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AN INSTITUTIONAL EVALUATION OF PROCESSED MASHED POTATOES

by

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Presented in partial fulfillment of the requirements for the degree of

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MONTANA STATE UNIVERSITY

1960

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## INTRODUCTION

The efficient operation of quantity food services today requires frequent examination of new equipment, new methods and new products. Any innovations must enable the operator to reduce costs and maintain standards of service. Among the diverse offerings designed to attain this end are a variety of pre-processed foods. Before the operator will consider any one as a regular part of the daily menu an item must be proven acceptable to the consumer.

In this country potatoes are a popular menu item. Of the many forms in which they appear, mashed potatoes are, perhaps, most often used. Essentially simple as the finished form appears, the factors involved in the production of a dish of fluffy, white, lump-free, fine-flavored mashed potatoes are numerous and many times difficult to control. The quantities needed by most operations will be large, requiring storage under suitable conditions of temperature and humidity to protect the quality. Transfer to the preparation area must be made, usually by man power. In preparation of large quantities a mechanical peeler is commonly used. Poor judgment on the part of an inexperienced worker can result in excessive waste. Lack of skill and carelessness in hand trimming will further reduce yields. After paring, potatoes must be cooked without delay or oxidation will cause discoloration. Although anti-oxidants can be used to prevent color development when holding is necessary, such treatment involves extra handling and adds to the total cost of the finished product.

## REVIEW OF LITERATURE

Potatoes are held in storage to supply the year round demand. Those marketed in the spring have a high moisture and sugar content with low solids. When such potatoes are cooked they cannot be mashed or whipped to produce a fluffy consistency. Flavor deteriorates as storage continues toward the following spring, resulting in an "old," "rooty," or "dirty" taste. Stored potatoes will often darken rapidly after preparation, presenting to the consumer an objectionable appearance. Various signs of decomposition such as spots of rot may develop during storage requiring trimming that will cause a loss in yield.(1)

Potatoes were among the first vegetables subjected to processes to remove water to reduce shipping and storage weight and prevent decay. The earliest patents dehydrated the raw potato. The exterior became case-hardened making the product difficult to rehydrate. The granules of the potato ruptured during the processing, allowing the starch to spill out. When water was added for rehydration a paste formed. When these potatoes were used for mashing the result was quite unlike anything the consumer had tasted before. Use of the product available during World War II for service to the armed forces built up a consumer resistance that is still evident.

An improved product is now available. This process subjects the pared potato to a pre-cook step at temperatures below boiling. The starch gelatinizes in the granules preventing pastiness when rehydrated. Final cooking at boiling temperature follows. The potatoes are quickly mashed or riced with sodium sulfite and other anti-oxidants to protect

the color and flavor. The mash can be adjusted in consistency by the addition of more or less water, thus permitting the use of potatoes of varying solid content. The mash is fed between heated drier rollers, in one operation, requiring less than one-half minute, the mash is dehydrated to 4% or less moisture content. At this stage of the operation either granules or flakes are produced. Rapid handling at each step of the processing minimizes off-flavor and color development in the finished product. (2), (3), (4), (5).

This study is undertaken to obtain data for an evaluation of the economy and acceptability of dehydrated mashed potatoes used in quantity food service as a vegetable, in dishes in combination with meat, such as baked hamburger pie, in potato puff combined with eggs, in cream of potato soup, compared with the same products made from fresh potatoes. Elements of flexibility or tolerance are also considered to determine how much abusive treatment the products can be given without complete consumer rejection resulting.

#### PROCEDURE

A series of 12 tests were made in which products prepared from fresh potatoes and dehydrated granules and flakes were compared. These are the two types of processed mashed potatoes most generally available to the quantity food service operator.

Selection of expert panel. The panel designated the expert panel was composed of individuals selected from the students and staff at Montana State University who volunteered to take the initial water flavor test. 10 out of 102 were able to qualify as judges by identifying four



solutions at low taste thresholds: bitter, salt, sour and sweet. The test solutions were prepared for the first test to select the expert panel and used at the start of each testing period. Solutions were prepared in one gallon quantities, 4 mg. quinine sulfate was used in the bitter solution, 300 mg. sodium chloride for the salt, 500 mg. citric acid for the sour, 400 mg. sucrose for the sweet.

One ounce paper cups coded "A", "B", "C", "D", each containing one of the solutions, were set before the volunteer. The candidate was asked to identify the taste of each of the four solutions by marking the sheet provided. (See appendix p.23 for sample of the water flavor score sheet.) This method of selection of the expert panel is a modified version of the method by Kotschevar. (6) His method of conducting the tests and of handling the data were used.

Selection of consumer panel. A second panel, called the consumer panel, was composed of students, faculty and employees of Montana State University who are regular boarders in the food service. This group was not subjected to the water flavor test. Such a panel was used because the average palate and not the expert palate will be, perhaps, the best indicator of population preference.

Test schedule. The 12 tests were conducted over a five week period in the Montana State University Food Service Department. Table I shows the test number, the date the item was prepared and served, the quantity prepared. All tests were run at the evening meal with the exception noted in test 5. Both panels participated in all tests except 9, 10, 11 and 12. (Tests were made at 10:45 a.m. and 4:45 p.m. when taste acuity is thought to be highest.) At the beginning of each test period

TABLE I  
 SCHEDULE FOR MAKING AND SERVING PRODUCTS MADE FROM  
 FRESH AND PROCESSED MASHED POTATOES

Test			Amount	
No.	Date, 1959			
1.	Feb. 10	Mashed potatoes, fresh	49	pounds
	Feb. 10	Mashed potatoes, granule	38 $\frac{1}{2}$	pounds
2.	Feb. 12	Mashed potatoes, fresh	51	pounds
	Feb. 12	Mashed potatoes, granule	39	pounds
3.	Feb. 18	Mashed potatoes, fresh	56	pounds
	Feb. 18	Mashed potatoes, flake	23	pounds
4.	Feb. 19	Mashed potatoes, fresh	53	pounds
	Feb. 19	Mashed potatoes, flake	24	pounds
5.	Feb. 23	Baked hamburger pie, fresh potatoes	34	pounds*
	Feb. 23	Baked hamburger pie, granule potatoes	34	pounds*
6.	Feb. 26	Potato puff, fresh	52	pounds
	Feb. 26	Potato puff, granule	39	Pounds
7.	Mar. 3	Mashed potatoes, fresh	48	pounds
	Mar. 3	Mashed potatoes, granule	68	pounds
8.	Mar. 4	Mashed potatoes, fresh	51	pounds
	Mar. 4	Mashed potatoes, flake	24	pounds
9.	Mar. 12	Potato puff, fresh	13	pounds
	Mar. 12	Potato puff, flake	11	pounds
10.	Mar. 12	Cream of potato soup, fresh	5	quarts
	Mar. 12	Cream of potato soup, granule	5	quarts
11.	Mar. 12	Cream of potato soup, flake	5	quarts
12.	Mar. 14	Baked hamburger pie, fresh potato	17	pounds
	Mar. 14	Baked hamburger pie, flake potato	17	pounds

\* Served at lunch

the judges of the expert panel were given the water flavor test to determine if taste acuity was still evident. No definite interval between the water flavor test and tasting of the potato samples was observed. Participants were urged to rinse the mouth with water before proceeding. If the judge did not correctly identify the water samples he was allowed to continue with the test but his preferences in the triangle test were not used in final calculations.

Triangle test used. To determine if the expert panel could correctly identify two identical samples of three presented a modified triangle test was used. Samples of fresh mashed potato and processed mashed potato were offered to the judges. The samples were labeled "A", "B", "C", with the identical pair, of fresh or processed, varying at random. At the time of the first test with plain mashed potatoes it was felt the paired product could be identified by visual means. A photographic dark room red light was provided to obscure differences. This was discarded after it was observed the judges had difficulty making selections based on visual differences even under normal lights.

Each judge was asked to state his preference for a sample or samples and to indicate why he preferred this sample or these samples. (See appendix p. 25 for sheet used by expert panel.) The expert judge's preference was used only if he had made correct identification in the water flavor test and in the triangle test.

