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Bulletin B-555
June 1960

***Consumer
Preference
Studies
on***

**Cottage
Cheese**

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C O N T E N T S

Review of Literature	5
Experimental Procedure	6
Preparation of Samples	6
Makeup of Taste Panels	8
Procedure for Taste Testing	8
How Consumer Scores Were Calculated	8
Results and Discussion	9
Salt Content	9
Rate of Creaming	11
Size of Curd	16
pH (Acidity)	17
Consumer Opinions on Cottage Cheese	19
Summary and Conclusions	21
Literature Cited	23

Consumer Preference Studies on Cottage Cheese

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Cottage cheese currently on the market varies considerably due to differences in opinions regarding the characteristics most desired by the consuming public. Aside from keeping quality, these differences primarily involve variations in the salt content, amount of cream or dressing added, acidity (or pH), and size of curd particles. All of these factors are rather easily controlled by varying the manufacturing procedures. Salt content and pH influence the keeping quality.

Since there appears to be very little information on the consumer preferences for the various characteristics of cottage cheese, the study herein was undertaken. The results may be of value as a guide to manufacturers in making cottage cheese that is more acceptable to the majority of the consumers.

Review of Literature

Information taken from three United States Department of Agriculture reports (5) shows that during the period from 1910 to 1919 only 0.7 pounds of cottage cheese was consumed per person per year, compared to 4.4 pounds per person in their preliminary survey of 1955. The consumption per person of cottage cheese has increased gradually since 1919 with a yearly increase of only 0.1 pound per person from 1952 to 1955.

The research reported herein was done under Oklahoma Agricultural Experiment Station Project 1015.

The American Dairy Association (1) study by Alfred Politz, Inc. reports on public attitudes and uses of dairy products. These surveys each covered approximately 4,000 interviews in 550 localities throughout the United States. They reported (1955) that cottage cheese is eaten by more women than men, more older people than young, and more dieters than non-dieters. They also stated that cottage cheese does not compete with milk drinking, and that members of the upper socio-economic levels consume more of the cheese and milk than those of the lower levels. In a later study (1956) they found that 74% of all households used cottage cheese but that only 22% had cottage cheese in the home at the time of the interview. The opinions on why people eat cottage cheese indicated the principal reasons were because it tastes good, is nourishing, and is low in calories. Other reasons were: High in protein, easy to prepare, and economical. A further study (1957) showed that the usage of cottage cheese increased during Lent. Sixteen percent of the housewives served cottage cheese on an average day during this period.

Blakley, McMullin, and Boggs (2) interviewed a random 1 percent of the Oklahoma City population in a dairy products and services survey. The study showed that of the 821 households interviewed, 57.1% used cottage cheese during the seven-day period prior to the interview. The per family cottage cheese consumption of these families was 19 ounces each week.

Dean, Davis, and Laity (3) reported a survey of marketing and family use of dairy products conducted with 750 families in Danville, Virginia. The average consumption per week per family was 0.01 pounds of cottage cheese.

Harmon, Trout and Bonner (6) made a survey of some characteristics influencing consumer acceptance and shelf life of cottage cheese. Data obtained in this survey revealed that shelf-life of cottage cheese might be extended by closer supervision of manufacturing, refrigeration, and low-temperature storage.

Experimental Procedure

Preparation of Samples

The cottage cheese used in this study was made in the Oklahoma State University dairy plant from fresh skimmed milk fortified with approximately 1% of low-heat milk solids-not-fat. The milk was pas-

teurized at 143° F. for 30 minutes, cooled to 90° F. and inoculated with 5% of a fresh, active lactic culture. Commercial coagulator equivalent to approximately 1 ml. of rennet extract per 1000 pounds of milk was used to assist coagulation. The curd normally was cut with 3/8-inch knives in about 4½ hours at a whey acidity of 0.5%. The curd was cooked to a temperature of 120°F., drained, and washed in the usual way.

Variations in the salt content were obtained by adding the calculated amounts of salt to the creaming mixture and dissolving completely before adding the mixture to the cheese. The salt concentrations in the finished cheese were verified by direct titration with mercuric nitrate (7).

The rate of creaming was calculated as the percentage by weight of the drained curd; i.e. 30% = 30 pounds of creaming mixture added to 100 pounds of curd. The creaming mixtures were made from 18% cream and 32 to 40% cream in such proportions that the fat content on each lot of finished cheese was 4.1%. The curd was allowed contact with the cream for several hours—usually overnight—to allow for absorption of the cream by the curd, and the samples then were submitted to consumer preference tests.

