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Palatability of Precooked Frozen Meat Products

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CONTENTS

SUMMARY

Formulas were developed for 17 precooked frozen meat products. Combinations included vegetables, fruits, and farinaceous products with beef, pork, and lamb. Samples were stored (-10°F to -20°F or -23°C or -29°C) in polyethylene containers or heat sealed boil-in-pouch bags. Sensory evaluations were conducted by a panel of laboratory personnel.

Considering a mean score of 5.0 (neither like nor dislike) and a score above as an indication of acceptability and three months as a minimum storage time, 16 of the products have commercial potential. Those containing farinaceous products demonstrated the longest shelf life. Lamb products were less tolerant of frozen storage than either beef or pork. There was a tendency for products containing sodium tripolyphosphate plus sodium ascorbate as the antioxidant to have a shorter shelf life than those without it. Based on this work no such conclusion can be made regarding the use of BHA. The formulas in this study represent classes of foods within which numerous variations can be made to enhance their commercial potential.

ACKNOWLEDGEMENT

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INTRODUCTION

Although a wide variety of precooked frozen foods has appeared on the market in recent years, improved palatability of this type of food is still a matter of major concern. Kahlenberg *et al.* (1961) developed a formula for a frozen beef stew which was preferred by a taste panel over a canned product. The frozen stew, containing U.S. Choice grade of beef, was preferred for the first nine months, but at the end of 12 months the canned product was rated higher than the frozen stew made with U.S. Cutter grade meat.

Bramblett and co-workers (1965) found the quality of cooked frozen beef with gravy acceptable through 12 months of storage, although reheated frozen samples were slightly less palatable than the freshly cooked meat. Palatability, except for juiciness, was rated higher for pork roasts when cooking followed rather than preceded freezing (Watts *et al.,* 1948).

The relationship of temperature of storage to quality of precooked frozen food was emphasized by Tinklin *et al.* (1950) and Harrison *et al.* (1953). A storage temperature of -10°F (-23.3°C) was more effective than 0°F (-17.8°C) in protecting the quality of beef products that were stored six months or longer. The storage life of pork stew was limited regardless of storage temperature. During a nine month storage period, precooked beef stew, pork stew, and swiss steak, all, gradually decreased in desirability (Harrison *et al.,* 1953).

A partial precooking procedure, "roasteak," for large boneless cuts of beef was found to yield acceptable meat when the precooking was followed by freezer storage. However, mean scores for aroma, flavor, and general acceptability were lower for broiled slices which had been preroasted, sliced, and frozen than for those from freshly preroasted meat. "Roasteak" slices of meat treated with antioxidant prior to freezing were rated higher than untreated samples for general acceptability and for flavor but not for aroma (Baldwin and Korschgen, 1968).

It is apparent that acceptable precooked or partially precooked frozen meat products have been produced but their quality is not as high as that of their unfrozen counterparts. It was the purpose of this study to develop new commercially adaptable precooked frozen meat products and to evaluate their palatability over an extended period of frozen storage.

PROCEDURE

Investigations included three species of meat: beef, pork, and lamb. For each species, formulas were developed which included vegetables, fruits, or some type of farinaceous product. Where sauces were needed, thickening was achieved by a freeze-stable starch. In most cases, samples were prepared with and without antioxidant and were stored in polyethylene containers (1-pt) or heat sealed bags (Polyethylene-Saran-Mylar-Laminated bag, International Kenfield Distributing Co., Chicago, Ill.) in a home type freezer at approximately -10°F to -20°F (-23°C to -29°C). Butylated hydroxyanisole (BHA) was used at the 0.02 percent level in formulas where a fat soluble antioxidant was needed. Sodium tripolyphosphate plus sodium ascorbate (1 g $Na_5P_3O_{10}$ and 0.27 g $NaC_6H_8O_6$ made to 100 ml with distilled water) was used where an antioxidant dip was needed for the meat.

Enough of each formula was prepared at one time to provide for periodic sampling throughout one year. However, testing was terminated if quality of the product fell into the undesirable classification (mean score for general acceptability below 5.0) before one year of storage was completed. Formulas and procedures for preparing the precooked frozen products are listed in Appendix tables.

Precooked Frozen Beef Products

Beef broth. Meat cubes (1 to 3 in.) were browned in a preheated pressure cooker. Then ½ cup of water per pound of meat was added, and the meat was cooked 20 minutes at 15 psi. Broth was collected, cooled quickly in pans held in ice water, and strained through a stainless steel strainer. All batches of broth were mixed.

Since availability of meat broth is a limiting factor in the production of gravy, evaluations were made of gravies containing different amounts of broth:

(a) 66⅔% meat broth plus 33⅓% water.
(b) 50% meat broth plus 50% water.
(c) 25% meat broth plus 50% water plus 25% broth made with hydrolyzed plant protein (Maggi hydrolyzed plant proteins, 22% Type 245 and 0.8% Type 4BE in water, The Nestle Co., White Plains, New York).

It was decided to use (b) 50% meat broth plus 50% water for all further work with gravy (Table I). The seasonings and colorings for gravies are listed in Table II.

Cubed beef for stew. Preliminary work with beef stew included a study of the influence of size of vegetable pieces and of meat cubes, methods of browning the meat, type of liquid for the stew, and type of antioxidant. However, the major part of the work dealt with preparation of the meat for a stew but not with the formula for stew.

Cubed beef (U.S. Utility grade) was cooked in two types of liquid and made into stew after freezer storage by cooking commercially frozen vegetable (Stokley's frozen vegetables for stew) with the meat while it was heated for serving.

The ingredients and the procedure for preparing beef for stew are listed in Table III. BHA was added to the fat in which half of the beef was browned as indicated in Table III. The remainder of the meat was prepared in the same way but without antioxidant.

Swiss steak. Prior to adopting the recipe for swiss steak which is given in Table IV, the following procedures were evaluated:

(a) "Roasteak" method for precooking meat (Korschgen *et al.,* 1963).
(b) Pressure cooking meat prior to slicing.
(c) Slicing and browning meat prior to cooking in oven or pressure cooking.
(d) Slicing, coating with flour, pounding, and browning meat prior to cooking in oven or pressure cooking.
(e) Use of water rather than tomato juice as the cooking liquid.

Beef with noodles and with spaghetti. Bottom round of beef (U.S. Utility grade) was browned in rendered suet, containing BHA, after which it was pressure cooked (15 psi) to the well done stage 180°F (82°C) and sliced ¼ inch thick (U.S. Berkel, U.S. Slicing Machine Co., Laporte, Ind.). One slice of meat (approximately 90 g or 3 oz) was packaged in each boil-in-pouch bag and covered with approximately ¾ c (175 g) of cooked noodles and gravy (1:1) or spaghetti and gravy (1:1). The ingredients for the gravy are listed in Table I.

Beef pie. As a test product for meat combined with pastry, the stew developed by Kahlenberg *et al.* (1961) was prepared for filling meat pies. Minor modifications in procedure were introduced. The size of the meat cubes (U.S. Utility grade) was reduced to ⅜ inch and the peas and carrots were boiled one minute before adding them to the stew mixture.

Pastry made with oil (Christy *et al.,* 1963) and with hydrogenated fat, and biscuit dough (Amick and Rodgers, 1960) made with hydrogenated fat were used for the meat pies. All pies were prepared in aluminum pans (6 in. diameter) with the bottoms painted black to maximize absorption of heat and promote baking of the bottom crust. Double aluminum foil was used to wrap the pies before they were inserted in protective bags and frozen. The tops of the pastry crusts were pricked before the frozen pies were baked at 375°F (191°C) for one hour. To prevent over-browning of the biscuit dough crust, which contained nonfat dry milk solids, it was necessary to cover the pie with brown paper for the final 40 minutes of baking.

Beef with pastry. A rump roast (U.S. Choice grade) was wrapped in heavy duty aluminum foil and cooked to an internal temperature of 160°F (71°C) in an oven with the thermostat set at 350°F (177°C). The cooked meat was sliced ⅛ inch thick. About one ounce (30 g) of sliced meat was sealed in each folded rectangle of pastry (3 x 8 x ⅛ in.) prepared from a standard recipe using hydrogenated shortening. The following variations were prepared for the beef:

(a) Sliced beef dipped in antioxidant.
(b) Sliced beef, dipped in antioxidant, plus 5 ml of broth from the roast
(c) Sliced beef plus 5 ml of gravy (Table V).

Beef sauerbraten. Preliminary work on sauerbraten included a storage study on round of beef (U.S. Utility grade) marinated for three days, and cooked in the marinade. Then it was sliced and packaged for freezing. The major study was based on a formula and procedure which did not require marinating the meat. U.S. Good grade top round of beef for this product was cooked at 180°F (82°C) to an internal temperature of 165°F (74°C). The sauerbraten sauce was prepared with beef broth, acidified with vinegar and lemon juice, seasoned with onion powder, ginger, bay leaf, salt, and cloves; sweetened; and thickened with modified tapioca starch (Fruitfil No. 4, Morningstar Products, A.E. Stanley Mfg. Co., Decatur, Ill.). The meat was sliced, and single slices (approximately 70 g or 2½ oz) were packaged in heat sealed polyethylene bags with ⅓ c (58 g) of sauerbraten sauce. For half of the packages, the meat was dipped in antioxidant before packaging.

