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EGG PRODUCTS FOR USE IN A COOK-FREEZE SYSTEM

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UNITED STATES ARMY
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NATICK, MASSACHUSETTS 01760



Food Engineering Laboratory
FEL-57

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19. ABSTRACT (Continue on reverse side if necessary and identify by block number) It was the purpose of this study to develop a number of egg dishes suitable for the breakfast meal which could be frozen successfully. Production guides for seven egg dishes and three sauces were written. Each Production Guide was tested by making a batch of the product, using raw materials and equipment commonly found in a central food preparation facility, and evaluating each product using a panel of trained food technologists. The results reported herein indicate the products were generally accepted.		

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PREFACE

There are some foods which do not lend themselves to freezing because of adverse effects on overall quality. Generally speaking, the breakfast meal category represents the lowest percentage of food components which can be frozen successfully. It was the purpose of this study and the project order which preceded it with the USDA to develop a number of egg dishes suitable for the breakfast meal and which could be frozen successfully.

This work was performed under project 1T762724AH99 Food Technology; work unit 631 25 206 069.

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INTRODUCTION

EGG PRODUCTS FOR USE IN A COOK FREEZE SYSTEM

The Food Service Industry has been moving more and more toward the use of convenience foods, central preparations of food for distribution to satellite outlets, and in the direction of other significant changes which decrease costs and conserve scarce trained help. The Armed Services too have been moving in the same direction. Because of their convenience and excellent quality, frozen foods are being used in increasing amounts.

The Armed Services Recipe Service has recipes for use by all of the Armed Services in their normal feeding facilities. However, these recipes are designed on the basis of 100 servings prepared by using customary kitchen equipment and served immediately. These recipes must be redesigned if they are to be used in a specialized frozen food system utilizing foods prepared by high volume production techniques. To this end, the Natick Research and Development Command (NARADCOM) formerly the US Army Natick Development Center (NDC), has developed a large number of production guides to be used in frozen food systems.

In July 1972, the U.S. Army Natick Development Center, renamed the U.S. Army Natick Research and Development Command, entered into a project order with the U.S.D.A. Western Marketing and Research Division, Berkeley, CA to "determine the feasibility of developing a variety of frozen egg products suitable for serving at Air Force Missile Sites." The criteria set up to guide the development effort were: (a) the egg products after freezing and prepared for consumption must be recognizable as a familiar meal item; (b) the products must be suitable for reheating in a microwave oven and in an infrared oven which can also function as a convection oven; (c) the products must be adaptable to packaging as individual servings in flexible pouches and as modules of 8 to 16 servings in flexible or semi-rigid commercial containers.

The results of the project order were reported by Palmer et al. in 1974.* The U.S.D.A. developed seven egg dishes and three sauces, each egg dish containing at least one egg per serving.

*Palmer, H. H., Lee-Shin Tsai, K. Ljicki, and C. A. Hudson, 1974. Frozen Egg Products for Air Force Missile Sites. Technical Report 75-73-FEL. US Army Natick Research Development Command (AD A009 749).

MATERIALS AND METHODS

The recipes in the 1974 technical report were converted into production guides, which are shown in this report as in Tables 1 through 10. Each production guide was tested by making a small batch for preliminary screening by members of the Dairy, Poultry, and Dehydrated Products Section, Animal Products Group, plus others, selectively chosen. Any changes in the formulations suggested by this group were made.

Following the preliminary screening, a large batch of each product was produced. Product made in accordance with each formulation was evaluated by a panel of food technologists (Table 11). A quality scale of 9 points was used where a rating of 1 is extremely poor and 9 is excellent. The technological panel evaluated the products for color, odor, flavor, texture, and appearance.

Production guide for scrambled eggs (Table 5 Footnote 2e) requires that the eggs be mechanically mixed to break them into the desired piece sizes. To determine the effect on texture (Table 12) the scrambled eggs were mixed for 30, 60, 90 and 120 seconds, respectively, at speed setting 1 on a Hobart Model N50 mixer, then packaged in half-size aluminum steam table pans and frozen at -28.9°C . The eggs were reheated for serving in an air convection oven set at 204°C .