Consumer panel test. Immediately after the expert taste panel tests the consumer panel was tested. About 60 of the boarders coming through the cafeteria line were asked to participate in the test. A paired sample was served each volunteer tester. One sample was on the

regular dinner plate banded in gray, the second was on a plate banded in red. Gravy was served or omitted according to the individual's choice. Each judge was given a sheet on which he was asked to mark preference for "red band," "gray band," or no choice." (See p. 26 in the appendix for sample of consumer panel sheet used.) Sheets were collected and recorded. The results of all consumer tests were pooled to determine if the panel had been able to distinguish between the fresh and processed items.

"The data obtained from both panels was subjected to a statistical test to ascertain significance. This was the ordinary "t-test" but a slightly different formula was used. Tasters who were unable to detect a difference between samples or to whom both samples were equally acceptable sometimes indicate no preference. These no preference selections have to be taken into account in evaluating the results of comparisons or some means used to dispose of them. For this reason, the practice has been adopted in many laboratories of including "no choice" notations in N (total number tasting) but not in the denominator:

$$\frac{x}{s} = \frac{a-b}{\sqrt{N}}$$

For instance, if 100 people tested samples a and b and 29 preferred a, 11 preferred b and 60 put "no choice" on their slips, the usual calculation of the t-test will indicate a probable chance of 1.8 which is not a sufficiently large statistic to indicate significance. The same result will be obtained if it is reasoned that those tasters who could not make an actual choice between a and b, would, in an arbitrary choice, have given equal preference to a and b. However, if "no choice" notations are disregarded and their number omitted from the calculations, the result would be 2.85 which would make the preference for sample a significant. It is unlikely that a comparison in which 60 out of 100 tasters could make no choice would show that a real preference existed for one sample over the other. Therefore, "no choices" by the panel are included in the total number of tasters in N, but not in a or b. This procedure is consistent with practices in many food testing laboratories."\*

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\*The above material was written by Dr. Lendal H. Kotschevar. The source was a private memorandum, No. M-2, copy 3, entitled "Progress Memorandum," Psychometric Practices and Plans from National Dairies.

Recipes used. Standardized recipes from the files of the Montana State University Food Service were used for the mashed potatoes, baked hamburger pie and potato puff. Recipes in which the processed potatoes, granule or flake were used, were modified from the directions suggested by the distributor of each type. These suggestions were found either on the label of the product or in pamphlets.

Paring fresh potatoes. Because the Montana State University Food Service uses pre-prepared fresh potatoes, this form of potato was used in the tests. These are delivered to the kitchen in 30 pound polyethylene bags and are made ready for preparation by rinsing in fresh water. To secure data on paring fresh potatoes, ten 100 pound sacks of U. S. Grade A russets from the Bitterroot Valley in Montana were pared in two lots of 500 pounds each using a mechanical peeler. Time, steps and waste were recorded for each 100 pounds and the means were applied in the study when tests were made using fresh potatoes. Results are shown in Table II. The amount usually cooked and mashed as a batch is 45 pounds. The time, step and waste factors are applied to this amount of edible portion of potato. The average waste of 37% is within the range reported on 130 samples in Food Yields Summarized by Different Stages of Preparation, Agriculture Handbook No. 102.

Recording of time and steps. Time and steps were recorded as the assigned cook followed the requisition for the preparation of one batch of the product needed for the meal. In a few instances these same observations were made for the tests conducted in a smaller kitchen for the expert panel only. Potatoes were taken from a walk-in refrigerator, rinsed, put into a perforated stainless steel steamer basket, set in the

TABLE II

POTATO PARING TIME AND LOSS

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Amount	Mean Calculations		
	Steps	Time	Waste
100 lbs	55	33mn	37 lbs

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steamer. After 40 minutes of steaming, potatoes were removed to a 60 quart bowl on a mixer. A wire whip was attached to the mixer for breaking up the potatoes and whipping after the addition of liquid. Instant dry skim milk powder was mixed with hot water and kept hot for addition as required. Fat is not added to mashed potatoes prepared by the Montana State University Food Service because it causes decrease in volume of the finished product.

Time was recorded as production time and total time. Production time refers to the time the worker actually spent working with the product and includes receiving, making-up, tending, tasting, storing. Total time includes time from start of production to completion of the product.

Time was recorded as production time and total time. Production time refers to the time the worker actually spent working with the product and includes time from start of production to completion of the product. This total time, therefore, includes time the worker did not spend working on the product but worked at some other task while the product was in process. Clean-up time is not included in any phase of the study. Production time was calculated by means of a stop watch. Total time was recorded by wall clock.

Evaluation of holding qualities. In large quantity food service it is sometimes necessary to hold products for periods of time on a

heated serving table. To evaluate the holding qualities of the three types of products, samples were kept on the electrically heated table for a period of  $3\frac{1}{2}$  hours after preparation. Two tests of this type were made. Samples were served the expert panel at 30 minute, 1 hour, 2 hour and 3 hour intervals. A score sheet was used to record numerically the judges adjectival rating of the appearance, color, consistency, flavor and texture of each of the products. (See appendix p. 27 for copy of the score sheet used.) Seven points was the highest score possible for the rating of "excellent."

During the period of holding samples for the expert panel, individuals in charge of the test made visual observations of the condition of the products as they stood on the steam table in pyrex beakers. Color change, formation of a skin on the surface, loss in volume and any change in textural appearance were noted.

Product handling. Because directions for preparation of a product are not always followed as given, it is desirable to know how the products will withstand excessive or incorrect handling. Observations were made on the effect of whipping samples for a total of 30 minutes. Samples were removed at 5 minute intervals for observation by the testers as to color, consistency and general appearance. These samples were not tested for acceptability by the panel.

Cost calculations. Costs for the tests were calculated for the ingredients and the labor. The total cost included cost of labor plus cost of ingredients. Ingredient costs were based on bid prices at Montana State University for Winter Quarter 1959. (See p. 49 in the appendix.) Labor costs were calculated at \$1.00 per hour for vegetable preparation and \$1.25 per hour for cooking. Cost for labor is

based on the production time figured to the nearest minute. The cost per pound for the finished product is based on the total cost.

## RESULTS AND DISCUSSION

### Acceptability

As shown in Table III the expert panel significantly preferred the fresh product in 1 test. The consumer panel preferences were significantly in favor of the fresh product in 6 out of 8 tests. Table III also gives the  $\bar{x}$ 's calculated from the preference.

The expert panel was able to pair samples visually in 95% of the tests. Flavor differences were frequently remarked upon by the panel. In the late winter potatoes held in storage take on a distinct flavor, often described as "dirty," to which the consumer gradually becomes accustomed and which he accepts as the natural flavor of fresh potato. The flavor of the experimental products was not similar enough to win acceptance in competition with the fresh.

After the first consumer test, it was felt the panel was expressing preference for the fresh product only because it was served from the steam table position usually reserved for potatoes and placed on the regular dinner plate with other hot foods. Many were prepared to reject it without even tasting, reasoning the second sample was certainly the experimental product. When the experimental product was served from the position associated previously with the fresh product the preference was still for the fresh. The consumer panel did not accept the flavor of the experimental products when served and tasted in direct comparison with the fresh product.