Beef stroganoff. The formula and procedure for preparation of beef stroganoff are shown in Table VI. A dried milk ingredient (Beatreme, Beatrice Food Co., Chicago, Ill.) was substituted for the sour cream which generally is used in stroganoff. For antioxidant treatment, BHA was added to the beef suet in the formula and the meat (U.S. Choice grade) was dipped in sodium tripolyphosphate and sodium ascorbate solution as indicated in Table VI. Meat in half of the packages was given no antioxidant treatment.

Precooked Frozen Pork Products

Tables VII, VIII, and IX list the ingredients and procedures which were developed for the following precooked frozen pork products: pork with fruit, sweet sour pork, and pork tetrazzini. BHA and antioxidant dip were used for tetrazzini as described above for stroganoff. For the other recipes, half of the samples were treated with the antioxidant dip as indicated in Tables VII and VIII. Pork with pastry was prepared as described for beef, but the boned pork loin was cooked to an internal temperature of 165°F (74°C). This cooked pork for the pastry product was prepared as follows:

(a) Sliced pork dipped in antioxidant.
(b) Sliced pork, dipped in antioxidant, plus fruit (1 apple ring, unpeeled and steamed 2 minutes, and a few raisins) and 2 g brown sugar.
(c) Sliced pork without antioxidant but with fruit and sugar as described above.

Precooked Frozen Lamb Products

The ingredients and procedures for four precooked lamb recipes are included in Tables X, XI, XII, and XIII. For cubed lamb for stew, only BHA was used as the antioxidant (Table X) and it was added to the drippings for half of the meat. For lamb with fruit and lamb curry, only the antioxidant dip was used to

treat half of the meat as shown in Tables XI and XII. Antioxidant treatment for lamb with vegetables was the same as described for stroganoff. Rolled leg of lamb for lamb with pastry was cooked, sliced as described for beef, and treated as follows:

(a) Sliced lamb plus 5 ml of broth from the roast.
(b) Sliced lamb plus 5 ml of commercial barbecue sauce (Maull's, St. Louis, Mo.).
(c) Sliced lamb dipped in antioxidant plus 5 ml of broth from the roast.

Sensory Evaluation

Periodically, each product was removed from the freezer, heated without thawing, and served to a panel of six judges, all members of the laboratory staff. These individuals were familiar with the subject under investigation but samples were coded for evaluation. Judging was conducted in a taste panel room with individual booths. The scoring instrument included a 9-point rating scale for flavor and general acceptability. The scale ranged from 1, "dislike extremely," to 9, "like extremely," with 5 denoting "neither like nor dislike."

For products which were unfamiliar to panel members, it was necessary to prepare fresh reference samples for each judging period. These included sauerbraten, stroganoff, lamb with fruit, lamb curry, lamb with vegetables, and all pork products except those with pastry.

Due to the loss of two panel members, the evaluations for the meat with pastry products were completed by only four judges during the last part of the study.

RESULTS AND DISCUSSION

Effects of Freezer Storage on Precooked Beef Products

Cubed beef for stew. In preliminary work preference was shown for meat cut into approximately ¾ inch cubes for stew and browned before cooking by slow moist heat. Both tomato juice and water were acceptable as the liquid for this product. When sodium tripolyphosphate plus sodium ascorbate was used as an antioxidant, there appeared to be an undesirable softening of the vegetables. Vegetables cut into approximately 2 inch pieces were preferred for stew. The quality of the vegetables was one of the major limiting factors in the acceptability of beef stew. Therefore, the storage study was confined to precooked beef (Table III), ready to combine with vegetables at the time of reheating.

Cubed beef prepared with water was preferred over that prepared with tomato juice at the beginning of the study, but close agreement was observed between mean scores for the two products after two months of frozen storage. In only one instance did a mean score indicate that the product could be described as very desirable (flavor of cubed beef prepared with water, after one month of frozen storage) although mean scores did not drop below a value of 5.0 (neither like nor dislike) in any evaluation period (Fig. 1).

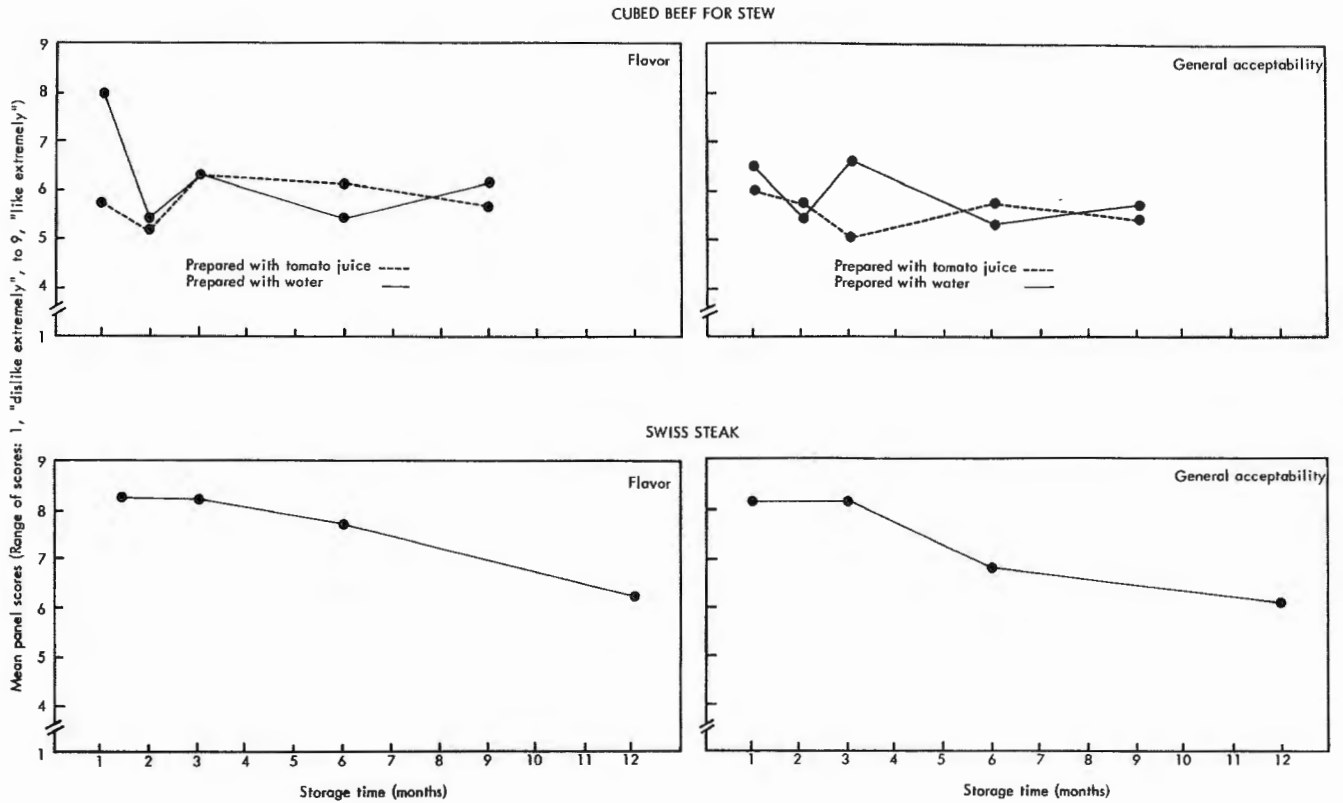

Figure 1. The effects of storage (approximately -20°F or -29°C) on mean panel scores for flavor and general acceptability of precooked beef for stew and swiss steak with antioxidant added (n=6).

Swiss steak. Swiss steak, prepared according to the formula in Table IV, was acceptable through 12 months of frozen storage. Mean scores for flavor and general acceptability decreased from 8.2 for both at the third month to 6.2 and 6.0, respectively, after 12 months of frozen storage (Fig. 1). The most successful of the various methods evaluated for preparing the meat for swiss steak was coating with waxy rice flour, pounding, and browning the meat prior to cooking it in an oven (300°F or 149°C). Tomato juice was preferred over water as the cooking liquid.

Beef with noodles and spaghetti. Mean scores for general acceptability of beef with noodles and with spaghetti did not show any marked trend toward decreased quality throughout the 12 months of storage. A considerable amount of fragmentation was observed in the noodles, but general acceptability of the product was not influenced greatly by this change. There was more fluctuation from period to period in mean scores for flavor of beef with noodles than for beef with spaghetti (Fig. 2).

Beef pie. The taste panel scores for beef pie filling, indicated that the product was liked throughout the entire 12 months storage at -10°F to -20°F (-23°C to -29°C). The detrimental effects of storage were more noticeable in flavor of the meat and the vegetables than in general acceptability. This decrease in quality became apparent after six months of frozen storage (Fig. 3).

The pastry for meat pie which was made with hydrogenated shortening demonstrated better storage qualities than the oil pastry or biscuit dough. The biscuit dough was scored lower in general acceptability than the other two types of pastry (Fig. 3).

Beef with pastry. Very little difference in palatability between the three treatments of beef with pastry was evident. Ratings for this product declined somewhat after eight months of storage. However, mean scores for flavor of the meat pastries with gravy and the mean scores for general acceptability of all three products did not fall below the acceptable level, even after 12 months of frozen storage (Fig. 4).

Beef sauerbraten. In developing the formula for sauerbraten, the following trends were found:

(a) Marinating the meat was unnecessary.
(b) Canned lemon juice could be substituted for fresh lemon slices and rind.
(c) Ginger powder was as satisfactory in flavor as ginger snap crumbs.
(d) Onion powder was preferred in flavor to sliced fresh onions.
(e) Vegetable hydrolysate (Maggi, Nestle Co., White Plains, New York) was not satisfactory as a substitute for beef broth.