Variation in size of curd was obtained by using ¼-, ⅜-, and ⅝-inch knives for cutting.

Variation in pH was obtained by variations in cutting acidity and amount of washing, and by adjusting the pH of the creaming mixture with 50% aqueous citric acid. The cutting acidities ranged from as low as practical for satisfactory cutting to as high as practical. The range was generally from 0.47% to 0.60% on the whey. The lots for the highest pH were washed 4 or 5 times; the lowest only twice.

The amount of added citric acid necessary to reduce pH of the creaming mixture to estimated levels was determined by running the pH on small lots of the cream with various amounts of 50% aqueous citric acid added. The pH values on the finished cheese were determined with a Beckman Model H-2 pH meter and glass electrode.

No sample was over three days old when examined by the respondents. The samples were transported in insulated containers and were under constant refrigeration, so that deterioration between preparation and examination was nil.

Makeup of Taste Panels

Several groups of respondents were used to evaluate the samples. Semi-trained taste panels were composed of members of the staff and advanced students of the Food, Nutrition and Institution Administration and the Department of Dairying at Oklahoma State University.

A second group of respondents was composed of dairymen attending a dairy meeting on the campus at Oklahoma State university. These were selected at random as they appeared in the lobby of the meeting place.

A third group of respondents was selected at random from shoppers in food stores in Tulsa, Oklahoma. In addition these respondents were asked their opinions concerning the quality of cottage cheese they had been purchasing. This information is found under the heading "Consumers' Opinions on Cottage Cheese."

Procedure for Taste Testing

Each participant in the preference study was given a paper plate on which about a tablespoonful of each sample had been placed. The samples were identified only by a random number. The participants were asked to check on a data sheet the term that most nearly described their reaction to each sample: Too low, slightly low, just right, slightly high, or too high. Curd size was characterized as too small, just right, too large, etc. In most of the trials with the semi-trained panels, a second set of samples, of the same lots of cheese but differently numbered was used, giving two observations on each sample.

With the remaining groups of respondents, the interviewers recorded the data on the observations and the answers to the questions on the data sheets.

How Consumer Scores Were Calculated

In order to obtain a preference rating for the samples, a consumer preference rating was calculated from the following values for the descriptive terms used on the data sheets: Two low=1; slightly low=2; just right=3; slightly high=2; and too high=1. As an additional criterion of consumer preference, the number and percentage of respondents choosing each of the five descriptive terms were calculated.

In trials where only three samples were employed and the con-

sumers ranked the samples, a value of 3 was given for first place, 2 for second, and 1 for third.

Methods applicable only to particular tests are described below.

Results and Discussion

Salt Content

Preliminary Test. A preliminary test with a semi-trained taste panel was run to determine the approximate levels of salt preferred by the respondents. In this trial there were 21 participants, each making observations of duplicate sets of 4 samples ranging from 0.6 to 2.0% salt. The data are shown in Table I.

Table 1.—Preference for Salt Content, Semi-trained Taste Panel of 21 Participants, Duplicate Samples.

Taste Classification	0.6%		Salt Content 1.0%		1.5%		2.0%	
	No.	%	No.	%	No.	%	No.	%
Too Low	35	83.3	4	9.5	0	---	0	---
Sl. low	6	14.3	23	54.8	3	7.1	1	2.4
Just right	1	2.4	13	31.0	17	40.5	3	7.1
Sl. high	0	---	1	2.4	22	52.4	19	45.2
Too high	0	---	1	2.4	0	---	19	45.2
Total	42	100.0	42	100.0	42	100.0	42	99.9
Score*		50		92		101		68
Rank		4		2		1		3

* See methods for calculation of consumer's score.

The cheese most acceptable to the panelists had 1.5% salt, with the highest number of "just right" opinions (40.5%), while the cheese with 1.0% salt had 31.0%.

Semi-trained Test Panels. Two additional trials were run with semi-trained taste panels on salt preference, using concentration of 0.75% to 1.75%, inclusive. These tests were made two months apart, and in each trial duplicate samples were used. In the first of these trials there were 34 participants used, in the second there were 8, for a total of 42. With duplicate samples the total observations numbered 84. The results were calculated separately but since the two sets of data indicated the same trend in preferences, they were combined and are presented in Table II.

The results show that the cottage cheese with 1.25% salt had the highest rating, with 1.0% salt ranked second and 1.5% salt ranked

Table II.—Preference for Salt Content, Semi-trained Taste Panel and Attendants at Dairy Meeting.