TABLE III

## CONSUMER AND EXPERT PANEL RESULTS

Test Product No	Consumer Panel				No. of Judges	Correct Pairings	Correct Water Sample Identification	Expert Panel		
	Preferences			X σ Favors				Preferences		
	Fresh	Pro- cessed	No Preference					Fresh	Pro- cessed	X σ Favors
1. Mashed Potato	37	22*	9	1.82	10	9	0			
2. Mashed Potato	37	12*	4	4.43 <sup>S</sup>	10	9	8	5	5*	.89
3. Mashed Potato	32	4**	12	4.04 <sup>S</sup>	9	9	6	9		2.00 <sup>S</sup>
4. Mashed Potato	31	11**	9	2.80 <sup>S</sup>	10	10	8	9	1*	1.86
5. Hamburger Pie	22	16*	19	.79	7	6	6	5	1**	1.22
6. Potato Puff	42	5*	8	4.99 <sup>S</sup>	7	6	7	5	2*	1.22
7. Mashed Potato	31	14*	8	2.33 <sup>S</sup>	8	7	5	6	1*	1.89
8. Mashed Potato	35	14**	7	2.81 <sup>S</sup>	9	9	5	2	3**	.33
9. Potato Puff	No consumer test				8	8	8	5	3**	.70
10. Cream Soup	"	"	"		8	8	8	6	2*	1.77
11. Cream Soup	"	"	"		8	8	8	7	1**	1.41
12. Hamburger Pie	"	"	"		9	7	7	1	6**	1.66

\* granule

\*\* Flake

S = Significant at the .05 level  $\left(\frac{X}{\sigma} = 1.96\right)$

It is of interest to note that dehydrated mashed potatoes had been used many times in the previous two years in this food service. There was available no record of marked rejection.

#### Cost Factors

Table IV compares the time and step data used in making the fresh and processed products. Quantities are compared on the basis of one pound of the finished product. Different batch quantities were produced as a matter of convenience in following the pattern of the Food Service and the use of full #10 cans in the recipes of the experimental items. Because the fresh product was the largest batch prepared the data is weighted in favor of the fresh and against the flake which was the smallest batch.

Time savings. Use of processed potato granules to produce mashed potatoes saved 74% of the time necessary to produce an equal amount of mashed potatoes from the fresh. Processed potato flakes used in preparing mashed potatoes saved 49% production time. Some difficulty was experienced in following the directions provided with the flake. When the manufacturer's directions were used, rehydration of the flake was not complete causing development of lumps. These lumps could not be smothered out by handling. In this test some panel members identified the product as the fresh, using lumps as the clue. In subsequent tests a waiting period of 1-1 $\frac{1}{2}$  minutes was allowed after the liquid and flakes were combined before whipping was started. This added to the production time but improved acceptability of the product. In preparation of dishes using mashed potatoes the savings in time was 55% for the granules and 51% for the flakes over the time required to

TABLE IV

COMPARATIVE TIMES AND STEPS PER POUND FRESH AND PROCESSED PRODUCTS

Test No.	Product	Yield	Fresh			Processed		
			Total Time Mn:Sec	Production Time Mn:Sec	Steps	Total Time Mn:Sec	Production Time Mn:Sec	Steps
1.	Mashed Potato	49 lbs	1:57	:59	8			
	Mashed Potato*	38½				:19	:17	4
2.	Mashed Potato	51	1:58	:54	7			
	Mashed Potato*	39				:20	:16	4
3.	Mashed Potato	56	1:37	:49	8			
	Mashed Potato**	23				:39	:24	5
4.	Mashed Potato	53	1:47	:54	9			
	Mashed Potato**	24				:34	:32	7
5.	Hamburger Pie	34	8:06	3:44	31			
	Hamburger Pie*	34				8:06	2:57	26
6.	Potato Puff	52	2:50	1:12	10			
	Potato Puff*	39				1:19	:22	4
7.	Mashed Potato	48	2:07	:53	9			
	Mashed Potato*	68				:13	:10	3
8.	Mashed Potato	51	2:06	:52	8			
	Mashed Potato*	24				:35	:28	6
9.	Potato Puff	13	10:01	1:55	11			
	Potato Puff**	11				4:32	1:11	13
10.	Cream Soup	5qts	11:48	9:21	48			
	Cream Soup*	5qts				6:00	2:17	18
11.	Cream Soup**	5qts				3:00	3:45	26
12.	Hamburger Pie	17	8:38	1:22	10			
	Hamburger Pie	17				6:00	:38	6
Totals			52:55	22:55	159	31:29	13:17	122

\* Granule  
 \*\* Flake

prepare the same dishes using the fresh potatoes.

Steps saved. In preparing processed granules as mashed potatoes the saving in steps amounted to 56%, in preparing the flakes there was a saving of 28% over the number required to prepare the same amount of fresh. In making the dishes using mashed potatoes the savings in steps was 46% for the granule, 29% for the flakes. In test 9, using flakes to prepare potato puff, the number of steps used was in excess of the number required to prepare the fresh. This was not obvious when the observations were being made. It may have been because the test was run in a smaller kitchen and was not scheduled as part of the cook's daily routine. This was the only job she had to do so she may have gone about it in a leisurely fashion.

Labor costs. Production time was the basis for computing labor costs, thus the dollar saving effected by using the processed items is in line with the decrease in production time. Table V shows the cost comparisons per pound for the fresh and processed products. Ingredient costs for the series of tests do not vary widely, labor costs for the fresh products is over twice as much as for the production of the processed items. If the batch quantities of the processed had equalled the fresh, the time saved in preparation of the processed items would have been even greater with corresponding decreases in labor cost. In test 7, double the amount of the experimental product was prepared with the addition of only one minute of total time. The savings in steps effected by the use of the processed product is a consideration in reducing worker fatigue.

Total costs. To produce fresh mashed potatoes at a per pound price competitive with the processed or granule price it would be necessary

TABLE V

## COST COMPARISON PER POUND FOR FRESH AND PROCESSED PRODUCTS

Test No.	Product	Yield	Fresh			Processed				
			Ingred. Cost	Labor Cost	Total Cost	Per lb. Cost	Ingred. Cost	Labor Cost	Total Cost	Per lb. Cost
1.	Mashed Potato*	49 lbs.	\$2.60	\$ .90	\$3.50	\$ .071	\$	\$	\$	\$
	Mashed Potato	38 $\frac{1}{2}$					1.73	.23	1.96	.051
2.	Mashed Potato*	51	2.60	.86	3.46	.067				
	Mashed Potato	39					1.73	.23	1.96	.050
3.	Mashed Potato**	56	2.60	.86	3.46	.062				
	Mashed Potato	23					2.00	.29	2.29	.099
4.	Mashed Potato**	53	2.60	.90	3.50	.066				
	Mashed Potato	24					2.00	.27	2.27	.094
5.	Hamburger Pie*	34	10.84	2.32	13.16	.387				
	Hamburger Pie	34					10.98	1.96	12.14	.380
6.	Potato Puff*	52	2.92	1.19	4.11	.079				
	Potato Puff	39					2.34	.29	2.63	.067
7.	Mashed Potato*	48	2.60	.99	3.59	.074				
	Mashed Potato	68					3.46	.25	3.71	.054
8.	Mashed Potato**	51	2.60	.98	3.58	.070				
	Mashed Potato	24					2.00	.23	2.23	.092
9.	Potato Puff**	13	.79	.46	1.25	.096				
	Potato Puff	11					1.19	.27	1.46	.139
10.	Cream Soup*	5 qts	1.36	.93	2.29	.458 <sup>1</sup>				
	Cream Soup**	5 "					1.40	.23	1.63	.326 <sup>1</sup>
11.	Cream Soup	5 "					1.45	.39	1.84	.370 <sup>1</sup>
12.	Hamburger Pie**	17 lbs.	4.39	.83	5.22	.307				
	Hamburger Pie	17 lbs.					4.34	.56	4.90	.288
Total			\$35.90	11.22	47.12		34.62	5.20	39.82	

\* Granule

\*\* Flake

1 per quart

to purchase potatoes at \$0.02 per pound, as opposed to the \$0.032 paid for the potatoes used in this study. If paring wastes could be held to the reported average of 24% (8), the price of the fresh potatoes could be as high as \$0.031 and compete with the processed potato.

Processed potatoes may save in ways other than ingredient and labor cost. Fresh potatoes require storage in a darkened area with fairly high humidity at temperatures around 50°F. The processed item can be stored under normal, cool, dry conditions. Table VI indicates the space required for the storage of the types of potatoes studied. When construction costs are high, any saving that can be effected in reducing storage space requirements in a food service means more space for other areas or a reduction of total space. In ordering supplies, advantage can be taken of quantity price reductions or purchases can be made in amounts necessary to meet varying daily requirements. Prices of the processed items will remain more stable throughout the year than will prices of the fresh. Quality variations, a constant problem, can be eliminated if a high grade processed potato is kept available for use.