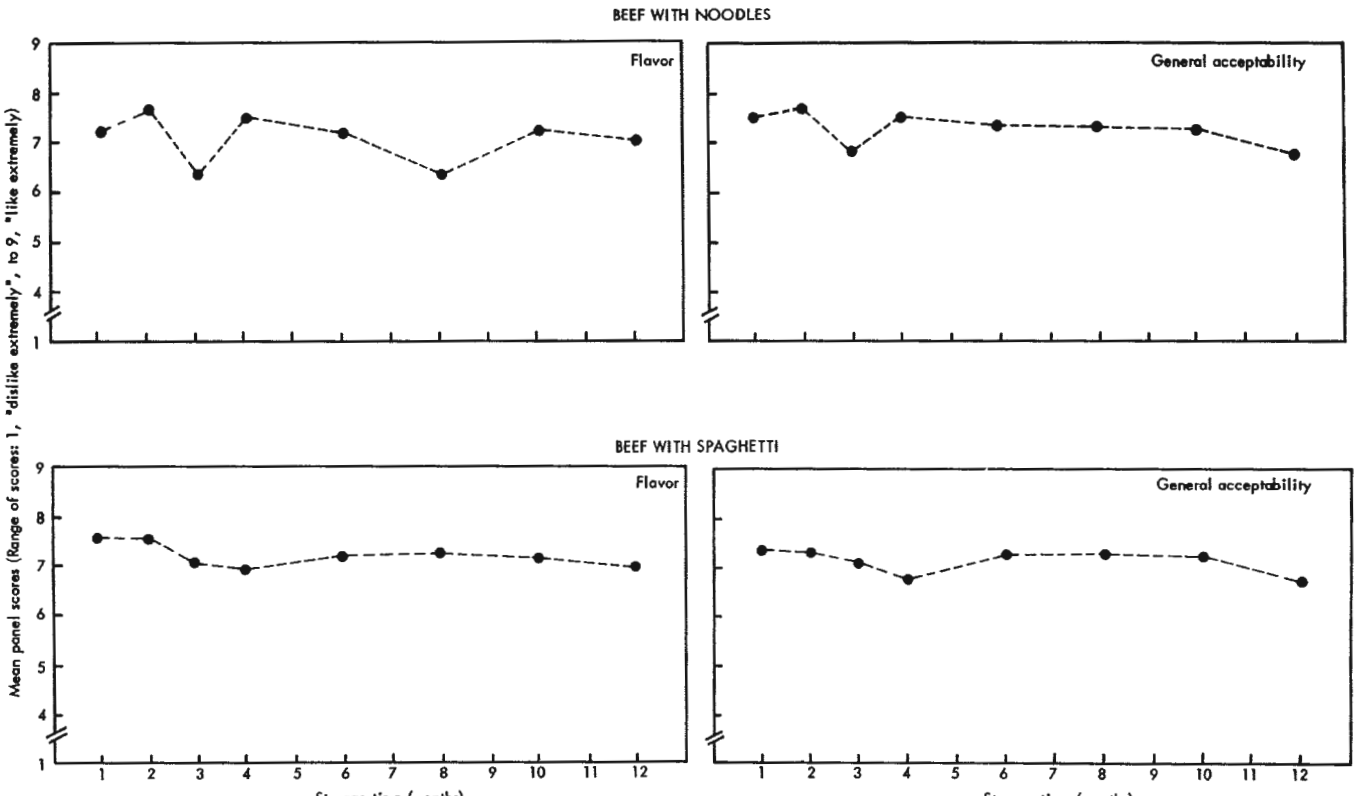

Figure 2. Effects of storage (approximately -20°F or -29°C) on mean panel scores for flavor and general acceptability of precooked beef with noodles and spaghetti with antioxidant added (n=6).

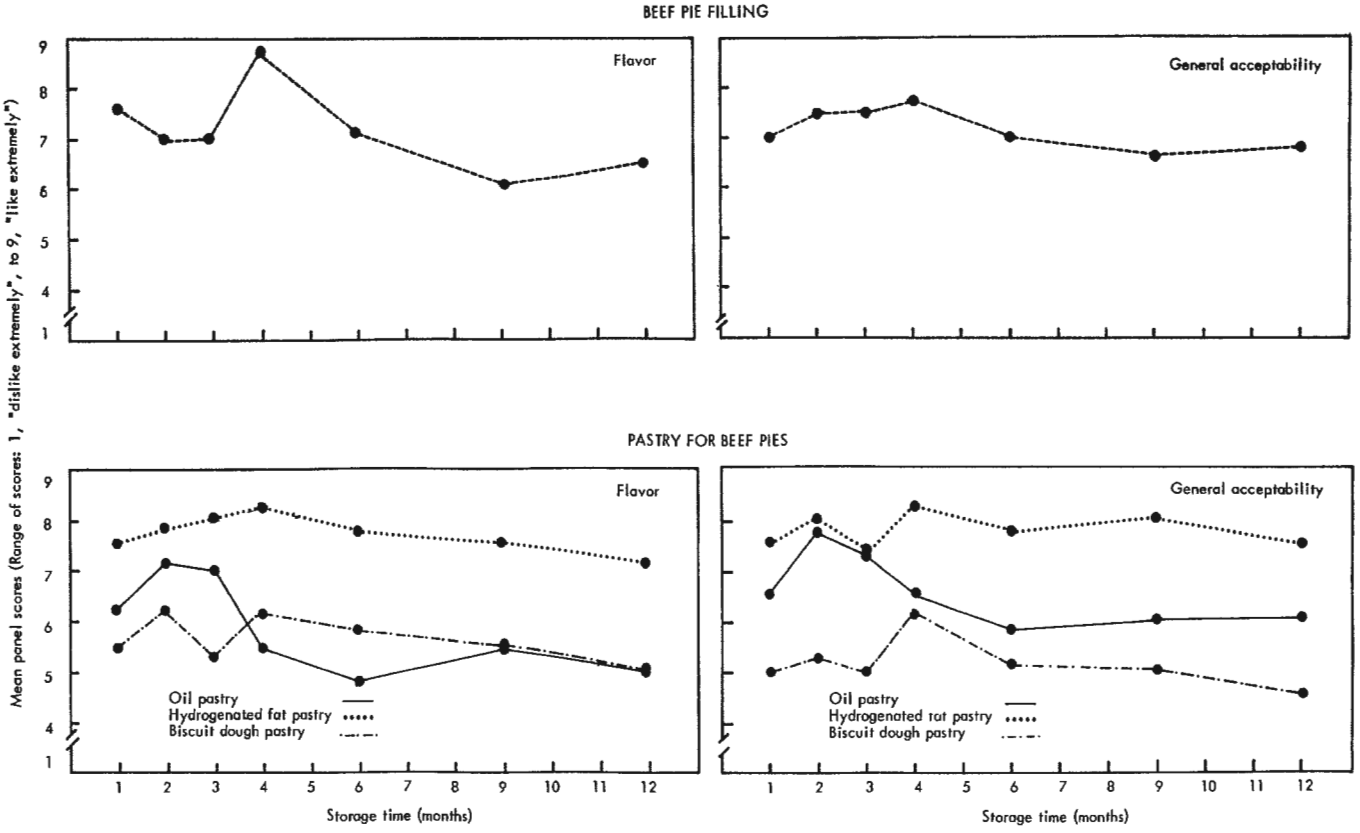

Figure 3. Effects of storage (approximately -20°F or -29°C) on mean panel scores for flavor and general acceptability of precooked beef pies with antioxidant added (n=6).

