (Seconds) Immediately after breaking	
*2 "	" "	630"	" "	285"	Viscosity after 24 hrs. storage at 48°F.	
"	1	3	1	3	Ease of Breaking Curd	
"	1	1	1	3	Strength *2	
"	4 / 3	2 / [illegible]	4 / 3	2 / 4	Flavor (Individual / Placings)	
"	Did not whey off	Did not whey off	Did not whey off	Did not whey off	0 Wheying off	
"	" " " "	Slightly wheyed Bubbles	" " " "	" " " "	24 after storage	
"	" " " "	¼" Whey Badly Bubbled	" " " "	" " " "	48	
"	" " " "	" " " "	" " " "	" " " "	72 (Hours at 48°F)	
	" " " "	" " " "	" " " "	" " " "	96	
	.912	.872	.936	.848	% Acidity N/10 Alk	LOT No. 2 — Gelatin added after heating milk and cooling to 135°F
	Too viscous	11"	Too viscous	230"	Viscosity 0 Hrs. (See Lot No. 1)	
	" "	75"	" "	Too viscous	Viscosity 24 Hrs.	
	2	2	2	1	Ease of Breaking Curd	
	2	3	2	1	Strength *2	
	2 / 4	[illegible]	2 / 4	3 / 2	Flavor	
	Did not whey off	Did not whey off	Did not whey off	Did not whey off	0 Wheying off	
	" " " "	Air Bubbles	" " " "	" " " "	24 after storage	
	" " " "	" " " "	" " " "	" " " "	48	
	" " " "	" " " "	" " " "	" " " "	72 (Hours at 48°F)	
	" " " "	" " " "	" " " "	" " " "	96	
	.896	.848	.92	.88	% Acidity N/10 Alk	LOT No. 3 — Gelatin added after product was made
	240"	189"	360"	255"	Viscosity 0 Hrs. (See Lot No. 1)	
	Too viscous	440"	Too [illegible]	Too viscous	Viscosity 24 Hrs.	
	3	1	2	2	Ease of Breaking Curd	
	3	2	2	2	Strength *2	
	3 / 4	1 / 1	2 / 2	4 / 3	Flavor	
	Did not whey off	Did not whey off	Did not whey off	Did not whey off	0 Wheying off	
	" " " "	Air Bubbles"	" " " "	" " " "	24 after storage	
	" " " "	" " " "	" " " "	" " " "	48	
	" " " "	" " " "	" " " "	" " " "	72 (Hours at 48°F)	
	" " " "	" " " "	" " " "	" " " "	96	
	.912	.824	.920	.944	% Acidity N/10 Alk	LOT No. 4 — Control — no gelatin used
	Too viscous	Too viscous	Too viscous	255"	Viscosity 0 Hrs. (See Lot No. 1)	
	" "	" "	" "	Too viscous	Viscosity 24 Hrs.	
	3	1	2	2	Ease of Breaking Curd	
	3	2	2	2	Strength *2	
	1 / 1	1 / 2-3	1 / 1	1 / 1	Flavor	
	Did not whey off	Did not whey off	Did not whey off	Did not whey off	0 Wheying off	
	" " " "	⅛" whey in bottom	" " " "	" " " "	24 after storage	
	" " " "	⅛ " " "	" " " "	" " " "	48 (Hours at 48°F)	
	" " " "	" " " "	" " " "	" " " "	72	
	" " " "	3/16 " " "	" " " "	" " " "	96	
	4	2	4	2	When Fresh — Gelatin added before heating	Placings on Flavor
	3	3-2 (tie)	3	4	After 24 Hrs. — Gelatin added before heating	
	2	4	3	3	When Fresh — Gelatin added after heating	
	4	4	4	2	After 24 Hrs. — Gelatin added after heating	
	3	3	2	4	When Fresh — Gelatin added after making	
	2	1	2	3	After 24 Hrs. — Gelatin added after making	
	1	1	1	1	When Fresh — Control	
	1	2-3 (tie)	1	1	After 24 Hrs. — Control	