RESULTS AND DISCUSSION

A preliminary screening of the egg products indicated that the Western Egg was too dark in color, even though the flavor was judged excellent. A change in formulation was made (Table 4) reducing the amount of soy sauce by one-half and adding 0.05 percent monosodium glutamate. This improved the overall acceptance of the item (Table 11).

The results of the organoleptic evaluation of the scrambled eggs are shown in Table 12. In general, the length of mixing time seemed to have little influence on the organoleptic factors studied. Comments by the panelists indicate that the production guide method of producing scrambled eggs produced a slightly drier texture than fresh eggs scrambled on a grill or frying pan. However, a more consistent product is obtained by the Production Guide Method (Table 5).

Creamed eggs with turkey and with chicken were borderline in acceptability. The most probable reason for the low acceptance is that these items were not as familiar to the panelists as the other products tested.

CONCLUSIONS

It may be concluded from the results of this effort that:

1. The Feasibility of developing a variety of frozen egg products suitable for serving at Air Force Missile Sites has been determined.
2. Seven Egg Dishes and three sauces were developed which substantially met the development criteria set forth in the introduction of this report.

Table 1. Production Guide for French Toast

Yield: 100 Portions

Each Portion: 2 Slices

Ingredients	Per - centage	Pounds	Grams	Procedure
Eggs, whole	50.33	12.40	5,624.6	1. Mix ingredients into a smooth batter.
Milk, whole	48.55	11.95	5,420.5	
Salt	1.12	0.27	122.5	
Breads ¹				2. Dip bread into batter for 30 to 45 seconds per slice.
Shortening or oil		2.03	925.0	3. Fry slices in a thin layer of shortening on a grill or electric skillet at 188°C (370°F) for approximately 2.25 minutes per side or until golden brown. 4. Cut cooked toast slices in half diagonally. 5. Pack 4-halves in each aluminum pan and cover with proper lid. ² 6. Mark and freeze.
TOTALS	100.00	24.62	11,167.6	

¹ 200 slices.

² Eko No. 7036 with foil/paper lid or equivalent.

Reconstitution:

a. Air convection oven: Place frozen slices on a sheet pan and heat in oven (204°C, 400°F) for 11 minutes.

b. Microwave oven: In the presence of a beaker of water in the oven, place two frozen slices on pyrex pan. Heat for 30 seconds. Turn off for 30 seconds. Repeat for four heating cycles.

Table 2. Production Guide for Egg and Potato Patty with Bacon

Yield: 100 Portions

Each Portion: 2 Patties

Ingredients	Per-centage	Pounds	Grams	Procedure
Egg, whole	40.57	11.01	4,994.1	1. Mix until milk, salt, and monosodium glutamate are dissolved.
Milk, nonfat, dry	4.06	1.10	499.0	
Onion flakes, dry	1.62	0.44	199.6	
Salt	0.81	0.22	100.0	
Monosodium glutamate	0.16	0.04	18.1	
Pepper, black	0.03	0.01	4.5	
Potatoes, shredded, hash browns, thawed	48.69	13.21	5,992.1	2. Mix 30 grams (1.1 ounces) of potatoes and 25 grams (0.9 ounces) of egg mixture. 3. Add 2.5 grams (0.09 ounce) of bacon bits to each potato-egg portion. 4. Drop onto a buttered or oiled skillet or griddle at 171°C (340°F). Form into 9-cm (3.5-in.) patties as they cook. Fry for two minutes on each side. 5. Pack 2 patties in each aluminum pan.* 6. Cover, mark and freeze.
Bacon bits	4.06	1.10	499.0	
TOTALS	100.00	27.13	12,306.1	

*Eko No. 7036 with foil/paper lid or equivalent.

Reconstitution:

a. Air convection oven: Heat for 30 minutes at 204°C (400°F) covered with aluminum foil.

b. Microwave oven: Remove patties from foil pan to glass dish. Heat for 30 seconds. Turn off for 30 seconds. Repeat for three heating cycles.

c. Serve with tomato catsup.

