ANALYSIS OF DATA OBTAINED IN A STUDY OF FACTORS INVOLVED IN THE FREEZING AND STORAGE OF CERTAIN PRECOOKED FROZEN FOODS

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Elaine Durwood Hudson

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THESIS

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ANALYSIS OF DATA OBTAINED IN A STUDY OF FACTORS INVOLVED IN THE FREEZING AND STORAGE OF CERTAIN PRECOOKED FROZEN FOODS

By

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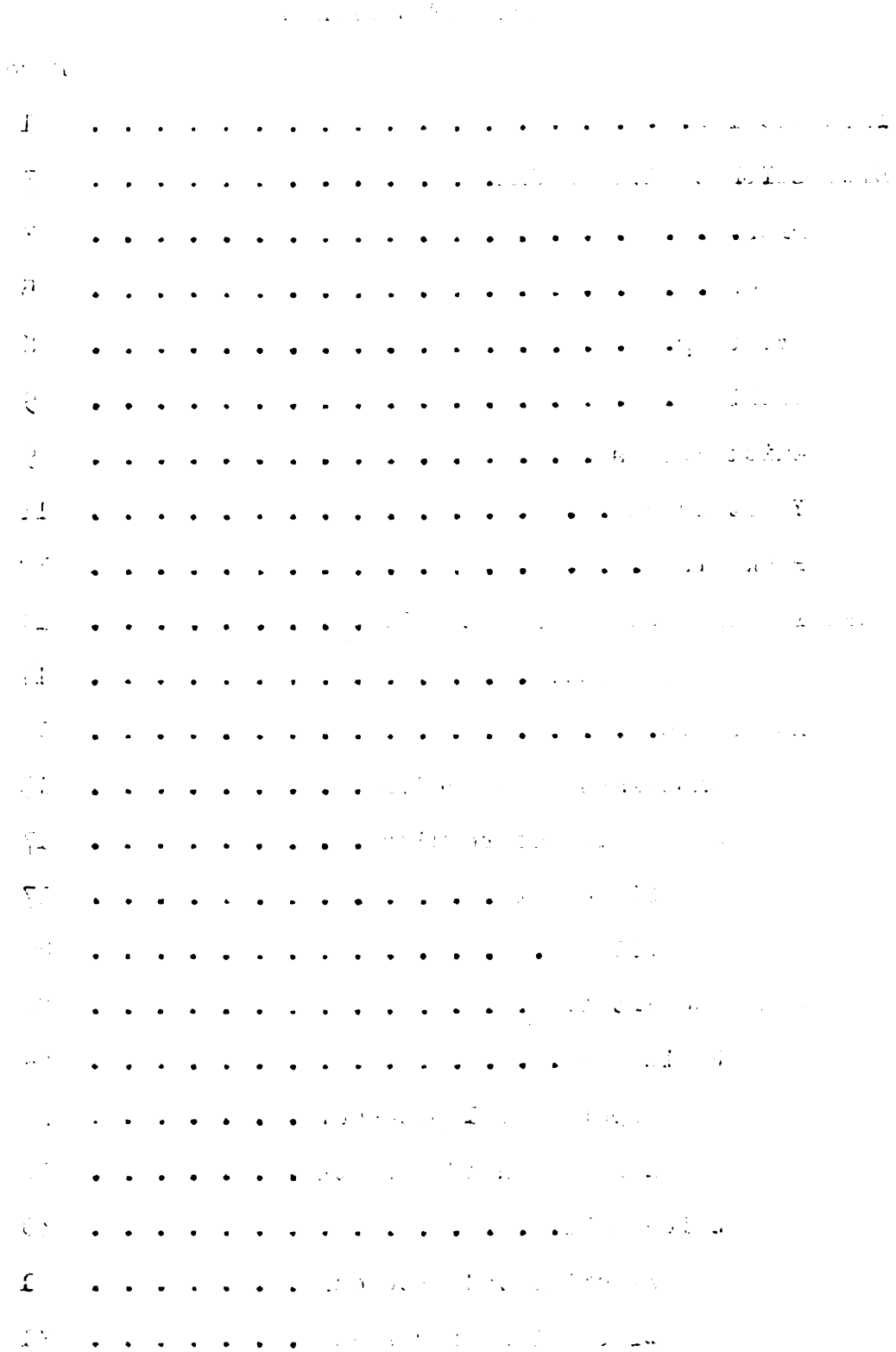

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INTRODUCTION

Freezing precooked foods is not a new idea. Our grandmothers baked several weeks supply of mince pies and froze them on the back porch. The pies were then thawed or reheated as they were needed.