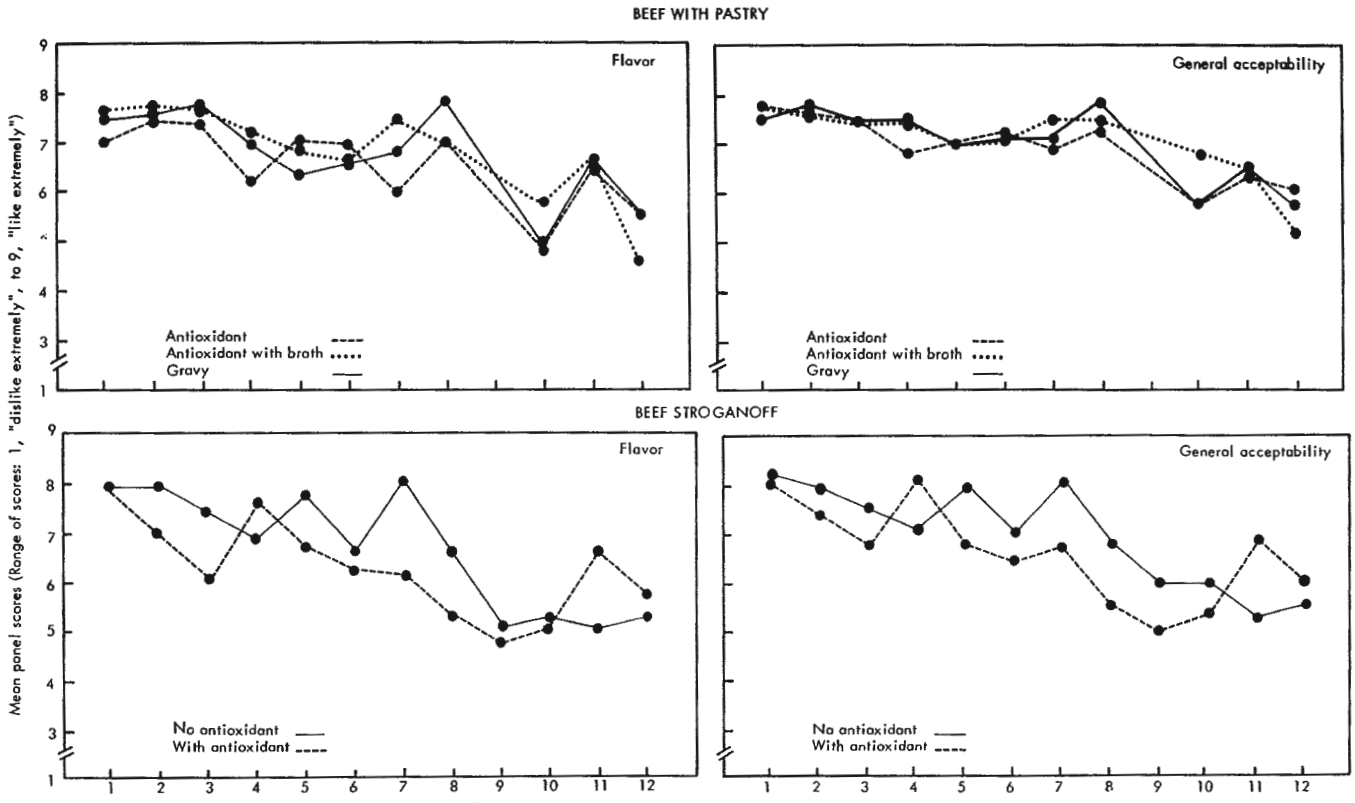

Figure 4. Effects of storage (approximately -20°F or -29°C) on mean panel scores for flavor and general acceptability of precooked beef with pastry and beef stroganoff, with and without antioxidant added (n=6).

At the end of the second month, mean scores for both flavor and general acceptability of beef sauerbraten were below 5.0. Therefore, the study of this product can be considered only preliminary to the development of an acceptable sauerbraten.

Beef stroganoff. A considerable amount of fluctuation was apparent in mean scores for flavor and general acceptability of beef stroganoff from period to period. Mean scores indicated a trend toward a decline in flavor and general acceptability of the stroganoff both with and without antioxidant between the seventh and the twelfth month of storage. In general, the product containing antioxidant was scored lower than that without (Fig. 4).

Effects of Freezer Storage on Precooked Pork Products

Pork with fruit. After the first three months, the general trend in mean scores for pork with fruit, both with and without antioxidant, was downward as length of storage increased. There was an apparent improvement in this product without antioxidant in the first three months of frozen storage. Pork with fruit containing antioxidant tended to decline in flavor and general acceptability more rapidly than that without, although it was favored at the beginning of the study. Since the mean score for general acceptability of this product was 4.8 at the end of the fifth month, testing was discontinued (Fig. 5).

Sweet sour pork. The mean scores for flavor and general acceptability of sweet sour pork without antioxidant were 5.0 or above throughout 12 months of storage. However, there was some fluctuation in mean scores and a general trend downward as storage time extended. The product containing antioxidant was rated lower than that without in both flavor and general acceptability through eight months of storage. At that point it ranked below 5.0 (Fig. 5).

Pork tetrazzini. Only once during the 12 months study (flavor, 10th month) did a mean score for tetrazzini without antioxidant fall below 5.0. There was fluctuation in mean scores from period to period and a slight downward trend in both flavor and general acceptability as storage time increased. There was a tendency for the product containing antioxidant to be scored lower than that without antioxidant (Fig. 6).

Pork with pastry. Pastry products containing slices of pork treated with antioxidant or with apple alone retained acceptable flavor for 11 months, and products with antioxidant plus apple retained it for 12 months. However, a trend toward decreased scores appeared after 11 months of frozen storage. Also, there was a tendency toward slightly higher ratings for the pastry samples containing pork treated with antioxidant plus apple than for the other treatments through 10 months of storage (Fig. 6).

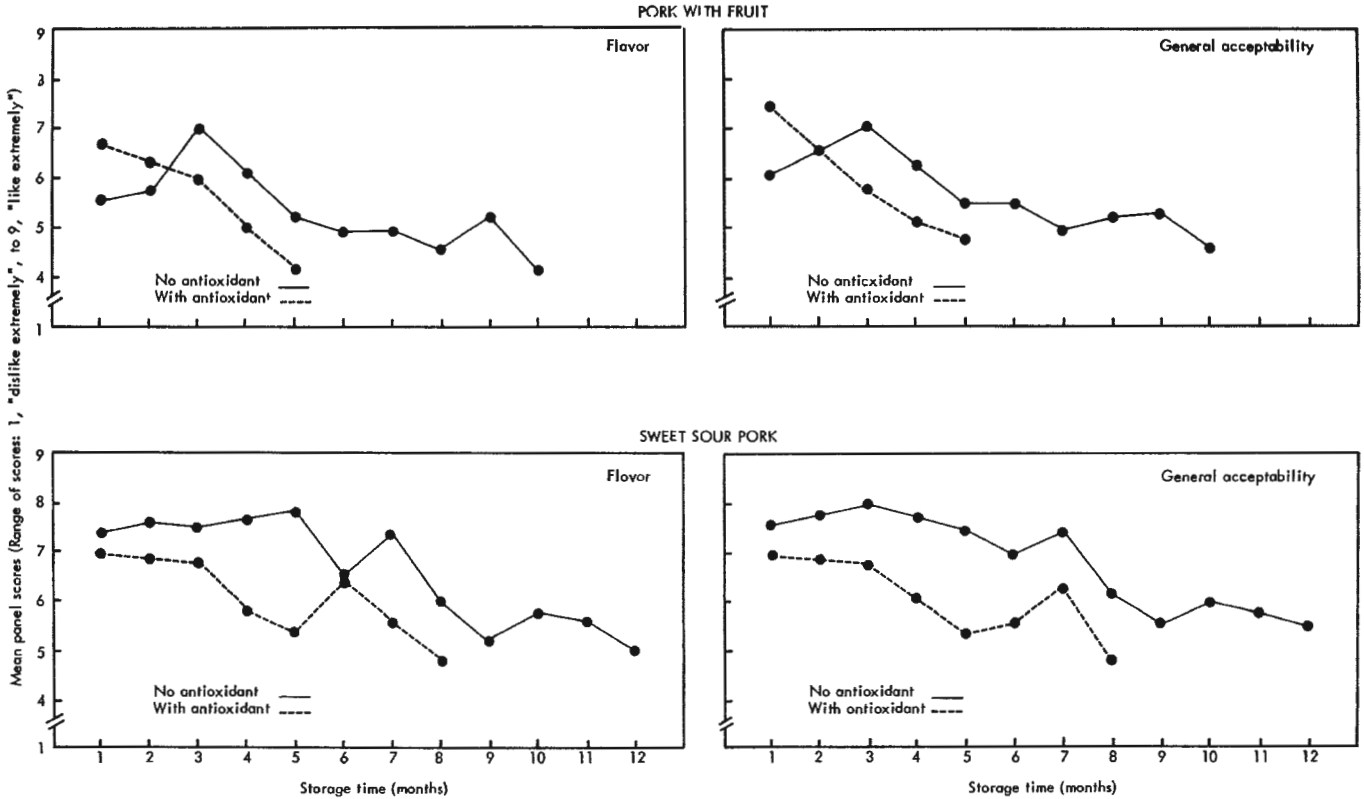

Figure 5. Effects of storage (approximately -20°F or -29°C) on mean panel scores for flavor and general acceptability of precooked pork with fruit and sweet sour pork, with and without antioxidant (n=6).