Table 3. Production Guide for Creamed Egg and Beef, Chicken or Turkey
On Toast

Yield: 100 Portions

Each Portion: 200 grams
(7 ounces)

Ingredients	Per- centage	Pounds	Grams	Procedure
Ground beef, chicken or turkey meat, raw	23.32	11.03	5,003.2	1. Mix. Form a loaf covering the bottom of one or more baking pans. 2. Cook by steaming for 45 minutes in a steam cooker at atmospheric pressure. Cool and re- frigerate overnight. 3. Dice to 0.95 cm (0.375 in.)
Egg, whole	2.59	1.22	553.4	
Salt	0.18	0.08	36.3	
Onion flakes, dry	0.08	0.04	18.1	
Monosodium glutamate	0.03	0.01	4.5	
Pepper, black	0.03	0.01	4.5	
Thyme (with Turkey)	0.01	0.01	4.5	
Egg yolk	14.25	6.74	3,057.3	4. Stir until dry in- gredients are dissolved. 5. Pour into one or more baking pans. Cook by steaming in a steam cooker at atmospheric pressure for 15 minutes. Cool and refrigerate. 6. Dice to 0.95 cm (0.375 in.)
Egg white	6.22	2.94	1,333.6	
Water	5.18	2.45	1,111.3	
Salt	0.18	0.08	36.3	
Monosodium glutamate	0.03	0.01	4.5	
Milk, whole	21.50	10.17	4,613.1	7. Blend dry ingredients with margarine in a steam jacketed kettle or double boiler until uniform. Add liquids, continue stirring and scraping sides until thickened and smooth. 8. Mix white sauce, diced meat and diced egg to- gether in a 2:1:1 ratio by weight. 9. Fill 200 grams (7 ounces) into 16x20 cm (6.5x8 inch) scotch pak pouches.* 10. Seal, mark and freeze.
Beef or chicken broth	20.72	9.81	4,449.8	
Flour, rice	2.33	1.10	499.0	
Margarine	1.68	0.80	362.9	
Flour, general purpose	1.16	0.55	249.5	
Salt	0.33	0.15	68.0	
Onion flakes, dry	0.08	0.04	18.1	
Monosodium glutamate	0.05	0.02	9.1	
Pepper, black	0.03	0.02	9.1	
Thyme (with Turkey)	0.02	0.01	4.5	
TOTALS	100.00	47.29	21,450.6	

*Kapak Industries stock No. 201, 9809 Logan Ave. So., Bloomington,
MN 55431

Reconstitution:

a. Air convection oven: Punch 10-12 holes in one surface of pouch. Place in pan and heat in a 204°C (400°F) oven for 35 minutes.

b. Microwave oven: Punch holes as above. Place pouch in a Pyrex baking dish. Heat for one minute on, one minute off. Repeat for three heating cycles.

Serve on 2 slices of toast.

Table 4. Production Guide for Western or Denver Egg

Yield: 100 Portions

Each Portion: 164.3 Grams
(5.8 ounces)

Ingredients	Per-centage	Pounds	Grams	Procedure
Egg white/methocel 1/	15.82	5.73	2,599.1	1. Heat 584.0 grams (20.6 oz) of water to 90°C (194°F). Gradually add 120.8 grams (4.3 oz) of methocel and stir with a mechanical mixer using a flat paddle and 2,332.4 grams (82.3 ozs) of cold blended egg white and chill to 10°C (50°F). Use 2,599.1 grams (91.6 ounces) of this mixture.
Onion, dehydrated, minced	0.51	0.18	81.6	2. Rehydrate onions in 749.7 grams (26.4 ounces) of water.
Peppers, green, finely chopped	4.56	1.65	748.4	3. Saute onions and peppers in oil and butter.
Oil, vegetable	1.98	0.72	326.6	
Butter	1.98	0.72	326.6	
Flour, rice	3.65	1.32	598.7	4. Add flour and water and cook briefly.
Water	15.21	5.51	2,499.3	
Water chestnuts, canned chopped	6.84	2.48	1,124.9	5. Blend egg white/methocel, sauteed onions and peppers, flour and water, water chestnuts, soy sauce, black pepper, smoke salt, nonfat dry milk, and egg yolk.
Soy sauce	1.82	0.66	299.4	
Monosodium glutamate	0.05	0.02	9.1	
Pepper, black	0.08	0.03	13.6	
Smoke salt	0.09	0.03	13.6	
Milk, Nonfat, dry	1.52	0.55	249.5	
Egg, yolk, blended	30.68	11.11	5,039.5	