Today, many commercial firms offer precooked frozen foods for sale. More than 100 items are on the list now, and the number is rapidly increasing. New improved home freezers have made it possible for homemakers to prepare and freeze their own precooked foods.

Chief reason for the preparation of precooked, frozen foods in the home is that the food is almost ready to serve when needed. Good foods for freezing are dishes which require long preparation; dishes that require little more work when prepared in quantity than they do when prepared in small amounts; dishes that require only slight thawing before serving; and dishes that require little time and attention between the freezer and the table.

Very little controlled laboratory work has been done on precooked frozen foods, consequently there is little authentic information available. The present work was planned to help answer some of the questions asked by homemakers, particularly questions concerning batter and dough products.

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The presentation falls into two sections. The first embodies a technical description of methods used and data obtained, while the second presents the information in popular form. The latter is written so that it may be printed in an extension bulletin.

Precooked and prepared foods which will be discussed are Apple Pie, Cakes, Cake Frosting, Cookies, Quick Breads and Yeast Bread.

Problems included in this study were to determine whether the products were better frozen raw or prebaked; to determine changes that took place during storage, and if possible, when they took place; to determine the storage life of each product. Tests were made to determine the effect of type shortening in pastry; to determine the effect of type baking powder in cake and biscuits; to determine the effect of type yeast in yeast bread; to determine the effect of shape of cake.

Laboratory work for the project was completed by Shirley Means and Mable Lou. This paper is an analysis of data which was obtained during the study.

DISCUSSION OF LITERATURE

The frozen food industry and colleges and government laboratories have been experimenting with precooked frozen foods for the past six years. Discussion of their work is presented grouped by products.

Pies

Woodroof and Atkinson (1945) stated that pies, whether frozen cooked or uncooked, gradually lost moisture through desiccation and flavor through volatilization. This did no apparent harm to the consistency of the pastry, but caused the filling to shrink and sometimes to change color. Upon thawing, the pastry was likely to absorb moisture and lose crispness.

Bride (1946) compared prebaked and unbaked pies which were frozen for one month. She found that the frozen prebaked pies steamed badly when heated in the oven. The fruit filling broke down into a soft homogeneous mass and the crust softened and lost its crippness. Prebaked pies did not have the fresh flavor of pies baked after thawing.

Tressler (1947) reported that unbaked frozen pies had a more tender and flaky crust, a more pleasing aroma, and a freshness of flavor superior to pies baked before freezing. Pies baked before freezing were best when warmed and thawed in the oven. When they were thawed at room temperature, they were similar in texture and appearance to day-old pies that had been kept in the refrigerator.

Fenton (1947) completed a study on frozen pies. She also found that pies baked before freezing were not as high in quality as those baked after freezing. The taste and aroma were not fresh and the pie tended to be pasty. Unbaked pies which were thawed at room temperature or in the refrigerator before being baked tended to have a soaked, underdone undercrust. Unbaked pies placed in the oven while still frozen received the highest palatability scores. She found that both plain lard and hydrogenated vegetable fats resulted in good pastry. The lard appeared to have a slightly higher shortening power. All of the frozen pastry was more tender than the fresh pastry, possibly because the strength of the gluten decreased.

Myers and Brodie (1948) found that hydrogenated vegetable shortening was superior in keeping quality to lard when used in frozen pastry.

Kiene (1947) stated that pies frozen raw were better than those frozen prebaked. She suggested a storage time of two months for the unbaked pie; four months for the baked pie.

Cake

Sunderlin, Collins, and Acheson (1940) reported that many batters and doughs could be successfully preserved by freezing. They found that frozen batters, of both plain and chocolate bases, yielded cakes which were indistinguishable from freshly mixed batters, up to and including four months' storage life. Poor texture and noticeable loss of flavor and volume were noted in each case after five months' storage.