Taste Classification	Salt Content									
	0.75%		1.0%		1.25%		1.50%		1.75%	
	No.	%	No.	%	No.	%	No.	%	No.	%
Semi-trained taste panel, 42 participants (duplicate samples)										
Too low	44	52.4	14	16.7	1	1.2	0	---	1	1.2
Sl. low	28	33.3	31	36.9	9	10.7	3	3.6	3	3.6
Just right	12	14.3	25	29.8	40	47.6	12	14.3	5	6.0
Sl. high	0	---	10	11.9	26	31.0	45	53.6	30	35.7
Too high	0	---	4	4.8	8	9.5	24	28.6	45	53.6
Total	84	100.0	84	100.1	84	100.0	84	100.1	84	100.1
Score	136		175		199		156		127	
Rank	4		2		1		3		5	
Attendants at dairy meeting, 64 participants										
Too low	37	57.8	10	15.6	6	9.4	1	1.6	4	6.3
Sl. low	15	23.4	24	37.5	14	21.9	7	10.9	7	10.9
Just right	10	15.6	23	35.9	24	37.5	22	34.4	6	9.4
Sl. high	1	1.6	6	9.4	18	28.1	28	43.8	19	29.7
Too high	1	1.6	1	1.6	2	3.1	6	9.4	28	43.8
Total	64	100.0	64	100.0	64	100.0	64	100.1	64	100.1
Score	90		140		144		143		111	
Rank	5		3		1		2		4	

third. A salt content of 0.75% was termed "too low" or "slightly low" by 87.5% of the panelists, and a salt content of 1.75% was "too high or "slightly high" by 89.3%.

Dairy Meeting Tests. A third set of data on salt preferences was collected from adults attending a dairy meeting. Most of these were men and were selected at random as they appeared prior to the meeting. There were five samples of cheese containing from 0.75 to 1.75% salt, inclusive. Each of the 64 participants made one observation on each sample. The results are shown in Table II.

The data indicated the same general trend in preference for salt as with the semi-trained taste panels, except there was a tendency in preference for the higher salt contents. The samples with 1.25% salt had the highest number (37.5%) of "just right" observations; the sample containing 1.0% salt was second with 35.9%. On overall ranking the samples were placed from first to fifth: 1.25%, 1.5%, 1.0%, 1.75% and 0.75%.

Food Store Survey. In a survey among patrons of food stores in Tulsa, Oklahoma, 75 shoppers selected at random were asked to place three samples containing 0.75%, 1.0% and 1.25% salt, respectively, and identified by random numbers. The results are shown in Table III.

**Table III.—Preference for Salt Content, Food Store Shoppers,
75 Participants.**

Placing	Salt Content					
	0.75%		1.00%		1.25%	
	No.	%	No.	%	No.	%
First	26	34.7	27	36.0	22	29.3
Second	16	21.3	38	50.7	21	28.0
Third	33	44.0	10	13.3	32	42.7
Total	75	100.0	75	100.0	75	100.0
Score		143		167		140
Rank		2		1		3

Among these food store shoppers, the sample with 1.0% salt ranked highest with 36% picking it in first place, 50.7% in second place and only 13.3% in third place. The sample with 0.75% salt ranked second in overall rating with 34.7% ranking it first, but with 44% ranking it third. These results would indicate that a salt content of about 1.0% is preferable to a higher or lower salt content.

The results of the four trials reported on preferences for salt content indicates the greatest preference for cottage cheese containing from 1.0 to 1.25% salt.

Rate of Creaming

The rate of creaming or amount of dressing added to cottage cheese currently marketed ranges from very dry with no free cream to excessive amounts of cream or dressing. In order to determine consumer preferences for various rates of creaming of cottage cheese, vats of cheese were made at several intervals following the usual procedure for the short-time set and cutting with 3/8-inch knives.

It should be emphasized that the amount of free cream in creamed cottage cheese depends largely upon the amount absorbed by the curd. The amount absorbed depends largely upon the size, firmness, and dryness of the curd particles. With the lots of curd used in these experiments, the relative amounts of free cream, when spooned onto a plate, were generally as follows:

20%, rather dry; sometimes incomplete coverage of the curd particles; no free cream.

25%, curd particles completely covered but no free cream.

30%, curd particles covered with a "glistening" layer of cream; a little free cream flowing from the mass when spooned onto a plate.

(This amount is considered by many cottage cheese specialists to be the ideal amount.)