Ingredients	Per-centage	Pounds	Grams	Procedure
Ham, chopped	15.21	5.50	2,499.3	6. Dice ham approximately 0.6 to 0.9 cm (0.25 to 0.375 in.) weight 35 grams (1.2 ounces) into each aluminum pan ² . 7. Add 130 to 135 grams (4.6 to 4.8 ounces) of egg mixture. Stir to blend. 8. Cover with lid and aluminum foil. 9. Steam for 13 minutes ³ . 10. Cover, mark and freeze.
TOTALS	100.00	36.22	16,429.2	

¹ Methocel MC, Dow Chemical Co., premium grade (food use), 15 cps.

² Ekco No. 7036 with foil/paper lid or equivalent.

³ These eggs can be easily overcooked.

Reconstitute by heating (lid on pan) in an air convection oven at 149°C (300°F) for 35 to 40 minutes.

Table 5. Production Guide for Scrambled Eggs with Bacon.

Yield: 100 Portions

Each Portion: 164.3 Grams
(5.8 Ounces)

Ingredients	Percentage	Pounds	Grams	Procedure
Eggs, whole	69.06	17.63	7,997.0	1. Mix eggs and milk in a mixer until smooth.
Milk, whole	17.27	4.41	2,000.4	
Starch, freeze-thaw stable	1.44	0.37	167.8	2. Blend dry ingredients well; add to egg-milk mixture with continuous stirring.
Monosodium phosphate monohydrate	0.43	0.11	50.0	
Salt	0.36	0.01	4.5	
Butter	1.08	0.27	122.5	3. Melt butter; add egg and continue mixing until dry ingredients are dissolved.
Bacon bits ¹	10.36	2.64	1,197.5	4. Cook eggs as shown in foot note. ²
				5. Pack 100 grams (3.5 ounces) of cooked egg ² into each aluminum pan. ³ Sprinkle 12 grams (0.4 ounces) of bacon bits on top of eggs.
				6. Cover, mark and freeze.
TOTALS	100.00	25.44	11,539.7	

¹ Use real bacon bits.

² Cook eggs as follows:

- a. Cut high density polyethylene tubing 7.6 cm (3 in.) wide into 38 cm (15 in.) lengths. Seal one end with a metal clip.
- b. Fill tubings with egg mixture and clip the open end. The clip should be approximately one inch above the level of the egg mixture. Eliminate as much air as possible from the egg mixture to prevent buoyancy and bursting problems.
- c. Cook the eggs in 75°C (167°F) water for 80 minutes.
- d. Cool cooked eggs to room temperature. Eggs may be kept at 2° to 3° (36° to 37°F) for up to 30 days before further processing.

- e. Open tubings and put the egg content into mixer bowl equipped with a wire whip. Break the cooked eggs into the desired chunk size by control of speed and length of whipping.
- f. Package as shown in step 5 of procedures.

³Ekco No. 7036 with foil/paper lid or equivalent.

Reconstitution:

- a. Air convection oven: Heat (lid on pan) at 204°C (400°F) for 30 to 35 minutes.
- b. Cold air convection oven: Put pan (lid on) in cold oven. Set temperature to 232°C (450°F) and heat 35-40 minutes.
- c. Microwave oven: Move eggs from aluminum pans into a nonmetal container with cover. Heat for 30 seconds. Turn off for 2.5 minutes. Heat for an additional 30 seconds.