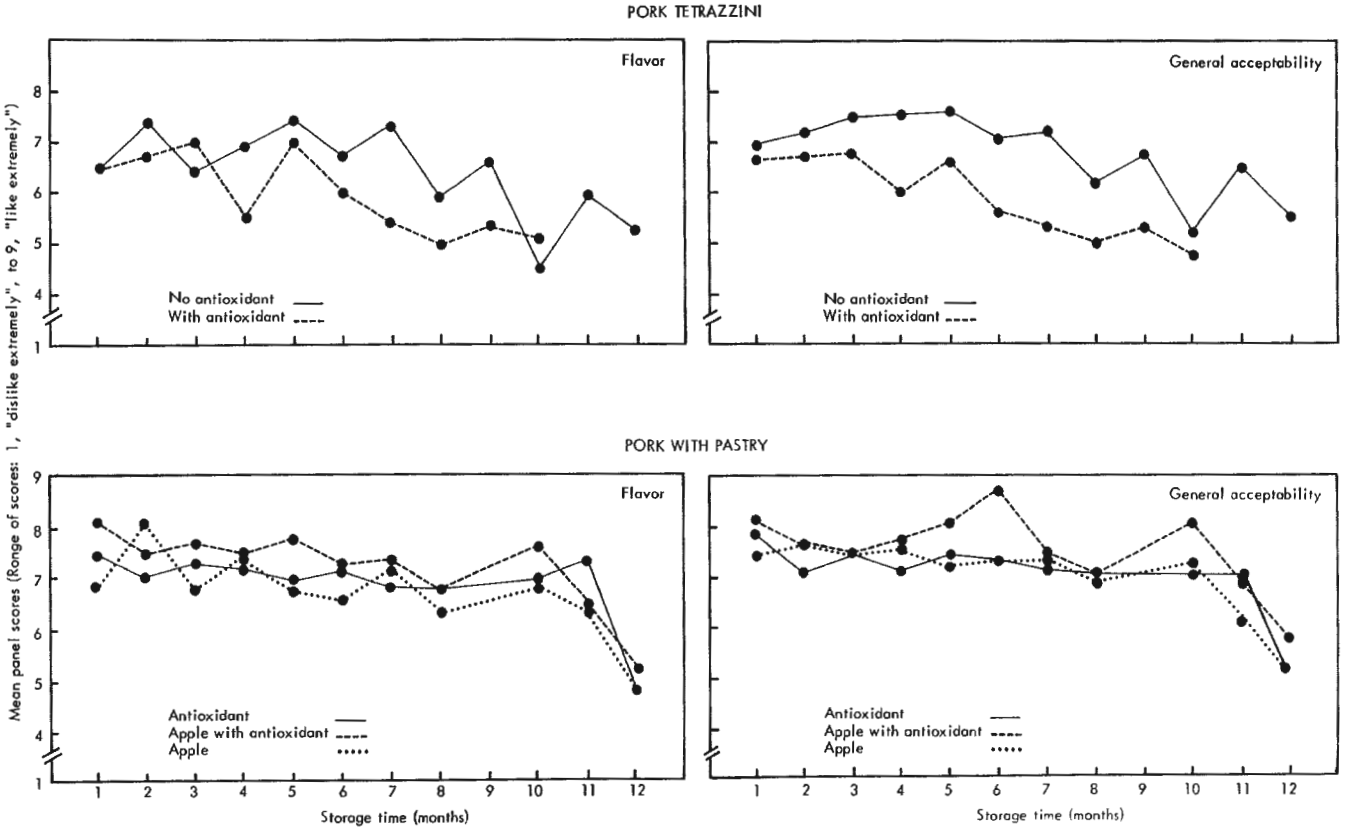

Figure 6. Effects of storage (approximately -20°F or -29°C) on mean panel scores for flavor and general acceptability of precooked pork tetrazzini and pork with pastry, with and without antioxidant added (n=6).

Effects of Freezer Storage on Precooked Lamb Products

Cubed lamb for stew. There was little difference between mean scores for lamb stew with and without antioxidant. A marked decline in flavor and general acceptability in lamb stew occurred after eight months of frozen storage. General acceptability was below 5.0 after 10 months of storage for the stew, both with and without antioxidant; therefore, testing of this product was terminated (Fig. 7).

Lamb with curry. Although lamb curry containing antioxidant was scored higher than that without antioxidant after one month of storage, the mean scores indicated that this product was slightly undesirable after three months of frozen storage. On the other hand, mean scores for curry without antioxidant improved in flavor and general acceptability through the first five months and then declined rapidly to below 5.0 at the seventh month (Fig. 7).

Lamb with fruit. Mean scores for lamb with fruit tended to be higher for the product containing no antioxidant and were 5.0 or above through nine months of frozen storage. In the early part of the study there appeared to be an improvement in flavor and general acceptability in lamb with fruit containing no antioxidant but a tendency toward declining scores was apparent after the third month. The product with antioxidant declined continuously in general acceptability, and mean scores were below 5.0 after six months of frozen storage (Fig. 8).

Lamb with vegetables. For the first four months of this study, lamb with vegetables containing antioxidant was scored higher than that without, but mean scores declined markedly for both flavor and general acceptability between the fourth and the sixth month. The mean scores for flavor and general acceptability for the product without antioxidant were higher at the second month than at the first. All mean scores were below 5.0 for lamb with vegetables after six months of storage (Fig. 8).

Lamb with pastry. Mean scores for flavor and general acceptability of lamb with pastry were in the acceptable range for the entire 12 months of storage, regardless of whether the meat was treated with broth only, antioxidant with broth, or barbecue sauce alone. Samples containing barbecue sauce were rated slightly higher than other treatments for flavor and general acceptability (Fig. 9).

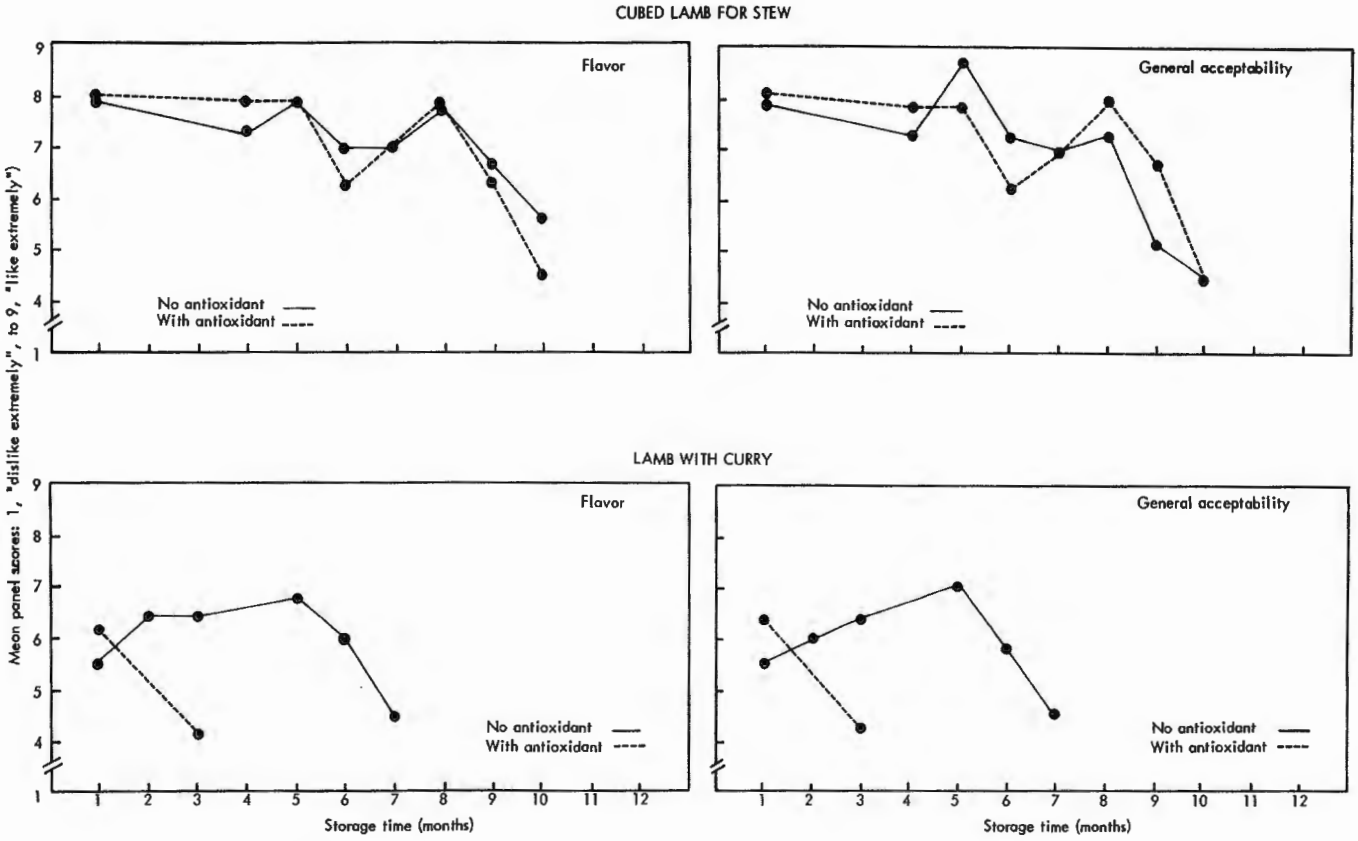

Figure 7. Effects of storage (approximately -20°F or -29°C) on mean panel scores for flavor and general acceptability of cubed lamb for stew and lamb with curry, with and without antioxidant addition (n=6).