35%, curd particles completely covered; considerable free cream in the carton and flowing from the mass when spooned onto a plate.

40%, curd particles literally swimming in cream; much free cream flowing from mass when spooned onto a plate.

The descriptions above are given to avoid any misunderstanding or mistakes in amount of cream added due to the size and absorptive capacity of the curd particles.

Semi-Trained Taste Panels, Trial I. In the first trial with a semi-trained taste panel, 27 respondents examined duplicate sets of 5 samples for a total of 54 observations. Observations were made both on appearance and on flavor. The creaming rates ranged from 20 to 40%. The results of the observations on appearance are shown in Table IV.

Table IV.—Preference for Appearance of Cheese with Various Rates of Creaming, Semi-trained Panel of 27 Participants, Duplicate Samples.

Appearance Classification	Amount of Cream Added									
	20%		25%		30%		35%		40%	
	No.	%	No.	%	No.	%	No.	%	No.	%
Too low	31	57.4	6	11.1	0	---	0	---	0	---
Sl. low	19	35.2	27	50.0	0	---	0	---	0	---
Just right	4	7.4	18	33.3	35	64.8	5	9.3	0	---
Sl. high	0	---	3	5.6	19	35.2	29	53.7	1	1.9
Too high	0	---	0	---	0	---	20	37.0	53	98.1
Total	54	100.0	54	100.0	54	100.0	54	100.0	54	100.0
Score		81		120		143		93		55
Rank		4		2		1		3		5

The results show that a creaming rate of 30% with this curd was the best, as 64.8% of the observations on this sample were checked as "just right." The sample creamed at the rate of 25% was called "slightly low" or "too low" in 61.1% of the observations, while that with 35% cream was called "slightly high" or "too high" in 90.7%. The sample cream with only 20% dressing was called "slightly low" or "too low" in 92.2% of the observations while that with 40% cream was considered "too high" a rate by all, except one observation of "slightly high". The overall ranking of the samples from first to fifth was 30%, 25%, 35%, 20% and 40%, respectively.

The results of the observations of flavor of the cottage cheese samples with various amounts of cream added are shown in Table

V. The flavor preferences were similar to those for appearance. The sample with 30% cream added ranked first in overall rating with 64.6% "just right" observations. The sample with 35% cream ranked second with 39.6% and the one with 25% cream ranked third with 25%. The remaining two samples with 20% and 40% cream, respectively, had only 12.5% each of "just right" observations.

Table V.—Preference for Flavor of Cheese with Various Rates of Creaming, Semi-trained Taste Panel of 24 Participants, Duplicate Samples.

Taste Classification	20%		Amount of Cream Added				35%		40%	
	No.	%	No.	%	No.	%	No.	%	No.	%
Too low	26	54.2	12	25.0	1	2.1	0	---	0	---
Sl. low	16	33.3	22	45.8	7	14.6	7	14.6	3	6.3
Just right	6	12.5	12	25.0	31	64.6	19	39.6	6	12.5
Sl. high	0	---	2	4.2	8	16.7	16	33.3	17	35.4
Too high	0	---	0	---	1	2.1	6	12.5	22	45.8
Total	48	100.0	48	100.0	48	100.1	48	100.0	48	100.0
Score		76		96		125		109		80
Rank		5		3		1		2		4

From this trial it appeared that a creaming rate of 30% was distinctly superior in consumer preference to the cheese with higher and with lower percentages of cream added.

Semi-Trained Taste Panel, Trial II. A second trial on preferences for rate of creaming by a semi-trained taste panel was conducted with 21 participants scoring duplicate sets of 5 samples. The results of the observations on appearance of 20 of the participants are shown in Table VI. As in the first trial, the results show that the samples with 30% and 25% cream added ranked first and second, respectively, with "just right" classifications, in 45% and 32.5% of the observations. In this trial, however, the sample with 20% cream with 35% of "just right" observations ranked third and the sample with 35% cream with only 5.0% "just right" observations ranked fourth. As in the first trial, the sample with 40% cream ranked last with no observations of "just right." It should be noted that the observations appeared to be much more erratic than in the first trial, but the general trends in the two trials are similar and indicate that a creaming rate of 30% was the most desirable to the respondents.

The preferences for flavor by 21 participants in this second trial are shown in Table VII. The rank on flavor was the same as that on

Table VI.—Preference for Appearance of Cheese with Various Rates of Creaming, Semi-trained Panel of 20 Participants, Duplicate Samples.