Table 6. Production Guide for Puffy Omelet

Yield: 100 Portions

Each Portion: 150 Grams
(5.3 Ounces)

Ingredients	Percentage	Pounds	Grams	Procedure
Margarine	9.94	3.86	1,750.9	1. In a steam kettle: melt margarine. Add dry ingredients mixed together. Stir to blend. Add water gradually with continuous stirring and heating until mixture thickens and reaches a temperature of 80°C (176°F).
Milk, nonfat, dry	4.26	1.65	748.4	
Methocel ¹	0.99	0.38	172.4	
Flour, rice	3.55	1.38	626.0	
Flour, general purpose	3.55	1.38	626.0	
Salt	0.71	0.28	127.0	
Water	40.63	15.76	7,148.7	
Egg yolk, blended	13.92	5.40	2,449.4	2. Beat egg yolk at high speed for 200 seconds (3.3 minutes) scraping bowl after 160 seconds (2.7 minutes). Add hot white sauce and beat at medium speed for 100 seconds (1.7 minutes). Scrape bowl after 50 seconds.
Egg, white, blended	22.45	8.71	3,950.9	3. Beat egg white at high speed until stiff but not dry. Fold 3,120 cm ³ (13 cups) of egg white into yolk mixture, then fold in remaining whites. 4. Place 150 grams (5.3 ounces) into aluminum pans ² . Add cover with a smaller pan with a one inch hole cut in the center. 5. Bake at 107°C (225°F) for one hour. 6. Cover, mark and freeze.
TOTALS	100.00	38.80	17,599.7	

¹ Methocel mc, Dow Chemical Co., premium grade (food use), 15 cps.² Ekco No. 7036 with Foil Paper lid or equivalent.

Reconstitution: Remove lide and cover omelet loosely with aluminum foil. Heat at 149°C (300°F) for 50 to 60 minutes. With Sauce: Remove frozen sauce (spanish, cheese or chipped beef) from package and place on top of omelet. Heat 60 minutes

at 149°C (300°F).

Table 7: Production Guide for Potato Pancakes

Yield: 100 Portions

Each Portion: 2 Pancakes

Ingredients	Percentage	Pounds	Grams	Procedure
Egg, whole	42.60	11.01	4,994.1	1. Mix milk, salt and monosodium glutamate with water and eggs until dissolved.
Milk, nonfat, dry	2.84	0.73	331.1	
Water	2.84	0.73	331.1	
Salt	0.43	0.11	50.0	
Monosodium glutamate	0.17	0.04	18.1	
Potatoes, shredded, hash browns	51.12	13.21	5,992.1	2. Mix portions of 30 grams (1.1 ounces) of potatoes and 25 grams (0.9 ounces) of egg mixture. 3. Drop onto greased skillet or griddle at 171°C (340°F). Form into 8.9 cm (3.5 inch) patties as they cook. Fry for 2 minutes on each side. 4. Pack 2 pancakes in each aluminum pan.* 5. Cover, mark and freeze.
TOTALS	100.00	25.83	11,716.5	

* Ekco No. 7036 with foil/paper lid or equivalent.

Reconstitution:

a. Air convection oven: Heat 30 minutes at 205°C (400°F) covered with aluminum foil.

b. Microwave oven: Remove patties from foil pans to glass dish. Heat for 30 seconds, turn off for 30 seconds. Repeat for 3 on cycles.

Table 8. Production Guide for Spanish Sauce

Yield: 100 Portions

Each Portion: 60 Grams
(2.1 Ounces)

Ingredients	Percentage	Pounds	Ounces	Procedure
Onion flakes, dry	0.32	0.04	19.2	1. Soak dry vegetables in water for 10 minutes.
Pepper, sweet flakes, dry	0.32	0.04	19.2	
Parsley flakes, dry	0.03	0.004	1.8	
Water	4.78	0.63	286.8	
Margarine	4.78	0.63	286.8	2. Melt margarine and cook vegetables lightly for 5 minutes.
Tomatoes, peeled, chopped, canned	89.24	11.72	5354.4	3. Add tomatoes and spices
Salt	0.47	0.06	28.2	
Pepper, black	0.02	0.003	1.2	Simmer until reduced to 2/3 volume.
Oregano, ground	0.02	0.003	1.2	4. Fill 60 grams (2.1 ounces) into 4 X 6 inch pouches.*
Garlic powder	0.02	0.003	1.2	
				5. Seal, mark and freeze.
TOTALS	100.00	13.133	6000.0	

*Kapak Industries Stock No. 203; 9809 Logan Ave. So., Bloomington, MN 55431.