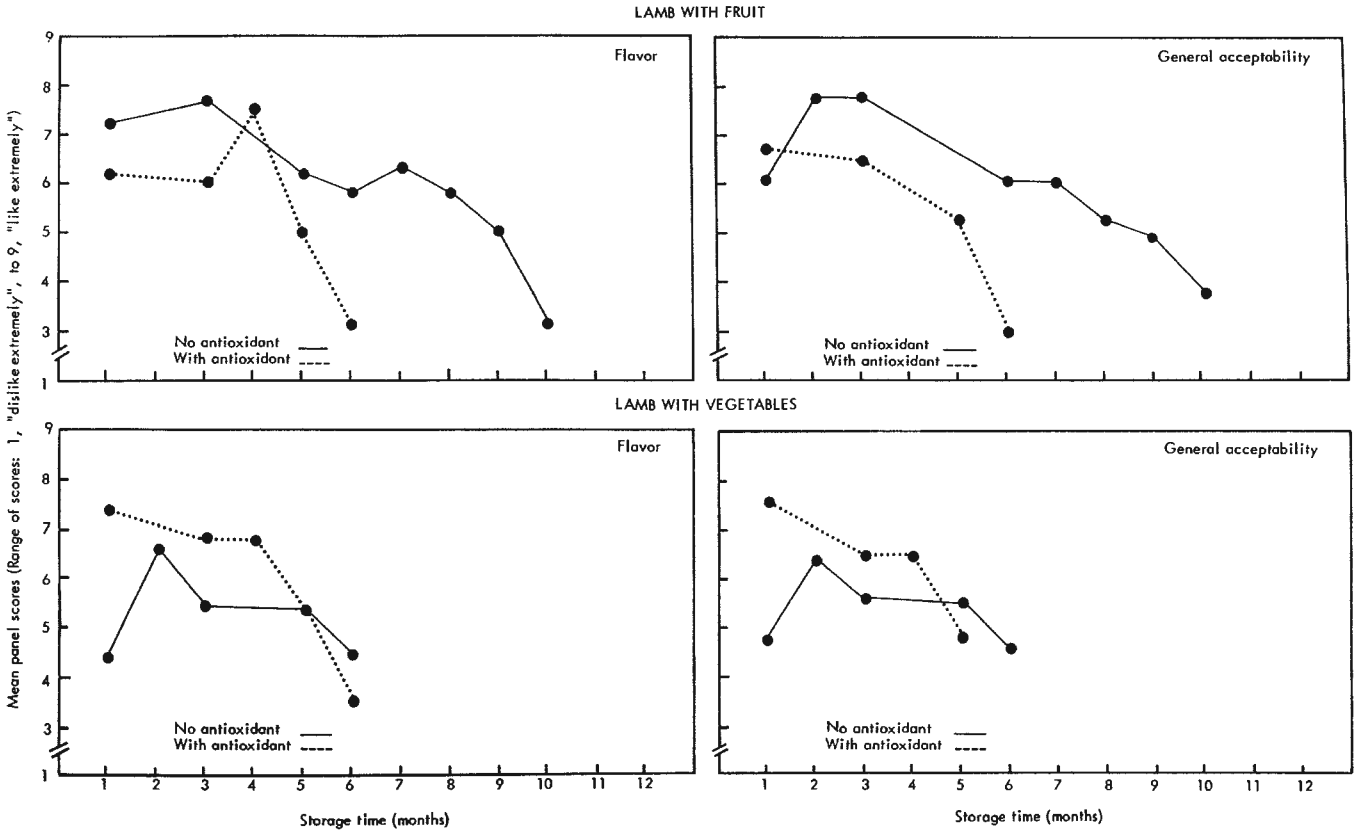

Figure 8. Effects of storage (approximately -20°F or -29°C) on mean panel scores for flavor and general acceptability of precooked lamb with fruit and vegetables, with and without antioxidant added (n=6).

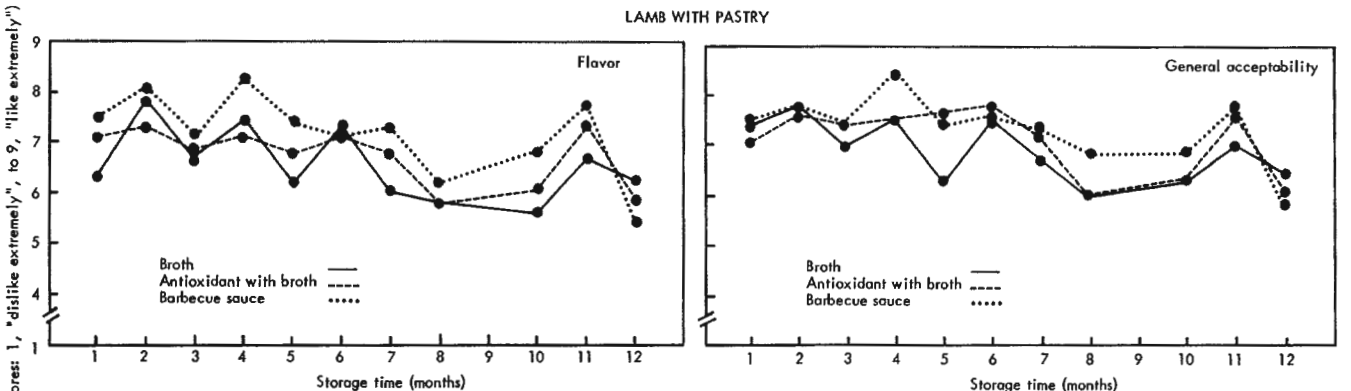

Figure 9. Effects of storage (approximately -20°F or -29°C) on mean panel scores for flavor and general acceptability of precooked lamb with pastry products, with and without antioxidant added (n=6).

General Discussion

Figure 10 illustrates the number of months of frozen storage over which each product maintained a mean score of 5.0 ("neither like nor dislike") or above for general acceptability. With present day facilities for transportation and storage it seems that any precooked frozen product which maintains acceptable quality three months or longer would have commercial potential. If this is a valid assumption, all products represented in Figure 10 are commercially adaptable.

There appears to be no reason for introducing an antioxidant such as sodium tripolyphosphate plus sodium ascorbate in the type of meat products included in this study. This finding is contrary to the statement of Chang *et al.* (1961) that slices of cooked meat dipped in this antioxidant solution were completely protected from oxidation during freezer storage. Also, in the stored "roasteak" slices evaluated by Baldwin and Korschgen (1968), the antioxidant-dipped slices were rated higher by the judges than frozen untreated samples. Chang *et al.* suggested that lipid oxidation of meat progresses slowly in the freezer and that rancidity developed during packaging and defrosting. This would not explain the differences between treatments which were observed in this work because all samples were handled in the same way. Statements by Chang *et al.* were based on odor evaluations and 2-thiobarbituric acid values whereas sensory evaluations of flavor and general acceptability but not aroma were considered in this study.

The usefulness of BHA as an antioxidant for precooked frozen meat products merits further study. Since BHA is fat soluble, it is not as versatile as the sodium tripolyphosphate plus ascorbic acid in water. The low solubility of BHA in water poses a problem in distributing it in, or on, meats unless there is a sauce or gravy containing fat which can serve as a carrier. In this study the precooked frozen meat products with sauces containing BHA as the antioxidant, demonstrated greater tolerance for frozen storage than other samples (Fig. 10).

The formulas included in this research can be considered examples of classes of recipes within which numerous variations might be made. In general, where farinaceous materials, such as noodles, spaghetti, and pastry, were utilized in quantity, the products retained a long shelf life. The shelf life of precooked frozen lamb was more limited than that of either beef or pork products. Since sweet sour pork maintained high quality throughout one year of frozen storage, it is possible that the high concentration of sugar exercised some protective effect. When sugar was included in other formulas it was at a much lower concentration than in the sweet sour pork and apparently did not exhibit this protective effect.

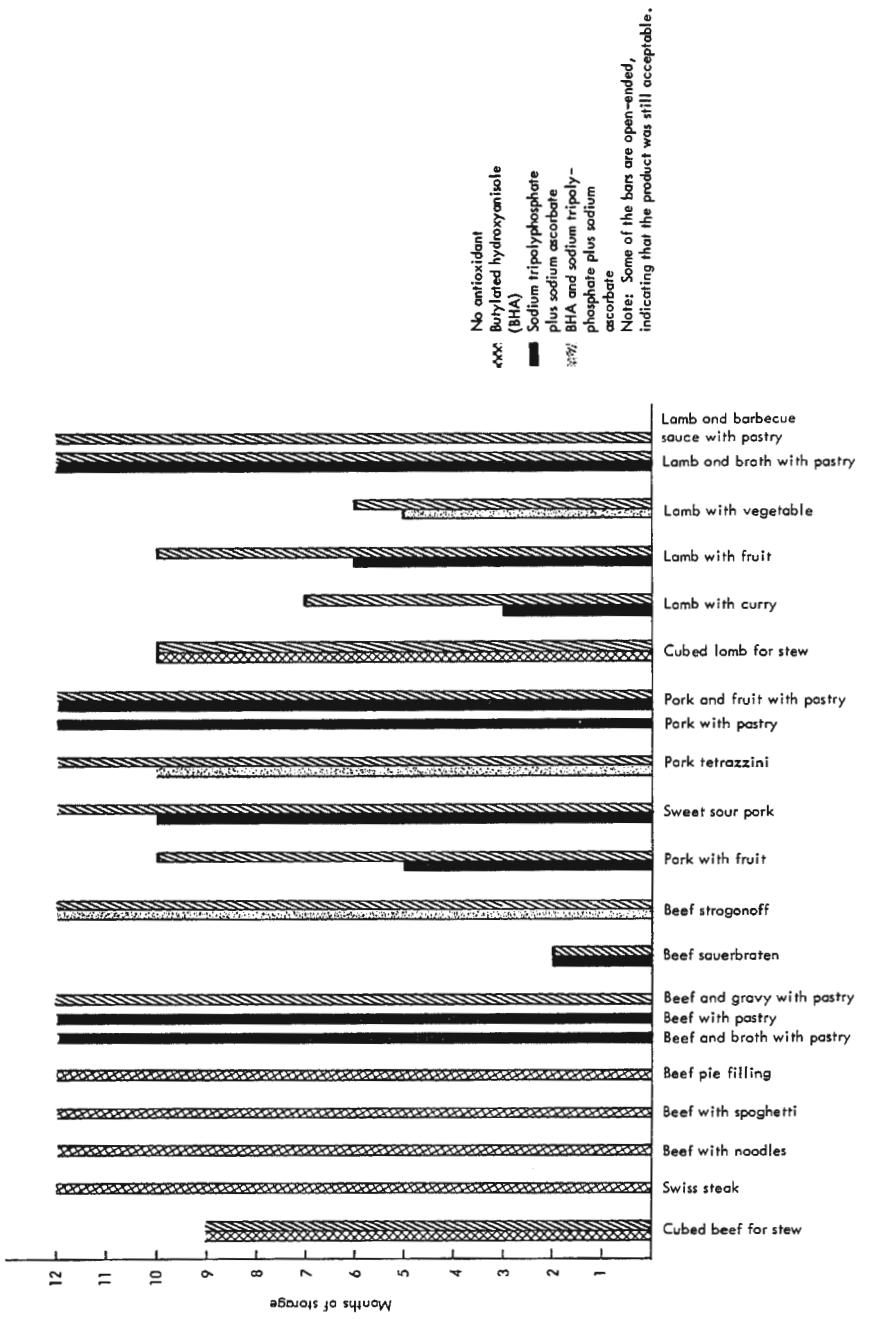

Figure 10. Maximum length of storage for retention of acceptable quality (mean score for general acceptability 5 or above) in precooked frozen meat products. (Range of scores: 1, "dislike extremely", to 9, "like extremely").