Appearance Classification	20%		Amount of Cream Added				35%		40%	
	No.	%	No.	%	No.	%	No.	%	No.	%
Too low	16	40.0	5	12.5	1	2.5	2	5.0	2	5.0
Sl. low	10	25.0	7	17.5	6	15.0	1	2.5	0	---
Just right	14	35.0	13	32.5	18	45.0	2	5.0	0	---
Sl. high	0	---	14	35.0	15	37.5	15	37.5	5	12.5
Too high	0	---	1	2.5	0	---	20	50.0	33	82.5
Total	40	100.0	40	100.0	40	100.0	40	100.0	40	100.0
Score		78		87		97		60		35
Rank		3		2		1		4		5

appearance, namely: 30%, first; 25%, second; 20%, third; 35%, fourth; and 40%, fifth. Here again it may be noted that the observations appear to be somewhat erratic. However, the sample with 30% cream added had 52.4% observations of "just right" and that with 25% cream had 45.2%, both of which percentages were much larger than for the other samples.

Table VII.—Preference for Flavor of Cheese with Various Rates of Creaming, Semi-trained Taste Panel of 21 Participants, Duplicate Samples.

Flavor Classification	20%		Amount of Cream Added				35%		40%	
	No.	%	No.	%	No.	%	No.	%	No.	%
Too low	9	21.4	1	2.4	3	7.1	0	---	2	4.8
Sl. low	20	47.6	12	28.6	8	19.0	4	9.5	2	14.3
Just right	11	26.2	19	45.2	22	52.4	7	16.7	6	14.3
Sl. high	2	4.8	7	16.7	8	19.0	16	38.1	11	26.2
Too high	0	---	3	7.1	1	2.4	15	35.7	21	50.0
Total	42	100.0	42	100.0	42	99.9	42	100.0	42	100.1
Score		86		99		102		76		67
Rank		3		2		1		4		5

Dairy Meeting Tests. In the survey among people attending a dairy meeting, 63 respondents scored 5 samples each for appearance in relation to rate of creaming. The results are shown in Table VIII.

The results with those respondents showed a tendency to favor lower percentages of creaming than the two trials with semi-trained panels. With these dairymen, the sample with 25% cream added ranked first, with 50.8% classifying it as "just right." The 20% sample ranked

Table VIII.—Preference for Appearance of Cheese with Various Rates of Creaming, Attendants at Dairy Meeting, 63 Participants.

Appearance Classification	Amount of Cream Added									
	20%		25%		30%		35%		40%	
	No.	%	No.	%	No.	%	No.	%	No.	%
Too low	16	25.4	10	15.9	1	1.6	0	---	0	---
Sl. low	20	31.8	19	30.2	6	9.5	2	3.2	0	---
Just right	22	34.9	32	50.8	19	30.2	3	4.8	3	4.8
Sl. high	5	7.9	2	3.2	33	52.4	22	34.9	4	6.4
Too high	0	---	0	---	4	6.4	36	57.1	56	88.9
Total	63	100.0	63	100.0	63	100.0	63	100.0	63	100.1
Score		186		196		184		122		77
Rank		2		1		3		4		5

second with 34.9% “just right,” and the 30% sample third with 30.2% “just right.” The samples with 35% and 40% cream placed fourth and fifth, respectively, with only 4.8% each having replies of “just right.”

Food Store Survey. Seventy-seven shoppers in food stores ranked the appearance on three samples of cottage cheese with 20%, 30%, and 40% cream added. The results are shown in Table IX.

Table IX.—Preference for Appearance of Cheese with Various Rates of Creaming, Shoppers in Food Stores, 77 Participants.

Placing	Rate of Creaming					
	20%		30%		40%	
	No.	%	No.	%	No.	%
First	20	26.0	22	28.6	35	45.4
Second	15	19.5	54	70.1	8	10.4
Third	42	54.5	1	1.3	34	44.2
Total	77	100.0	77	100.0	77	100.0
Score		132		175		155
Rank		3		1		2

The data show that the cheese with 40% cream added had the highest percentage of first places (45.4%) compared to 28.6% and 26.0% respectively, for the cheese with 30% and 20% cream. However, the cheese creamed at the rate of 30% had the highest overall ranking largely because it was placed second in 70.1% of the observations. Furthermore, this sample was ranked third in only one observation. In overall ranking, the cheese creamed at the rate of 40% ranked second and the one with 20% ranked third. From the data it appears that a medium rate (30%) generally would be acceptable.