TABLE VI

STORAGE SPACE REQUIRED FOR FRESH OR PROCESSED GRANULE OR FLAKE POTATOES

Type Potatoes	No. Servings Per Pound AP	Cubic Inches Required For Storage	
		Per lb.	Per Serving
Fresh	5	47	9.2
Flake	33	158	4.8
Granule	26	46	1.8

### Holding Qualities

Scores were recorded for two separate tests to evaluate the three types of mashed potatoes as they were held on a steam table and sampled at the intervals indicated on Table VII. Scoring for the fresh product started at a higher level but dropped more than did the scores for the two processed items. The average score for the fresh product dropped 5.76 points as compared with the drop for the granule of 4.36 and 4.22 for the flake. There were some increased scores as the tests progressed. The flake and granule both increased in average score after the first test. Higher scores are noted in the flavor for the flake and in appearance, color, consistency and texture for the granule. Evaporation of some of the moisture and resulting slight collapse of the foamy structure may have improved the products in the view of the panel. Appearance was the only quality in the fresh product that was upgraded after the first sample.

Deterioration, recorded by the scores of the expert panel, does not appear to be too rapid when the potatoes were held for a period as long as  $3\frac{1}{2}$  hours. There is some question as to the point at which taste fatigue on the part of the panel may have caused distortion in the scoring. The testing session covered 2, 4-hour periods, making unusual demands on a group not highly trained.

Samples observed on steam table. Observations of the samples held on the steam table over the period of four hours during which the tests were made indicate the holding time of  $2\frac{1}{2}$  hours is possible if the heat control on the unit is good. After  $2\frac{1}{2}$  hours the fresh product formed a thick crust on top that hardened rapidly. The color darkened,

TABLE VII

AVERAGE SCORES OF JUDGES FOR TWO SEPARATE TESTS IN  
EVALUATING MASHED POTATOES UPON STANDING IN A STEAM TABLE\*

Time	Appearance	Color	Consistency	Flavor	Texture	Total
12:30 p.m.						
Flake	4.21	4.77	2.91	2.60	3.33	16.82
Granule	3.77	4.41	3.24	2.77	3.58	17.77
Fresh	4.38	4.60	4.46	4.08	4.11	21.63
	12.36	13.78	10.61	9.45	11.02	56.22
1:00						
Flake	3.94	4.50	2.81	3.15	2.79	17.19
Granule	4.72	4.65	4.13	2.48	3.84	19.82
Fresh	4.55	4.46	4.12	3.75	4.11	20.99
	13.21	13.61	11.06	9.40	10.64	58.00
2:00						
Flake	3.71	4.25	3.31	2.75	3.16	17.18
Granule	3.91	3.33	3.35	3.56	3.25	17.40
Fresh	4.26	3.79	3.91	3.54	3.97	19.47
	11.88	11.37	10.57	9.85	10.38	54.05
3:00						
Flake	3.47	4.44	2.83	2.35	2.88	15.97
Granule	3.19	2.86	2.41	2.52	2.33	13.35
Fresh	3.75	3.94	3.58	3.50	3.36	18.13
	10.41	11.24	8.82	8.37	8.57	47.45
4:00						
Flake	2.58	2.79	2.65	2.11	2.47	12.60
Granule	3.06	3.18	2.51	2.28	2.38	13.41
Fresh	3.28	3.34	3.37	3.09	2.79	15.87
	8.92	9.31	8.53	7.48	7.62	41.88

\* Highest possible score 7 points.



carmelization of the starch occurred to a depth of 3 inches or more from the bottom of the container. Above the carmelized layer was a very soggy layer. The processed products carmelized more slowly. The granule item yellowed quickly and decreased in volume slightly under a softer skin formed over the top. The layer under this skin was somewhat dried. The flake product did not lose its whiteness except in the layer at the bottom where stickiness developed. A thin skin formed on top, volume decreased and stickiness was evident when a portion was spooned out.

Holding of potatoes for  $2\frac{1}{2}$  hours represents very poor practice in any food service. Ease of preparation of processed mashed potatoes would remove the temptation to prepare and hold only one batch to supply a long serving period.

Abusive handling. Samples taken at 5 minute intervals during a 30 minute whipping of batches of each of the three types of potatoes were observed for acceptable appearance only. No taste tests were made because the samples were cold after the first 5 minutes. This would have interjected another factor into the panel's acceptance or rejection. It was the opinion of the testers that any of the products could be whipped for 15-20 minutes without producing a totally unacceptable product. The quality at this point could not be considered good, but would probably be acceptable to the consumer if the temperature was elevated by reheating.

#### SUMMARY

Use of processed mashed potatoes can save the quantity food service operator time and labor costs. Storage space required to handle

dehydrated mashed potatoes is sharply reduced over that necessary for proper holding of fresh potatoes. The processed potatoes withstand overhandling and abusive treatment to a degree equal to the fresh item.

At the time of this study the use of processed mashed potatoes in institutional food service is limited by the need for improvement in processing to develop a product of better flavor. Recognition of the processed item is not difficult for the average palate because of a definite dissimilarity to the product prepared from fresh potatoes.

## REFERENCES

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**APPENDIX**

WATER FLAVOR SCORE SHEET FOR SELECTION OF TASTE PANEL

Please mark the letter A, B, C, or D under the followings:

SALT

BITTER

SWEET

SOUR

NAME \_\_\_\_\_

ADDRESS \_\_\_\_\_

TELEPHONE NUMBER \_\_\_\_\_

What days are you available to taste samples?

11:30 a.m.

5:00 p.m.

SCORE SHEET FOR EXPERT PANEL

To identify the water flavors, please mark the letter A, B, C, or D under the following:

SALT

BITTER

SWEET

SOUR

Product \_\_\_\_\_

Name \_\_\_\_\_

Of the 3 samples, which 2 are alike:

under red light \_\_\_\_\_

under normal light \_\_\_\_\_

Which do you prefer? \_\_\_\_\_

Why do you prefer it?

Flavor \_\_\_\_\_

Color \_\_\_\_\_

Consistency  
(thin, thick) \_\_\_\_\_

Texture  
(mouth feel) \_\_\_\_\_

Other \_\_\_\_\_

COMMENTS:

SCORE SHEET FOR CONSUMER PANEL

Which sample do you prefer?

Red band

Gray Band

no choice

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_  
SAMPLE NO.

POTATO SCORE SHEET

\_\_\_\_\_  
JUDGE

CHARACTERISTIC	7 Excellent	6 Very Good	5 Good	4 Fair	3 Less Than Fair	2 Poor	1 Objection- able	Descriptive Comments
APPEARANCE								<input type="checkbox"/> skin on top <input type="checkbox"/> weeping <input type="checkbox"/> other _____
COLOR								<input type="checkbox"/> gray <input type="checkbox"/> yellow
CONSISTENCY								<input type="checkbox"/> too thick <input type="checkbox"/> too thin
FLAVOR								<input type="checkbox"/> dirty <input type="checkbox"/> scorched <input type="checkbox"/> pasty
TEXTURE (mouth feel)								<input type="checkbox"/> lumpy <input type="checkbox"/> other _____



Test 1-2-7

MASHED POTATOES

Recipe

Fresh

45 lbs	Potatoes, E. P.
1 gal	Water
1 lb	Skim milk powder
$\frac{1}{2}$ cup	Salt
1 T	Pepper

- Directions:
1. Steam potatoes until done, about 40 minutes.
  2. Beat at low speed in mixer until broken.
  3. Change to high speed for 2-3 minutes until no lumps remain.
  4. Mix water and skim milk powder add hot to potatoes.  
Add seasoning.
  5. Beat at low speed until blended. Beat at high speed until fluffy as desired.