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APPENDIX

TABLE I. INGREDIENTS FOR GRAVY

Ingredients	Amount
Rendered suet (0.02% BHA added)	36 g
Waxy rice flour[1]	34 g
Salt	12 g
Beef broth (broth:water, 1:1)	948 ml
Liquid 201 Mix (Table II)	6 g
Yield: Approximately 938 g or 4 c	

[1]Nu Formula flour, Rice Products Co., Inc., 275 Post Street, San Francisco, Calif.

TABLE II. INGREDIENTS FOR 201 MIX

Ingredients	Liquid Mix	Dry Mix[1]
Monosodium glutamate	4.8 g	7.0 g
Onion powder	1.2 g	1.0 g
Pepper (white)	1.2 g	0.3 g
Caramel color	10.0 ml[2]	1.3 g[3]
Salt		11.1 g
Water	20.0 ml	

[1]Particle size, Wiley mill screen No. 60.

[2]Caramel food color, Nugget Distributors, Stockton, Calif.

[3]B-C caramel color, Sethness Caramel Powder Co., 1013 West Webster, Chicago, Ill.

TABLE III. INGREDIENTS AND PROCEDURE FOR PREPARING CUBED BEEF FOR STEW

Ingredients	Amount
Bottom round of beef (U.S. Utility grade)	2.0kg (4½ lbs)
Rendered suet (0.02% BHA added)	14.0 g (1 Tbsp)
Hot liquid (water or 3 c tomato juice plus 1½ c water	1.0 l (4½ c)
Monosodium glutamate	4.8 g (2 tsp)
Pepper	1.0 g (½ tsp)
Salt	10.0 g (2 tsp)
Worcestershire sauce	9.0 g (2 tsp)

Procedure

1. Slice meat[1], then cube into 3/4 in. pieces.
2. Brown meat cubes in hot fat.
3. Add hot liquid.
4. Add seasonings. Cover and cook in oven 300°F (149°C) for approximately 2 1/4 hours.

Packaging and Storing

Place approximately 8 oz (227 g) of cooked meat in each 1-pt polyethyelene carton. Seal and store in freezer approximately -20°F (-29°C). Yield: 8 cartons.

Preparation for Serving

Heat one carton of meat in ½ c (118 ml) water until thawed. Add 8 oz Stokeley's frozen vegetables for stew. Bring to boil and simmer for 15 min.

[1]U.S. Berkel, U.S. Slicing Machine Co., Laporte, Ind.

TABLE IV. INGREDIENTS AND PROCEDURE FOR PREPARATION OF SWISS STEAK

Ingredients	Amount
Beef clod (U.S. Utility grade)	908.0 g (2 lbs)
Waxy rice flour[1]	63.0 g (½ c)
Salt	6.0 g (1½ tsp)
Pepper	1.0 g (½ tsp)
Monosodium glutamate	1.2 g (½ tsp)
Rendered suet (0.02% BHA added)	35.3 g (1 Tbsp)
Celery, chopped	442.0 g (1 c)
Onion, chopped	400.0 g (1 c)
Mushrooms, canned	81.0 g (½ c)
Tomato juice, heated	351.0 ml (1½ c)

Procedure

1. Slice meat 3/4 in. thick.
2. Coat meat with waxy rice flour and pound well.
3. Rub meat with salt, pepper, and monosodium glutamate.
4. Brown meat in rendered suet.
5. Add celery, onion, mushrooms and hot tomato juice.
6. Cover and cook two hr. in oven, 300°F (149°C)

Packaging and Storing

Place one slice of meat (approximately 6 oz or 180 g) and 3/4 c of sauce in a boil-in-pouch bag. Store in freezer approximately -20°F (-29°C). Yield: 5 packages.

Preparation for Serving

Heat 2 unthawed packages in 3 qt boiling water 20 min.

[1]Nu Formula flour, Rice Products Co., Inc., 275 Post Street, San Francisco, Calif.

TABLE V. INGREDIENTS AND PROCEDURE FOR GRAVY USED IN BEEF WITH PASTRY

Ingredients	Amount
Starch[1]	9 g
Dry 201 Mix (Table II)	3 g
Broth	114 ml
Water	114 ml

Procedure

Mix ingredients and bring to a boil.

Yield: Approximately 240 g or 1 c.

[1]Polar Gel 1, American Maize Products Co., 250 Park Avenue, New York, N.Y. 10017.

TABLE VI. INGREDIENTS AND PROCEDURE FOR BEEF STROGANOFF

Ingredients	Amount
Kitchen Bouquet	20.0 g (3 tsp)
Salt	14.2 g (3 tsp)
Mustard (dry)	4.6 g (3 tsp)
Pepper	0.6 g (¼ tsp)
Marjoram	0.3 g (3/8 tsp)
Rendered suet (0.02% BHA added)	35.3 g (3 Tbsp)
Onion, sliced	400.0 g (3 c)
Water	947.0 ml (2½ c)
Mushrooms, canned	268.0 g (6 oz)
Modified tapioca starch[1]	52.0 g (6½ Tbsp)
Dried milk product[2]	59.0 g (9 Tbsp)
Catsup	93.0 g (6 Tbsp)
Roasted beef slices approximately 3/16 in. thick, cut into strips 3/4 x 4 1/2 in., dipped in antioxidant[3]	36 strips

Procedure

1. Mix all dry ingredients with the Kitchen Bouquet.
2. Coat strips of cooked beef with the seasonings.
3. Brown coated beef strips in hot fat.
4. Add onions and water (all but 120 ml or ½ c). Cook for 5 min.
5. Combine starch with remaining 120 ml (½ c) water to prepare starch slurry. Add to onion-meat mixture.
6. Heat to 195°F (91°C) and hold 5 min or until thick.
7. Add canned mushrooms including juice.
8. Mix dried milk product and catsup until smooth. Stir gently into the meat mixture.

Packaging and Storing

Place 3 strips (approximately 3 oz or 90 g) of beef and ½c sauce in a boil-in-pouch bag. Store in freezer, approximately -20°F (-29°C). Yield: 12 packages.

Preparation for Serving

Heat 2 unthawed packages in 3 qt boiling water 20 min.

[1]Fruitfil No. 4, Morningstar Products, A.E. Staley Mfg. Co., Decatur, Ill.

[2]Beatreme, Beatrice Food Co., 1526 S. State St., Chicago, Ill.

[3]1 g $Na_5P_3O_{10}$ and 0.27 g $NaC_6H_8O_6$ made to 100 ml with distilled water.

TABLE VII. INGREDIENTS AND PROCEDURE FOR PORK WITH FRUIT

Ingredients	Amount
Apples, (Jonathan) unpeeled, cut in ½ in. rings.	528.0 g (6)
Vinegar	45.0 ml (3 Tbsp)
Water	780.0 ml (3¼ c)
Salt	4.8 g (1 tsp)
Brown sugar	150.0 g (3/4 c)
Modified tapioca starch[1]	40.0 g (5 Tbsp)
Raisins	68.0 g (½ c)
Roasted pork slices, approximately 3/16 in. thick, dipped in antioxidant[2]	24 slices

Procedure

1. Cook apple rings in vinegar, water (all but 120 ml or ½ c), salt and brown sugar for 4 min.
2. Remove apples.
3. Prepare slurry with starch and remaining water.
4. Add starch slurry and raisins to hot liquid.
5. Heat to 195°F (91°C) and hold for 5 min or until thick.

Packaging and Storing

Place 2 slices of pork (approximately 3 oz or 90 g), three apple rings, and ½ c raisin sauce in boil-in-pouch bag. Store in freezer, approximately -20°F (-29°C). Yield: 12 packages.

Preparation for Serving

Heat 2 unthawed packages in 3 qt boiling water 20 min.

[1] Fruitfil No. 4, Morningstar Products, A. E. Staley Mfg. Co., Decatur, Ill.

[2] 1 g $Na_5P_3O_{10}$ and 0.27 g $NaC_6H_8O_6$ made to 100 ml with distilled water.