Size of Curd

Cottage cheese is usually available in two sizes of curd: Small curd or country style cut with $\frac{1}{4}$ -inch knives, and large or flake type curd cut with $\frac{1}{2}$ -inch or larger knives. Dairy plants can easily determine the consumer preferences for the small and the large curd by the volume of sales of each type. A number of plants successfully market a medium size curd only (cut with $\frac{3}{8}$ -inch knives).

In order to determine consumer preferences for the three sizes of curd mentioned above, two trials were run: One with attendants at a dairy meeting and another with shoppers in food stores. For each trial, three vats of cheese were made from the same lot of milk with identical procedures except that $\frac{1}{4}$ -, $\frac{3}{8}$ -, and $\frac{5}{8}$ -inch knives were used, respectively. Each lot of finished curd was creamed and salted in the usual manner and submitted to the respondents for classification and preference ranking.

Dairy Meeting Tests. In the first trial with 65 respondents attending a dairy meeting, 63 expressed their opinions regarding the size of the curd and all of them ranked them in order of preference. The results are shown in Table X.

Table X.—Preference for Curd Size of Cottage Cheese, Attendants at Dairy Meeting.

Classification by 63 Parti- cipants	Curd Size					
	Small		Medium		Large	
	No.	%	No.	%	No.	%
too small	17	27.0	2	3.2	0	---
l. small	21	33.3	12	19.1	0	---
just right	25	39.7	28	44.4	13	20.6
l. large	0	---	21	33.3	15	23.8
too large	0	---	0	---	35	55.6
total	63	100.0	63	100.0	63	100.0
score		134		152		104
rank		2		1		3
reference Plac- ing by 65 Parti- cipants						
1st	24	36.9	26	40.0	15	23.1
2nd	17	26.2	37	56.9	11	16.9
3rd	24	36.9	2	3.1	39	60.0
total	65	100.0	65	100.0	65	100.0
score		130		154		106
rank		2		1		3

The medium size curd ranked first with 44.4% "just right" opinions and a consumer score of 152. The small curd ranked second with

39.7% "just right" classifications and a consumer score of 134. The large curd had the lowest rating with only 20.6% "just right" opinions and a consumer score of 104. The preference ranking of the three samples by the 65 participants confirm the results from the classification given above. The medium size curd ranked first with 40.0% first places and a score of 154. The small curd ranked second with 36.0% first places and a score of 130. The large curd had only 23.1% first places and a score of 106.

Food Store Survey. In the second trial, 77 food store shoppers ranked the three samples in order of preference. The results are shown in Table XI.

Table XI.—Preference for Curd Size of Cottage Cheese, Shoppers in Food Stores, 77 Participants.

Placing	Curd Size					
	Small		Medium		Large	
	No.	%	No.	%	No.	%
First	30	39.0	21	27.3	26	33.8
Second	20	26.0	49	63.6	8	10.4
Third	27	35.0	7	9.1	43	55.8
Total	77	100.0	77	100.0	77	100.0
Score		157		168		137
Rank		2		1		3

The results are slightly different from those obtained in the first trial, in that, on the basis of first place choices, the small curd ranked first with 39.0%, the large curd ranked second with 33.8% and the medium size curd last with 27.3%. On the basis of preference score, however, the medium size curd ranked first with 168, the small curd second with 157, and the large curd last with 137. These results are in agreement with those obtained in the first trial. It should be noted that the medium size curd was ranked second by 63.6% of the respondents and third by only 9.1%.

The results of the two trials indicate that a medium size curd would be more acceptable than either a small or a large curd.

pH (Acidity)

Various investigators have found that the acidity or pH of the finished cheese has a profound influence on the keeping quality, with a low pH value delaying spoilage. Two trials were run involving consumer reactions to the taste of cottage cheese with different pH levels.

Semi-trained Taste Panels. In the first trial with a semi-trained panel the pH values ranged from 5.12 to 4.83. Duplicate sets of these samples were submitted to a semi-trained panel of 32 participants, for a total of 64 observations on each sample. The participants were asked to taste the samples for acid content. The results are shown in Table XII.

Table XII.—Preference for pH (Acidity) of Cottage Cheese, Semi-trained Taste Panel of 32 Participants, Duplicate Samples.