Recipe

Dehydrated Granules

1 gal	Hot water from tap, (appro. 170°F.)
14 oz	Skim milk powder
1 #10 can (6 lbs)	Potato granules
3 gal	Hot water from tap
$\frac{1}{2}$ cup	Salt
1 T	Pepper

- Directions:
1. Mix 1 gallon of water and instant skim milk powder in a bowl of mixer on low speed to dissolve.
  2. Add remainder of water.
  3. Gradually empty one can of potato granules into bowl with mixer at low speed, mix until moist. Scrape sides of bowl as necessary.
  4. Add seasoning, mix at high speed until fluffy as desired.

Test 3-4-8

Recipe

MASHED POTATOES

Fresh

45 lbs Potatoes, E. P.  
1 gal Water  
1 lb Skim milk powder  
 $\frac{1}{2}$  cup Salt  
1 T Pepper

- Directions:
1. Steam potatoes until done, about 40 minutes.
  2. Beat at low speed in mixer until broken.
  3. Change to high speed for 2-3 minutes until no lumps remain.
  4. Mix water and skim milk powder, add hot to potatoes. Add seasoning.
  5. Beat at low speed until blended. Beat at high speed until fluffy as desired.
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Recipe

Dehydrated Flakes

2 $\frac{1}{2}$  gal Hot water from tap (approx. 170°F)  
14 oz Skim milk powder  
2 #10 can  
(1 lb-  
12 oz) Potato flakes  
 $\frac{1}{2}$  cup Salt  
1 T Pepper

- Directions:
1. Mix water and skim milk powder in bowl at low speed.
  2. Pour in potato flakes, mix at low speed until moist.
  3. Turn off mixer, allow to stand 1-1 $\frac{1}{2}$  minutes.
  4. Add seasoning, mix at high speed until fluffy as desired.

Test 5

BAKED HAMBURGER PIE

296 lbs Ground beef  
15 lbs Chopped celery  
4 lbs Chopped onions  
3 gals Gravy  
2 lbs Salt  
1 cup Saligen  
1 cup Pepper

200 lbs Potatoes, E. P.  
9 gals Water  
9 lbs Skim milk powder  
1 3/4 " Salt

- Directions:
1. Brown ground beef in stock pot. Skim off fat.
  2. Add all other ingredients, except potatoes.
  3. Steam and mash potatoes.
  4. Scale 5 lbs potatoes into bottom of serving pan, spread with 7 lbs meat mixture, cover with 5 lbs of mashed potatoes. Brush with margarine.
  5. Heat in oven at 375°F, to brown lightly.
  6. Serve with gravy.
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Dehydrated Granules

1 gal Hot water from tap (approx. 170°F.)  
14 oz. Skim milk powder  
1 #10  
can  
(6 lbs) Potato granules  
3 gal Hot water from tap  
1/2 cup Salt  
1 T Pepper

- Directions:
1. Mix 1 gallon of water and skim milk powder in bowl of mixer on low speed to dissolve.
  2. Add remainder of water.
  3. Gradually empty one can of potato granules into bowl with mixer at low speed, mix until moist. Scrape sides of bowl as necessary.
  4. Add seasoning, mix at high speed until fluffy as desired.
  5. Spread 5 lbs of potato into bottom of serving pan, cover with 7 lbs of meat mixture (above recipe) and top with 5 lbs of mashed potato. Brush with margarine.
  6. Heat in oven at 375°F. to brown lightly.
  7. Serve with gravy

Test 6

POTATO PUFF

Fresh

200 lbs Potatoes, E. P.  
4 3/4 lbs Skim milk powder  
4 1/4 lbs Whole eggs, frozen  
3/4 lb. Margarine  
2 1/4 lbs Salt  
4 T Pepper  
6 3/4 gal Water

- Directions:
1. Steam potatoes about 40 minutes.
  2. Mix milk and water, keep hot.
  3. Beat potatoes at low speed until broken.
  4. Change to high speed for 2-3 minutes until no lumps remain.
  5. Add milk and seasonings, beat at low speed to blend.
  6. Add slightly beaten eggs, beat at high speed until fluffy.
  7. Dip into greased baking pans. Brush well with melted margarine.
  8. Bake at 375°F., about 35 minutes, until golden brown.
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Dehydrated Granules

1 #10 can  
(6 lb) Potato granules  
1 gal Hot water from tap (approx. 170°F.)  
14 oz Skim milk powder  
3 gal Hot water from tap  
1 lb Whole eggs, frozen  
3/4 cup Salt  
1 T Pepper  
1 lb Margarine

- Directions:
1. Mix 1 gallon of water and skim milk powder in bowl of mixer on low speed to dissolve.
  2. Add remainder of water.
  3. Gradually empty one can of potato granules into bowl with mixer at low speed, mix until moist. Scrape sides of bowl as necessary.
  4. Add seasoning and slightly beaten eggs. Mix at high speed until fluffy.
  5. Dip into greased baking pans. Brush well with melted margarine.
  6. Bake at 375°F., about 35 minutes, until golden brown.

Test 9

POTATO PUFF

Fresh

10	lbs	Potatoes, E. P.
5	cups	Water
4	oz	Skim milk powder
3	oz	Whole egg
5	oz	Margarine
2	T	Salt
$\frac{1}{2}$	tsp	Pepper

Directions:

1. Steam potatoes about 40 minutes.
2. Mix milk and water, keep hot.
3. Beat potatoes at low speed until broken.
4. Change to high speed for 2-3 minutes until no lumps remain.
5. Add milk and seasonings, beat at low speed to blend.
6. Add slightly beaten eggs, beat at high speed until fluffy.
7. Dip into greased baking pan. Brush well with melted margarine.
8. Bake at 375°F., about 35 minutes, until golden brown.

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Dehydrated Flakes

1	gal	Hot water from tap (approx. 170°F.)
7	oz	Skim milk powder
1	#10	Potato Flakes
3	oz	Whole eggs
4	oz	Margarine
2	T	Salt
$\frac{1}{2}$	tsp	Pepper

Directions:

1. Mix water and skim milk powder in bowl at low speed.
2. Pour in potato flakes, mix at low speed until moist.
3. Turn off mixer, allow to stand 1-1 $\frac{1}{2}$  minutes.
4. Add seasonings and slightly beaten egg, mix at high speed until fluffy.
5. Dip into greased baking pan. Brush well with melted margarine.
6. Bake at 375°F., about 35 minutes, until golden brown.

Test 10-11

CREAM OF POTATO SOUP

Terrell

Fresh

6	lbs	Potatoes, E. P.
3	T	Dehydrated onion flakes
1	cup	Water
1	gal	Hot milk
2/3	cup	Margarine
6	T	Flour
3	T	Salt
1/2	tsp	Pepper

Directions: 1. Cook potatoes and mash.  
2. Soak onion flakes in water  $\frac{1}{2}$  hour.  
3. Melt butter, add flour and blend. Add hot milk and seasonings. Cook until thickened.  
4. Blend mashed potatoes into white sauce.  
5. Heat thoroughly.

Dehydrated Granules

3	T	Dehydrated onion flakes
1	cup	Water
1	gal	Hot milk
1/4	lb	Margarine
3	T	Salt
1/2	tsp	Pepper
1 1/2	lbs	Potato granules

Directions: 1. Soak onion flakes in water  $\frac{1}{2}$  hour  
2. Bring milk to boiling point, add onions, allow to cook until soft.  
3. Add potatoes, blend thoroughly, cook 1 minute stirring constantly.

Dehydrated Flakes

3	T	Dehydrated onion flakes
1	cup	Water
1	gal	Hot milk
1/4	lb	Margarine
3	T	Salt
1/2	tsp	Pepper
14	oz	Potato flakes

Directions: 1. Soak onion flakes in water  $\frac{1}{2}$  hour.  
2. Bring milk to boiling point, add onions, allow to cook until soft.  
3. Add potatoes, blend thoroughly, cook 1 minute stirring constantly.