Reconstitute by removing from pouch and placing on top of a fluffy omelet.
Follow heating directions for omelet.

Table 9. Production Guide for Creamed Chipped Beef Sauce

Yield: 100 Portions

Each Portion: 60 Grams
(2.1 Ounces)

Ingredients	Percentage	Pounds	Grams	Procedure
Milk, nonfat, dry	6.75	0.89	405.0	1. Reconstitute milk
Water	64.82	8.50	3,889.2	
Margarine	8.10	1.06	486.0	2. Melt margarine.
Flour, general purpose	2.03	0.27	121.8	3. Add flours and pepper. Stir until smooth.
Flour, rice	2.03	0.27	121.8	4. Add milk gradually and stir over medium heat until mixture comes to a boil and thickens.
Pepper, black	0.07	0.01	4.2	
Beef, chipped, dried	16.20	2.13	972.0	5. Shred beef. Add to white sauce and heat slowly for 5 minutes.
				6. Fill 60 grams (2.1 ounces) into 4 X 6 inch pouches.
				7. Seal, mark and freeze.
TOTALS	100.00	13.13	600.00	

* Kapak Industries Stock No. 203; 9809 Logan Ave., So., Bloomington, MN 55431.

Reconstitute by removing from pouch and placing on top of Fluffy Omelet. Follow heating directions for Omelet.

Table 10. Production Guide for Cheese Sauce

Yield: 100 Portions

Each Portion: 60 Grams
(2.1 Ounces)

Ingredients	Percentage	Pounds	Grams	Procedure
Cheese, processed American	66.64	10.01	4,540.5	1. Cut cheese into 0.5 inch cubes.
Milk, whole	33.35	5.01	2,272.5	2. Combine ingredients in a double boiler or other suitable vessel. Heat and stir until cheese is melted and sauce is smooth.
Pepper, black	0.01	0.01	4.5	3. Fill 60 grams (2.1 ounces) into 4 X 6 inch pouches.*
				4. Seal, mark and freeze
TOTALS	100.00	15.03	6,817.5	

*Kapak Industries Stock No. 203; 9809 Logan Ave. So., Bloomington, MN 55431.

Reconstitute by removing from pouch and placing on top of a fluffy omelet. Follow heating directions for omelet.

Table 11. Mean Organoleptic Ratings for Egg Dishes

Egg Product	Organoleptic Factor				
	Color	Odor	Flavor	Texture	Appearance
Potato Pancakes <u>1/</u>	6.0	6.5	6.2	6.3	5.9
Creamed Egg and Chicken <u>1/</u>	6.0	6.8	5.5	6.0	5.6
Creamed Egg and Turkey	6.1	6.7	5.5	6.2	5.7
Western Egg <u>2/</u>	6.4	6.5	6.9	6.5	6.3
Puffy Omelet with Cheese Sauce <u>2/</u>	6.9	7.1	7.1	6.8	7.0
Puffy Omelet with Spanish Sauce <u>2/</u>	7.0	6.9	6.4	6.6	6.8
Puffy Omelet with Creamed Chipped Beef Sauce <u>3/</u>	6.8	6.9	7.2	7.1	6.5
Egg and Potato Patty with Bacon <u>4/</u>	7.1	7.0	6.8	6.4	7.1
French Toast <u>1/</u>	6.9	7.0	6.8	6.3	6.9

1/ N = 11

2/ N = 13

3/ N = 5

4/ N = 14

Table 12. Mean Organoleptic Ratings for Scrambled Eggs Mixed for Various Lengths of Time

Length of Mixing (Sec.)	Organoleptic Factor				
	Color	Odor	Flavor	Texture	Appearance
30	6.8*	6.6	6.6	5.6	6.6
60	6.8	6.7	6.4	5.9	6.4
90	6.8	6.3	6.7	6.1	6.5
120	6.8	6.6	6.1	5.8	6.5

*N = 13