Acidity Classification	pH Values									
	5.12		5.05		4.95		4.88		4.83	
	No.	%	No.	%	No.	%	No.	%	No.	%
Too low	9	14.1	17	26.6	4	6.3	5	7.8	5	7.8
Sl. low	14	21.9	22	34.4	13	20.3	17	26.6	10	15.6
Just right	17	26.6	17	26.6	20	31.3	23	35.9	21	32.8
Sl. high	16	25.0	8	12.5	20	31.3	12	20.3	19	29.7
Too high	8	12.5	0	0	7	10.9	6	9.4	9	14.1
Total	64	100.1	64	100.1	64	100.1	64	100.0	64	100.0
Score		128		128		137		140		135
Rank		4		4		2		1		3

The results show a tendency to prefer a low pH value in cottage cheese. The ratings were ranked as follows: First, pH 4.88; second, pH 4.95; third, pH 4.83 and tied for fourth and fifth, pH 5.05 and 5.12. It may be noted that the cheese with the next to lowest pH (4.88) had the highest percentage of "just right" observations with 35.9%, while that with the lowest pH (4.83) had the next highest with 32.8%. The data were scattered over a rather wide range, indicating the consumers vary considerably in the degree of acid preferred in cottage cheese.

Food Store Survey. In the second trial on consumer preferences for pH, samples of cottage cheese representing three levels of pH were ranked for preference by 74 shoppers in food stores. It was planned to have the pH levels at 5.2, 5.1 and 5.0. The final pH values representing high, medium and low were 5.25, 5.20 and 5.0. Results of the placings by the 74 respondents are shown in Table XIII. The results show a tendency for preference of a low pH level in cottage cheese, as the cheese with a pH of 5.0 ranked first, that with a pH of 5.2 second, and that with the highest pH of 5.25 third. As noted in the first trial, the results are rather widely scattered, which may indicate that people are less sensitive to pH than they are to some of the other factors concerned with the quality of cottage cheese.

From the results of these two trials it would appear that a low pH in cottage cheese is desirable from the standpoint of consumer ac-

Table XIII.—Preference for pH (Acidity) of Cottage Cheese, Shoppers in Food Stores, 74 Participants.

Preference Placing	pH Levels					
	5.25 (Low Acid)		5.20 (Medium Acid)*		5.0 (High Acid)	
	No.	%	No.	%	No.	%
First	16	21.6	33	44.6	25	33.8
Second	21	28.4	16	21.6	37	50.0
Third	37	50.0	25	33.8	12	16.2
Total	74	100.0	74	100.1	74	100.0
Score		127		156		161
Rank		3		2		1

* Through an error in preparation of the samples, this lot was higher than desired in pH level.

ceptance. The value of a low pH is further enhanced by the chances for improvement in keeping quality. It must be recognized, however, that low pH values developed during manufacture tend to make a soft, pasty body in the cheese. From the practical standpoint, an acceptable product can be obtained by using manufacturing procedures that will give a fairly low pH on the finished curd yet not impair the body, then adjusting the pH on the creaming mixture by adding some acid, such as citric.

Consumer Opinions on Cottage Cheese

A questionnaire was prepared and a survey run to determine consumers' opinions on cottage cheese. Two hundred respondents were selected at random from shoppers in food stores in Tulsa, Oklahoma. These respondents were housewives shopping in 7 large food stores and one small neighborhood grocery. The responses to the questions asked and recorded by the interviewer are given in the order in which they appeared on the questionnaire.

1. What are the good points about cottage cheese, or why do you include cottage cheese in your menu? In answer to this question 15 respondents (7.5%) replied that they did not buy or use cottage cheese. Among the remainder of the respondents, the most common replies listed in order of frequency were: Low in calories, high in food value, family likes it, high in protein, inexpensive, good for us, easy to serve, versatile, needs no preparation, and adds milk to the diet. There were 13 more miscellaneous replies.

2. What do you dislike about cottage cheese? To this question 70 respondents made no comment, and 58 said that the cheese was always satisfactory. Of the remaining respondents, the replies

listed in order of frequency were: Poor keeping quality, 39%; don't like the taste, 20%; lacks distinct flavor, 14%; and large curd not always available, 14%. These made up 87% of the replies. There were several miscellaneous replies.

3. Has the cottage cheese you have been purchasing been satisfactory? The answers to this question were 77.5% "yes" and 22.5% "no." What criticisms do you have regarding the quality of the cottage cheese purchased? Of the 109 criticisms offered, the following were the most prominent: Watery, 28.4%; flavor too flat, 12.8%; tastes old, 9.2%; too dry 9.2%; rubbery or tough, 8.3%; and too sour, 7.3%. Additional criticisms were: Too soft or mushy, body and texture vary too much, flavor varies too much, rancid, and musty or moldy.