Test 12

BAKED HAMBURGER PIE

Fresh

15 lbs Ground beef  
8 oz Chopped celery  
3 T Dehydrated onion flakes  
1½ cups Gravy  
2 T Salt  
1 tsp Pepper

10 lbs Potatoes, E. P.  
5 cups Water  
4 oz Skim milk powder  
2 T Salt  
½ tsp Pepper

- Directions:
1. Brown ground beef in oven. Skim off fat.
  2. Add all other ingredients, except potatoes.
  3. Steam and mash potatoes.
  4. Scale 5 lbs potatoes into bottom of serving pan, spread with layer of meat mixture, cover with 5 lbs of mashed potatoes. Brush with margarine.
  5. Heat in oven at 375°F., to brown lightly.

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Dehydrated Flakes

2 qts Hot water from tap (approx. 170°F.)  
7 oz Skim milk powder  
½ #10  
can  
(1lb-12 oz) Potato flakes  
2 T Salt  
½ tsp Pepper

- Directions:
1. Mix water and skim milk powder in bowl at low speed.
  2. Pour in potato flakes, mix at low speed until moist.
  3. Turn off mixer, allow to stand 1-1½ minutes.
  4. Add seasoning, mix at high speed until fluffy.
  5. Scale 5 lbs potatoes into bottom of serving pan, top with meat mixture, cover with 5 lbs potato. Brush with melted margarine.
  6. Heat in oven at 375°F., to brown lightly.

Test 1

<u>Fresh</u>	Time	Steps
Peeling (76#) Potatoes	25:00	42
Potatoes from refrig. to steamer	6:00	64
Mix powdered milk and water	5:05	66
Assemble mixer, bring potatoes	2:00	59
Mix, add milk and season	5:10	81
Stop mixer, dip to pans	2:00	16
Store for use	<u>3:07</u> 48:22	<u>66</u> 394
Total Time 1 hr. 36 min.		
<u>Experimental - Granules</u>		
Open can - to mixer	1:06	20
Measure water into bowl		
add DSM	1:02	10
Mix and add potato	:59	5
Add water and Seasoning	2:07	10
Stop mixer, dip to pans	2:46	10
Store for use	<u>2:58</u> 10:58	<u>101</u> 156
Total Time 12 minutes		



Test 2

<u>Fresh</u>	Time	Steps
Peeling (76#) potatoes	25:00	42
Potatoes from refrig. to steamer	5:00	81
Mix powdered milk and water	4:03	69
Assemble mixer - bring potatoes from steamer	2:09	44
Mix, add milk and season	3:11	90
Stop mixer, dip to pans	2:28	11
Store for use	<u>4:06</u>	<u>45</u>
Production Time	45:57	382

Total Time 1 hr. 40 min.

Experimental - Gramules

Open can - to mixer	1:01	21
Measure water into bowl, add DSM	1:17	11
Mix, add potato	1:07	13
Add water and seasoning	2:01	10
Stop mixer, dip to pans	2:04	8
Store for use	<u>3:01</u>	<u>104</u>
	10:31	167

Total Time 13 min.

Test 3

<u>Fresh</u>	Time	Steps
Peeling (76#) potatoes	25:00	42
Potatoes from refrig. to steamer	5:33	84
Mix powdered milk and water	2:34	109
Assemble mixer - bring potato from steamer	2:06	33
Mix, add milk and season	3:32	60
Stop mixer, dip to pans	2:48	10
Store for use	<u>4:48</u>	<u>102</u>
	46:21	440
Total Time 1 hr. 31 min		
 <u>Experimental - Flakes</u>		
Open can - to mixer	1:30	26
Measure water into bowl add DSM	3:30	5
Mix, add potato and add seasoning	4:34	20
Stop mixer, dip to pans	2:10	17
Store for use	<u>2:02</u>	<u>49</u>
	13:46	117
Total Time 15 min.		

Test 4

<u>Fresh</u>	Time	Steps
Peeling (#76) potatoes	25:00	42
Potatoes from refrig. to steamer	7:28	113
Mix powdered milk and water	2:08	96
Assemble mixer, bring potatoes from steamer	3:02	55
Mix, add milk and season	3:36	45
Stop mixer, dip to pans	2:08	28
Store for use	<u>4:49</u>	<u>107</u>
	48:11	486
Total Time 1 hr. 35 min		
 <u>Experimental - Flakes</u>		
Open can - to mixer	1:36	38
Measure water into bowl add DSM	2:02	12
Mix - add potato and seasoning	4:24	26
Stop mixer, dip to pans	2:44	8
Store for use	<u>2:11</u>	<u>82</u>
	12:47	166
Total Time 14 min.		

Test 5

<u>Baked Hamburger Pie</u>	Time	Steps	
Meat from refrig. unwrap	10:00	48	
To kettle, break large pieces	5:00	48	
Get paddle - stir	3:00	45	
Trays to sink	2:00	20	
Assemble pans	3:00	122	
Tend meat	5:00	131	
Gravy from refrig. to table	1:54	44	
Tend meat, skim fat	14:30	40	
Chop celery and onions	12:50	89	
Weigh ingredients for gravy, blend and stir	24:34	120	
Get celery and onions, add	1:05	20	
Add gravy - stir	<u>2:15</u>	<u>10</u>	
	1:25: 8	737	
 <u>Potatoes - Fresh</u>			
Peel potatoes	15:00	30	(for 33 lbs only)
Potatoes from refrig. to steamer	5:00	82	
Mix DSM and water	6:00	30	
Assemble mixer	4:00	56	
Potatoes steamer to mixer, mix	8:54	74	
Weigh meat and potatoes into pans - (2 pans)	2:06	20	
To oven	<u>1:03</u>	<u>30</u>	
	42: 3	322	
Total Time 4 hrs. 37 min.			

Test 5 continued

<u>Potato Granules</u>	Time	Steps
Open cans - to mixer	2:10	45
Mix milk powder and water	1:03	15
Add potatoes, mix	2:12	8
Add water and seasoning	2:49	18
Stop mixer - move to meat	:51	18
Fill (2) pans with meat and potatoes	2:06	10
To oven	<u>1:03</u>	<u>30</u>
	12:14	144
Total 1:25 8+ 15:01 = 1:40: 9		

Test 6

<u>Potato Puff - Fresh</u>	Time	Steps
Peel Potatoes	25:00	42
Potatoes, refrig. to steamer	7:57	83
Weigh frozen eggs - unwrap margarine	7:15	131
Mix powdered milk and water	6:38	55
Grease pans	2:00	24
Set-up mixer	1:24	18
Potatoes steamer to mixer, mix	2:06	41
Add eggs, seasonings, mix	6:24	40
Dip into pans	5:01	47
To oven	<u>1:09</u>	<u>35</u>
	1:2:54	516

Total Time 2 hrs. 28 min.

<u>Experimental - Granules</u>		
Open potatoes, to mixer	2:06	50
Get DSM - mix with water	2:04	24
Add potatoes, mix	1:04	4
Weigh and add egg, seasonings	2:19	4
Mix	2:25	5
Dip into pans	3:30	25
To oven	<u>1:02</u>	<u>30</u>
	14:30	142

Total Time 16:30  
35  
 51 min. 30 sec.

Test 7

<u>Fresh</u>	Time	Steps
Peeling (76#) potatoes	25:00	42
Potatoes from refrig. to steamer	5:12	80
Mix powdered milk and water	1:14	62
Assemble mixer, bring potatoes from steamer	1:10	50
Mix, add milk and season	3:15	19
Stop mixer, dip to pans	2:38	13
Store for use	<u>4:07</u>	<u>173</u>
	42:36	439
Total Time 1 hr. 42 min.		
<u>Experimental - Granules</u>		
Open cans, to mixer	2:04	80
Measure water into bowl add DSM	1:32	8
Mix, add potato	1:08	9
Add water and seasoning	1:38	10
Stop mixer, dip to pans	2:18	39
Store for use	<u>2:56</u>	<u>84</u>
	11:36	230
Total Time 15 min.		