O Series

Section	Item	Controls	4	3	2	1
Data Regarding Gelatin	Grade		4	3	2	1
	Strength -- Bloom Gelometer		178	212 G	139 G	240 G
	Ph. Value		4.4	4.6	4.8	4.4
	Bacteria Count			All less than 10,000 per cc.	B Coli - None	
Data regarding Buttermilk Mfg.	Culture Used	Controls	E	C	A	D
	Milk Heated to	190°F	190°F	190F	190°F	190°F
	Time Held	1 min	1 min	1 min	1 min	1 min
	% Culture Used	3	3	3	3	3
	Incubation Temp.	70°F	70°F	70°F	70°F	70°F
Lot No. 1 — Gelatin added before heating milk	% Acidity by N/10 Alk		.912 %	.96 %	.96 %	.72 %
	Viscosity (seconds) Immediately after breaking		130"	197"	111"	33"
	Ease of breaking curd		2	2	1	2
	Strength *2		2	2	1	2
	Flavor		Badly off	Slightly flat, High acid	Fair, High acid	Flat, Foamy
	Wheying off after storage (Hours at 48°F): 24		Few bubbles on top, no whey	No whey	Few bubbles on top, no whey	¼" whey on bottom
	72		No change	No change	No change	No change
	6 Days		"	"	"	"
	9 Days		"	"	"	"
PRELIMINARY Lot No. 2 — Gelatin added after heating milk and cooling to 135°F	% Acidity by N/10 Alk		.912%	.952%	.976 %	.80 %
	Viscosity (in seconds) when fresh		150"	118"	170"	22"
	Ease of breaking curd		3	3	2	3
	Strength *2		3	3	2	3
	Flavor		Badly off	Slightly flat	Slightly metallic, high acid	Flat, Foamy
	Wheying off after storage (Hours at 48°F): 24		No whey	No whey	Slightly foamy, no whey	Ragged curd, Wheyed off ¼" on bottom
	72		No change	No change	Slight breaking on bottom	No change
	6 Days		"	"	No change	"
	9 Days		"	"	"	"
TEST Lot No. 3 — Gelatin added after product was made	% Acidity by N/10 Alk.		.984 %	.984%	.96 %	.816 %
	Viscosity at 48°F after 24 Hours Storage		350	38"	Too viscous *1	155"
	Viscosity after storage at 48°F followed by warming…		190	20	308	Not taken
	Ease of breaking curd		1	1	3	1
	Strength *2		1	1	3	1
	Flavor		High acid, metallic poor quality	Fair, High acid	Slightly watery, thin, high acid	Not taken
	Wheying off after storage (Hours at 48°F): 24		No whey	No whey	No whey	Few bubbles on top, no whey
	72		No change	No change	No change	No change
	6 Days		"	"	"	"
	9 Days		"	"	"	"
Lot No. 4 — Control - No gelatin used	Acidity		.92 %	.904 %	Lost	.76 %
	Viscosity (in seconds) when fresh		163	311"	216"	70"
	Ease of breaking curd		1	1	3	1
	Strength *2		1	1	3	1
	Flavor		High acid, Fair	High acid, Good	High acid, Good	Mild
	Wheying off after storage (Hours at 48°F): 24		¼" whey in middle	No whey	No whey	Ragged Curd, Wheyed off ⅛" in middle
	72		No change	Indications of breaking	Slight breaking on bottom	Wheyed off 1" on bottom
	6 Days		"	Wheying in center, slight	Wheying off on bottom	" " 1½ " "
	9 Days		¾" whey in middle	¼" whey	¼" whey on bottom	" " 1⅛ in middle

Note: *1 "Too viscous" means the product was too viscous to flow a distance of 18 inches over glass plate set at an angle of 23°-40'.
*2 Strength indicated by pressing on surface of curdled milk with flat milk agitator.