4. How do you serve cottage cheese? The most popular way to serve it was plain or as it comes from the package, 33.6%. Other popular ways were: With fruit, 24.7%; with fruit and vegetables, 17.3%; in gelatin salads, 7.2%; and in dips, 5.8%. These made up over 88% of the ways used to serve the cheese. Other ways of serving mentioned included: With vegetables, with toast or crackers, filling for baked potatoes, pie topping, in sandwich spreads, cheese cakes, cake topping, and as a substitute for meat.

5. Do you make any changes in cottage cheese before serving? If so, how do you change it? Of the 191 people who replied to this question about half (96) answered "yes" and half (95) "no." Of the 125 ways listed for modifying cheese before serving, 80.8% added salt, pepper or other seasoning, 13.6% added cream or milk; 2.4% drained off the excess cream and 3.2% added sugar.

6. How often do you purchase cottage cheese? Twelve of the 200 respondents indicated that they never purchased cottage cheese. Of the remaining 188, 0.5% (1 respondent) purchased it four times a week, 3.7% three times a week, 13.3% twice a week, and 50.0% once a week, for a total of 67.5% purchasing the cheese once a week or more often. Less frequent users were: 16.5% purchased the cheese once every two weeks, 11.2% once every month, and 4.6% only occasionally. Ninety-five percent of the respondents purchased one package of cottage cheese at a time. Also, 62.2% purchased the 12 oz. package, compared to 37.8% for the 2 lb. package.

From the above data on opinions it appears that most families use cottage cheese for the principal reasons that it is easy to serve, needs no special preparation, is high in proteins and minerals, is low in calories, adds milk constituents to the diet, and is low in cost. The most common

objections to cottage cheese: it has poor keeping quality, it lacks a desirable and distinct flavor, and it is not a food that most people like to eat every day. It appears that much of the cottage cheese purchased in food stores had undergone deterioration, as evidenced by the remarks on quality.

Cottage cheese was served in a great variety of ways, the most popular of which were plain, with fruit, and with fruit and vegetables. About half of the purchasers of cottage cheese interviewed modified it before serving, chiefly by seasoning or by adding milk or cream.

Most users of cottage cheese purchased it once a week or more often, usually 1 package at a time, and preferred the 12 oz. package to the 2 lb. carton.

Summary and Conclusions

A survey was made on consumer preferences for salt content, rate of creaming, size of curd particles and pH of cottage cheese. Various lots of cottage cheese, representing differences in the factors being studied, were prepared in the dairy plant at Oklahoma State University. These lots of cheese were submitted to organoleptic tests by various groups of respondents, including semi-trained panels, attendants at a dairy meeting, and shoppers in food stores. Additional information was gained by interviewing shoppers in food stores regarding cottage cheese currently on the market.

Most of the consumers interviewed preferred a salt content of from 1.0 to 1.25%. Although salt helps to delay spoilage, the results indicate about 1% salt or slightly more would be most acceptable, as it is very easy to add the additional salt desired by many consumers.

In these trials, the addition of cream at the rate of 30% of the weight of the curd had a higher consumer acceptance among the respondents than did a higher or lower rate. Because of differences in amount of absorption by different lots of cheese, it should be emphasized that the 30% rate of creaming resulted in coverage of all particles of the cheese with a little free cream flowing from the mass when spooned onto a plate.

A medium-sized curd obtained by using 3/8-inch cheese knives had a higher preference rating than the small curd, cut with 1/4-inch knives or the large curd, cut with 5/8-inch knives.

The data on preferences for pH showed a rather wide range, with cheese in the lower pH ranges preferred over the cheeses having high pH levels. Because of this, and because of the protective effect of low pH levels against spoilage, it appears logical to recommend a relatively low pH (about 5.0) on the finished cheese, but not so low as to impair the body of the cheese.

The consumers' opinions on cottage cheese indicate a rather high regard for this product. The principal "good points" about cottage cheese were that it is low in calories, high in food value—particularly proteins and minerals—inexpensive, easy to serve, requires no special preparation, and adds milk constituents to the diet. The principal objections to cottage cheese were that it had poor keeping quality, lacked a desirable and distinct flavor, and was not a food that the consumers would eat every day.

The majority of consumers purchased cottage cheese once a week or more often, but 12 of 200 respondents indicated that they never purchased this product. The majority purchased one package of cottage cheese at a time; also, the 12 oz. package was more popular than the 2 lb. carton.

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