Test 8

<u>Fresh</u>	Time	Steps
Peeling (76#) potatoes	25:00	42
Potatoes from refrig. to steamer	4:46	98
Mix powdered milk and water	2:26	50
Assemble mixer,	1:08	15
bring potatoes from steamer	3:34	34
Mix, add milk, season	2:02	31
Stop mixer. dip to pans	2:38	21
Store for use	<u>2:59</u>	<u>132</u>
	44:33	427
Total Time 1 hr. 43 min.		

<u>Experimental - Flakes</u>		
Open cans - to mixer	1:24	19
Measure water into bowl, add powdered milk, mix	2:06	20
Add potato and mix	3:65	16
Dip into pans	1:50	16
Store	<u>2:01</u>	<u>85</u>
	11:26	156
Total Time 14 min.		



Test 9

<u>Potato Puff - Fresh</u>	Time	Steps
Peel Potatoes	15:00	16
Potatoes refrig. to steamer	1:36	21
Mix powdered milk and water	1:04	40
Bring potatoes to mixer, mix	:30	15
Add eggs and seasoning	1:22	13
Mix	2:00	12
Dip into pans (2)	2:19	14
To oven	<u>1:00</u>	<u>10</u>
	24:51	141

Total Time 2 hrs. 13 min.

<u>Experimental - Flakes</u>	Time	Steps
Open potatoes, take to mixer	1:36	33
Mix powdered milk and water	2:37	42
Add potatoes, mix	:15	5
Add egg and seasoning	1:60	26
Mix	2:40	15
Dip into pans	2:57	10
To oven	<u>1:00</u>	<u>10</u>
	13: 5	141

Total Time 15 min.  
+ Bake 35  
50

## Test 10

Cream of Potato Soup (Fresh)	Time	Steps
Potatoes , peel	10:00	14
Potatoes from refrig. to steamer	1:36	21
Margarine to stove	:52	32
Measure flour and milk, and onions	1:02	25
Milk to steamer	:30	27
Blend flour and fat	1:06	15
Add onions and milk	:28	35
Tend	24:17	35
Potatoes to mixer, mix	1:05	28
Blend potatoes and white sauce	<u>5:50</u>	<u>10</u>
	46:46	242
Total Time 59 min.		

Experimental - Granules

Open and weigh granules	1:40	30
Measure milk, take to stove	1:30	19
Add onions	:30	29
Tend	5:50	10
Add potatoes, stir	<u>1:55</u>	<u>5</u>
	11:25	93
Total Time 30 min.		

Test 10 continued

<u>Experimental - Flakes</u>	Time	Steps
Open and measure flakes	1:25	16
Measure milk, take to stove	3:05	20
Add onions	:40	20
Get whip and tend	2:35	40
Add margarine	:45	20
Tend	8:30	10
Add potato, stir	<u>1:45</u>	<u>5</u>
	18:45	131
Total Time 20 min.		

## Test 11

BKD Hamburger Pie (Fresh)	Time	Steps
Unwrap meat - to oven	2:22	25
Chop celery - measure onion flakes	3:18	15
Tend meat	1:01	10
Add celery, onion, seasoning, gravy	2:19	6
Tend	1:32	6
Dip into pans, to oven	<u>5:04</u>	<u>10</u>
	15:36	72
Total Time 1 hr. 27 min.		
<u>Fresh Potatoes</u>		
Peel Potatoes	20:00	30
Potatoes from refrig. to steamer	1:36	21
Mix powdered milk and water	1:04	10
Potatoes to mixer	1: 51	15
Add milk and seasoning	1:11	10
Dip	<u>2:03</u>	<u>7</u>
	27:45	93
Total Time 1 hr.		

Test 12

<u>Flake Potato</u>	Time	Steps
Open can - to mixer	2:01	6
Mix powdered milk and water	1:33	4
Add potato and seasoning, mix	3:17	15
Dip	<u>4:01</u>	<u>5</u>
	10:52	30

Total Time 15 min.  
+ 1:27  
1:42:00

COSTS OF FOODS USED

Ingredient Costs

Fresh Potatoes, U. S. #1 Russets	\$3.20/100 lbs.
Ground Beef	.50/lb.
Skim Milk Powder	.155/lb.
Salt	.0214/lb.
Pepper	.63/lb.
Saligen	2.07/lb.
Margarine	.1899/lb.
Frozen whole eggs	.417/lb.
Celery	.133/bunch
Onions, fresh	.10/lb.
Onions, dehydrated	3.00/lb.
Fresh milk	.22 qt.
Flake Potatoes	.92/#10 or 1 lb. 12 oz.
Granule Potatoes	1.58/#10 or 6 lb.

Test No. 1 MASHED POTATOES Ingredients and Labor Cost

Fresh

Yield: 49 pounds

Potatoes, E. P.	45	lbs	\$ 2.43
Water	1	gal	-
Skim milk powder	1	lb	.16
Salt	$\frac{1}{2}$	cup(	.01
Pepper	1	T )	
		Ingredient Cost	<u>\$ 2.60</u>
		Labor Cost	<u>.90</u>
		Total Ingredient and Labor Cost	<u><u>\$ 3.50</u></u>

Dehydrated Granules

Yield: 38 $\frac{1}{2}$  pounds

Water	4	gal	\$ -
Skim milk powder	14	oz	.14
Potato granules	1	#10 can	1.58
Salt	$\frac{1}{2}$	cup(	.01
Pepper	1	T )	
		Ingredient Cost	<u>\$ 1.73</u>
		Labor Cost	<u>.23</u>
		Total Ingredient and Labor Cost	<u><u>\$ 1.96</u></u>

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Test No. 2 MASHED POTATOES Ingredient and Labor Cost

Fresh

Yield: 51 pounds

Potatoes, E. P.	45	lbs	\$ 2.43
Water	1	gal	-
Skim milk powder	1	lb	.16
Salt	$\frac{1}{2}$	cup(	.01
Pepper	1	T )	
		Ingredient Cost	<u>\$ 2.60</u>
		Labor Cost	<u>.86</u>
		Total Ingredient and Labor Cost	<u><u>\$ 3.46</u></u>

Dehydrated Granules

Yield: 39 pounds

Water	4	gal	\$ -
Skim milk powder	14	oz	.14
Potato granules	1	#10 can	1.58
Salt	$\frac{1}{2}$	cup(	.01
Pepper	1	T )	
		Ingredient Cost	<u>\$ 1.73</u>
		Labor Cost	<u>.23</u>
		Total Ingredient and Labor Cost	<u><u>\$ 1.96</u></u>

Test No. 3

MASHED POTATOES

Ingredient and  
Labor Cost

Fresh

Yield: 56 pounds

Potatoes, E. P.	45	lbs	\$ 2.43
Water	1	gal	-
Skim milk powder	1	lb	.16
Salt	$\frac{1}{2}$	cup(	.01
Pepper	1	T )	
		Ingredient Cost	<u>\$ 2.60</u>
		Labor Cost	
Total Ingredient and Labor Cost			<u>.86</u> <u><u>\$ 3.46</u></u>

Dehydrated Flakes

Yield: 23 pounds

Water	$2\frac{1}{2}$	gal	\$ -
Skim milk powder	14	oz	.14
Potato flakes	2	#10 cans	1.85
Salt	$\frac{1}{2}$	cup(	.01
Pepper	1	T )	
		Ingredient Cost	<u>\$ 2.00</u>
		Labor Cost	<u>.29</u>
Total Ingredient and Labor Cost			<u><u>\$ 2.29</u></u>

Test No. 4

MASHED POTATOES

Yield: 53 pounds

Fresh

Potatoes, E. P.	45	lbs	\$ 2.43
Water	1	gal	-
Slim milk powder	1	lb	.16
Salt	$\frac{1}{2}$	cup(	.01
Pepper	1	T )	
		Ingredient Cost	<u>\$ 2.60</u>
		Labor Cost	<u>.90</u>
Total Ingredients and Labor Cost			<u><u>\$ 3.50</u></u>