TABLE VIII. INGREDIENTS AND PROCEDURE FOR SWEET SOUR PORK

Ingredients	Amount
Vinegar	120.0 ml (½ c)
Water	600.0 ml (2½ c)
Bouillon cube, chicken	2 cubes
Soy sauce	20.0 ml (4 tsp)
Sugar	200.0 g (1 c)
Salt	4.8 g (1 tsp)
Pepper	0.4 g (1/8 tsp)
Green pepper, cut in ½ inch squares	130.0 g (1)
Modified tapioca starch[1]	32.0 g (4 Tbsp)
Pineapple tidbits (13½ oz can)	2 cans
Roasted pork slices, approximately 3/16 in. thick, dipped in antioxidant[2]	24 slices

Procedure

1. Combine vinegar, water (all but 120 ml or ½ c) bouillon cubes, soy sauce, sugar, and spices.
2. Cook green pepper in liquid until tender.
3. Prepare a slurry with remaining water and starch.
4. Add starch slurry to green pepper mixture.
5. Heat to 195°F (91°C) and hold 5 min or until thick.
6. Add pineapple to thickened sauce.

Packaging and Storing

Place 2 slices pork (approximately 3 oz or 90 g) and ½ c sweet-sour-sauce in boil-in-pouch bag. Store in freezer, approximately -20°F (-29°C). Yield: 12 packages.

Preparation for Serving

Heat 2 unthawed packages in 3 qt boiling water 20 min.

[1]Fruitfil No. 4, Morningstar Products, A.E. Staley Mfg. Co., Decatur, Ill.

[2]1 g $Na_5P_3O_{10}$ and 0.27 g $NaC_6H_8O_6$ made to 100 ml with distilled water.

TABLE IX. INGREDIENTS AND PROCEDURE FOR PORK TETRAZINNI

Ingredients	Amount
Spaghetti	230.0 g (½ lb)
Boiling water	2.9 l (3 qt)
Salt	24.0 g (5 tsp)
Onion, chopped	74.5 g (½ c)
Green pepper, chopped	79.5 g (½ c)
Pork fat (0.02% BHA added)	23.4 g (2 Tbsp)
Pimiento	34.0 g (4 Tbsp)
Broth	720.0 ml (3 c)
Modified tapioca starch[1]	48.0 g (6 Tbsp)
Cheese, Cheddar type	230.0 g (½ lb)
Roasted pork slices, approximately 3/16 in. thick, dipped in antioxidant[2]	24 slices

Procedure

1. Place spaghetti in boiling water with 14.1 g (3 tsp) salt. Let stand for 15 min. Drain.
2. Cook onion and pepper in fat over low flame for 5 min.
3. Combine starch with broth.
4. Add broth-starch slurry to vegetables and cook for 5 min.
5. Stir in pimiento, cheese, remaining salt and heat until cheese is melted.
6. Pour over spaghetti.

Packaging and Storing

Place 2 slices pork (approximately 3 oz or 90 g) and ½ c cheese-spaghetti sauce in boil-in-pouch bag. Store in freezer, approximately -20°F (-29°C). Yield: 12 packages.

Preparation for Serving

Heat 2 unthawed packages in 3 qt boiling water 20 min.

[1] Fruitfil No. 4, Morningstar Products, A.E. Staley Mfg. Co., Decatur, Ill.

[2] 1 g $Na_5P_3O_{10}$ and 0.27 g $NaC_6H_8O_6$ made to 100 ml with distilled water.

TABLE X. INGREDIENTS AND PROCEDURE FOR PREPARING CUBED LAMB FOR STEW

Ingredients	Amount	
Lamb shoulder, cubed	2.0 kg	(4 1/2 lb)
Rendered lamb fat (0.02% BHA added)	30 g	(2 Tbsp)
Salt	12 g	(2 1/2 tsp)
Ginger, ground	6 g	(3 tsp)
Water	1.5 l	(6 1/2 c)

Procedure

1. Brown cubed lamb (approximately 1 1/2 in. cubes) in fat.
2. Add ginger, salt, and water.
3. Simmer 40 min.

Packaging and Storing

Place approximately 3 oz (90 g) of cooked lamb and 3/8 c (90 g) of drippings in 1 pt polyethylene carton. Seal and store in freezer approximately - 20°F (-29°C). Yield: 12 cartons.

Preparation for Serving

Heat one carton of frozen lamb in 100 ml water over low heat for 15 min. Mix 14.4 g (2 Tbsp) flour in 50 ml cold water and add to meat along with blanched frozen vegetables (7-8 oz of carrots and celery). Simmer 15 min.

TABLE XI. INGREDIENTS AND PROCEDURES FOR LAMB WITH CURRY

Ingredients	Amount	
Onion soup mix	65.5 g	(1½ pkg)
Curry powder	1.0 g	(½ tsp)
Salt	9.4 g	(2 tsp)
Water	2.4 l	(10 c)
Apples, peeled and cut in 3/8 in. slices	228.0 g	(3)
Modified tapioca starch[1]	80.0 g	(10 Tbsp)
Roasted lamb slices, approximately 3/16 in. thick, dipped in antioxidant[2]	24 slices	

Procedure

1. Combine soup mix, curry, and salt with water (all but 120 ml or ½ c). Boil for 10 min.
2. Add sliced apples and boil until apples are tender.
3. Use the remaining water to prepare starch slurry.
4. Combine cold starch slurry with hot soup mixture.
5. Heat to 195°F (91°C) and hold for 5 min or until thick.

Packaging and Storing

Place 2 slices lamb (approximately 3 oz or 90 g), 6 apple slices, and ½ c sauce in boil-in-pouch bag. Store in freezer approximately -20°F (-29°C). Yield: 12 packages.

Preparation for Serving

Heat 2 unthawed packages in 3 qt boiling water 20 min.

[1]Fruitfil No. 4, Morningstar Products, A.E. Staley Mfg. Co., Decatur, Illinois.

[2]1 g $Na_5P_3O_{10}$ and 0.27 $NaC_6H_8O_6$ made to 100 ml with distilled water.

TABLE XII. INGREDIENTS AND PROCEDURE FOR LAMB WITH FRUIT

Ingredients	Amount
Sugar	67.5 g (6 Tbsp)
Marjoram	0.5 g (1 tsp)
Salt	8.4 g (1 3/4 tsp)
Frozen orange juice concentrate (6 oz can)	1 can
Liquid from Mandaran orange segments	240.0 ml (1 c)
$CaCl_2$ (0.009N)	120.0 ml (8 Tbsp)
Water	720.0 ml (3 c)
Modified tapioca starch[1]	32.0 g (4 Tbsp)
Mandaran orange segments (11 oz can)	2 cans
Roasted lamb slices, approximately 3/16 in. thick, dipped in antioxidant[2]	24 slices

Procedure

1. Combine sugar, marjoram, salt, orange juice concentrate, liquid from Mandaran orange segments, $CaCl_2$ solution and water (all but 120 ml or 1/2 c).
2. Prepare slurry of remaining water and starch.
3. Add slurry to liquid mixture, heat to 195°F (91°C) and hold for 5 min.
4. Add orange segments.

Packaging and Storing

Place 2 slices of lamb (approximately 3 oz. or 90 g) and 2/3 c orange sauce in boil-in-pouch bag. Store in freezer, approximately -20°F (-29°C). Yield: 12 packages.

Preparation for Serving

Heat 2 unthawed packages in 3 qt boiling water 20 min.

[1]Fruitfil No. 4, Morningstar Products, A.E. Staley Mfg. Co., Decatur, Ill.

[2]1 g $Na_5P_3O_{10}$ and 0.27 g $NaC_6H_8O_6$ made to 100 ml with distilled water.

TABLE XIII. INGREDIENTS AND PROCEDURE FOR LAMB WITH VEGETABLES

Ingredients	Amount
Onion, sliced	110.5 g (1 c)
Lamb fat	11.7 g (1 Tbsp)
Garlic powder	0.3 g (1/8 tsp)
Parsley flakes (dry)	0.6 g (¼ tsp)
Dill (dry)	0.3 g (1/8 tsp)
Salt	11.7 g (2½ tsp)
Broth (lamb)	240.0 g (1 c)
Water	960.0 ml (4 c)
$CaCl_2$ (0.009N)	90.0 ml (6 Tbsp)
Celery, sliced diagonally in ½ in. pieces	221.0 g (1½ c)
Zucchini, unpeeled, sliced ½ in. thick	518.0 g (3 c)
Modified tapioca starch[1]	40.0 g (5 Tbsp)
Roasted lamb slices, approximately 3/16 in. thick, dipped in antioxidant[2]	24 slices

Procedure

1. Brown onions in fat.
2. Combine spices, broth, water (all but 120 ml or 1/2 c) and $CaCl_2$ solution with onions.
3. Add sliced celery and boil 10 min.
4. Add sliced zucchini and cook 10 min. longer.
5. Drain liquid from vegetables.
6. Mix remaining water with starch to make a slurry.
7. Heat starch slurry to 195°F (91°C) and hold for 5 min, or until thick.
8. Pour thickened sauce over cooked vegetables.

Packaging and Storing

Place 2 slices of lamb (approximately 3 oz. or 90 g), and 2/3 c vegetables and gravy in boil-in-pouch bag. Store in freezer, approximately -20°F (-29°C). Yield: 12 packages.

Preparation for serving

Heat 2 unthawed packages in 3 qt boiling water for 20 min.

[1] Fruitfil No. 4, Morningstar Products, A.E. Staley Mfg. Co., Decatur, Illinois.

[2] 1 g $Na_5P_3O_{10}$ and 0.27 g $NaC_6H_8O_6$ made to 100 ml with distilled water.