Dehydrated Flakes

Yield: 24 pounds

Water	$2\frac{1}{2}$	gal	\$ -
Skim milk powder	14	oz	.14
Potato Flakes	2	#10 cans	1.85
Salt	$\frac{1}{2}$	cup(	.01
Pepper	1	T	
		Ingredient Cost	<u>\$ 2.00</u>
		Labor Cost	<u>.27</u>
Total Ingredient and Labor Cost			<u><u>\$ 2.27</u></u>



Test No. 5

BAKED HAMBURGER PIE

Ingredient and  
Labor Cost

Fresh

Ground Beef	229	lbs	\$148.00
Chopped celery	15	lbs	1.55
Chopped onions	4	lbs	.40
Gravy	3	gals	-
Salt	2	lbs	.05
Saligen	1	cup	1.30
Pepper	1	cup	.16
			<u>\$151.46</u>

Potatoes, E. P.	200	lbs	10.80
Water	9	gal	-
Skim milk powder	9	lbs	1.40
Salt	1 3/4	lbs	.04
			<u>\$ 12.24</u>

Ingredient cost for 2 pans used	\$ 10.84
Labor Cost	2.32
	<u>\$ 13.16</u>

Dehydrated Granules

Hot water	4	gals	\$ -
Skim milk powder	14	oz	.14
Potato granules	1	\$10 can	1.58
Salt	1/2	cup(	.01
Pepper	1	T )	-
			<u>\$ 1.73</u>

Ingredient cost for 2 pans used	\$ 10.98
Labor cost	1.96
Total Ingredient and Labor cost	<u>\$ 12.94</u>

Test No. 6

POTATO PUFF

Ingredient and  
Labor Cost

Fresh

Potatoes, E. P.	200	lbs	\$ 10.81
Skim milk powder	4 3/4	lbs	.74
Whole egg, frozen	4 1/4	lbs	1.77
Margarine	3/4	lbs	1.28
Salt	2 1/4	lbs(	.05
Pepper	4	T )	
Water	6 3/4	gal	-
		Ingredient Cost (10 Pans)	\$ 14.65
		" " 2 pans used	2.92
		Labor Cost	1.19
		<b>Total Ingredients and Labor Cost</b>	<u>\$ 4.11</u>

Dehydrated Granules

Potato Granules	1	#10 can	\$ 1.58
Hot Water	4	gals	-
Skim milk powder	14	oz	.14
Whole eggs, frozen	1	lb	.42
Salt	3/4	cup(	.01
Pepper	1	T )	
Margarine	1	lb	.19
		Ingredient Cost	\$ 2.34
		Labor Cost	.29
		<b>Total Ingredient and Labor Cost</b>	<u>\$ 2.63</u>

Test No. 7

MASHED POTATOES

Ingredient and  
Labor Cost

Fresh

Yield: 48 pounds

Potatoes, E. P.	45	lbs	\$ 2.43
Water	1	gal	-
Skim milk powder	1	lb	.16
Salt	1/2	cup(	.01
Pepper	1	T )	
		Ingredient Cost	\$ 2.60
		Labor Cost	.99
		<b>Total Ingredient and Labor Cost</b>	<u>\$ 3.59</u>

Dehydrated Granules

Yield: 68 pounds

Water	8	gals	\$ -
Skim milk powder	28	oz	.28
Potato granules	2	#10 cans	3.16
Salt	1	cup(	.02
Pepper	1	T )	
		Ingredient Cost	\$ 3.46
		Labor Cost	.25
		<b>Total Ingredient and Labor Cost</b>	<u>\$ 3.71</u>

Test No. 8

MASHED POTATOES

Ingredient and Labor Cost

Fresh

Yield: 51 pounds

Potatoes, E. P.	45	lbs	\$ 2.43
Water	1	gal	-
Skim milk powder	1	lb	.16
Salt	$\frac{1}{2}$	cup(	.01
Pepper	1	T )	
		Ingredient Cost	<u>\$ 2.60</u>
		Labor Cost	.98
		Total Ingredient and Labor Cost	<u><u>\$ 3.58</u></u>

Dehydrated Flakes

Water	$2\frac{1}{2}$	gals	\$ -
Skim milk powder	14	oz	.14
Potato flakes	2	10 cans	1.85
Salt	$\frac{1}{2}$	cup(	.01
Pepper	1	T )	
		Ingredient Cost	<u>\$ 2.00</u>
		Labor Cost	.23
		Total Ingredient and Labor Cost	<u><u>\$ 2.23</u></u>

Test No. 9

POTATO PUFF

Ingredient and Labor Cost

Fresh

Yield: 13 pounds

Potatoes, E. P.	10	lbs	\$ .54
Water	5	cups	-
Skim milk powder	4	oz	.04
Whole egg	3	oz	.15
Margarine	5	oz	.06
Salt	2	T (	-
Pepper	$\frac{1}{2}$	tsp)	
		Ingredient Cost	<u>\$ .79</u>
		Labor Cost	.46
		Total Ingredient and Labor Cost	<u><u>\$ 1.25</u></u>

Dehydrated Flakes

Yield: 11 Pounds

Water	1	gal	\$ -
Skim milk powder	7	oz	.07
Potato flakes	1	10 can	.92
Whole eggs	3	oz	.15
Margarine	4	oz	.05
Salt	2	T (	-
Pepper	$\frac{1}{2}$	tsp)	
		Ingredient Cost	<u>\$ 1.19</u>
		Labor Cost	.27
		Total Ingredient and Labor Cost	<u><u>\$ 1.46</u></u>

Test No. 10

CREAM OF POTATO SOUP

Ingredient and  
Labor Cost

Fresh

Yield: 5 Quarts

Potatoe, E. P.	6	lbs	\$ .32
Dehydrated Onion	3	T	.05
Water	1	cup	-
Hot Milk	1	gal	.88
Margarine	2/3	cup	.05
Flour	6	T	.05
Salt	3	T (	.01
Pepper	1/2	tsp)	
		Ingredient Cost	\$ 1.36
		Labor Cost	.93
		Total Ingredient and Labor Cost	<u>\$ 2.29</u>

Dehydrated Gramules

Yield: 5 Quarts

Dehydrated Onions	3	T	\$ .05
Water	1	cup	-
Milk	1	gal	.88
Margarine	1/4	lbs	.05
Salt	3	T (	.01
Pepper	1/2	tsp)	
Potato Gramules	1 1/2	lbs	.41
		Ingredient Cost	\$ 1.40
		Labor Cost	.23
		Total Ingredient and Labor Cost	<u>\$ 1.63</u>

Test No. 11

Dehydrated Flakes

Yield: 5 Quarts

Dehydrated onions	3	T	\$ .05
Water	1	cup	-
Hot Milk	1	gal	.88
Margarine	1/4	lb	.05
Salt	3	T (	.01
Pepper	1/2	tsp)	
Potato flakes	14	oz	.46
		Ingredient Cost	\$ 1.45
		Labor Cost	.39
		Total Ingredient and Labor Cost	<u>\$ 1.84</u>

Test No. 12

BAKED HAMBURGER PIE

Ingredient and  
Labor Cost

Meat Filling

Ground Beef	15	lbs	\$ 7.50
Chopped celery	8	oz	.07
Dehydrated onion	3	T	.05
Gravy	1½	cups	-
Salt	2	T (	-
Pepper	1	tsp)	-
			<hr/>
			\$ 7.62
		Divided into two pans	3.81

Fresh Potato

Potatoes, E. P.	10	lbs	\$ .54
Water	5	cups	-
Skim milk powder	4	oz	.04
Salt	2	T (	-
Pepper	½	tsp)	-
			<hr/>
			.58
		Ingredient Cost	3.81
		Labor Cost	.83
		Total Ingredient and Labor Cost	<hr/>
			\$ 5.22

Dehydrated Flakes

Water	2	qts	\$ -
Skim milk powder	7	Oz	.07
Potato flakes	14	oz	.46
Salt	2	T (	-
Pepper	½	tsp)	-
			<hr/>
			.53
		Ingredient Cost	3.81
		Labor Cost	\$ 4.34
		Total Ingredient and Labor Cost	<hr/>
			.56
			4.90