Graul and Lowe (1947) found the volumes of both frozen cakes and batters decreased with storage for longer than two months. In general, the effect was progressive with longer storage. Frozen cake had better volume and received higher palatability ratings than cakes baked from frozen batter obtained from the same mixes. The addition of synthetic vanilla to the mixes produced unpalatable cakes with storage at either 0° or -10° F. In explaining the smallest volumes of the stored batters, they said that it was possible that dissipation of the leavening in

batters took place because of the prolonged contact of baking powder with moisture. There was a possibility of some denaturation of proteins in the batters as a result of aging and freezing. Denaturation would decrease the extensibility of some of the proteins and bring about decreased volume in the cakes baked from batters which had been frozen. As denaturation would increase with longer storage, the effect on cake volume would be progressive with longer storage.

Tressler (1947) noted that baked frozen cakes of both the butter and sponge types were generally more successful than cakes made from the unbaked frozen batters. When defrosted, it was hard to distinguish between the frozen and the fresh product. Frozen cake became stale in flavor and dried out more rapidly after thawing than the freshly baked cake.

Unbaked batters gave satisfactory products when thawed and baked, but they were limited in their storage life. After four months' storage, cake batter tended to lose volume when baked and often became soggy or developed a tough crust and poor texture.

If cake batters were packaged and frozen in a cake pan so that they could be placed directly in the oven, the

type of baking powder used did not make any apparent difference in the quality of the baked product. If the cake batters were packaged in cartons, and then transferred to baking dishes, it was believed advisable to use a double action baking powder (sodium-aluminum-sulphate) to decrease the loss of leavening power during the transferring from one container to another.

Thawing procedures which Tressler suggested were: thaw loaf or cup cakes completely before baking in order to prevent the formation of humps or cracks caused by the outside of the cake batter setting before the center had time to thaw and expand. He recommended thawing cake batters at room temperature. Transfer batters from cartons to baking pans before completely thawed; allow to finish thawing in the pan before baking. Layer cakes could be baked without previous thawing, since the batter was shallow and would thaw quickly and evenly.

Owens, Chase and Van Duyne (1947) suggested that storing cake batter had several advantages over storing the prebaked cake, it was easier to package, required less locker space, and the cake seemed more moist. A frozen baked cake, however, required less time to prepare for serving after it was taken from storage. Sponge cakes, frozen baked, while similar in quality to freshly baked cakes, were likely to shrink a little in freezer storage.

The use of spices in cakes presents an additional problem. Hutchings and Evers (1946) reported that certain flavorings and spices tended to "shrink" or completely disappear after freezing and prolonged storage, yet others "grow" and unpleasantly predominate over all other flavors after a given time. They suggested that the use of oil of spices rather than dry spices might make the matter of controlling these variables much easier.

Frosting

Tressler (1947) reported that confectioner's sugar frosting which is high in fat content and frosting of the cooked candy type yielded acceptable products. Fudge and penuche remained soft and creamy as fillings but after one month's storage as frostings they tended to harden so that they cracked and crumbled when cut. Soft frostings stuck to the wrappings and boiled frostings became spongy and crystalline during storage. Fenton and Darfler (1946) said that frosting of the seven minute or boiled frosting type became frothy and spongy, and were therefore not satisfactory.

Cookies

Sunderlin, Collins and Acheson (1941) reported that raw cookie dough could be stored successfully for at least twelve months. Kiene (1947) stated that rich cookies could be frozen satisfactorily. However she suggested freezing the cookie dough. Cookie dough required less storage space than the baked cookies, and the cookies could be quickly baked when needed. Tressler (1947) said that refrigerator cookies could be sliced without thawing if a sharp knife was used. If the dough was too hard to slice, it should be thawed in the refrigerator. Thawing at room temperature made the dough difficult to slice. Drop cookie batter should be thawed at room temperature until soft enough to drop by spoonfuls onto a cookie sheet.

Quick Breads

Fenton and Darfler (1946) reported that quick breads were more certain of success if they were frozen after baking. Frozen unbaked they had a shorter storage life and might be smaller in volume and tougher. They suggested baking muffins in paper cups. Baking powder biscuits might be packed unbaked in a round container into which they just

fit (to keep out the air). The biscuits were separated by two layers of cellophane or waxed paper between each one. Thin biscuits were more likely to be successful than thick ones.

Sunderlin and Collins (1941) found that baking powder biscuits could be stored only one month when frozen raw. After that time, there was too great a loss of carbon dioxide gas, resulting in heavy biscuits.

Tressler (1947) stated that most frozen unbaked quick bread batters were limited in their storage life (two to eight weeks). Baked frozen products could be kept four to six months. Unbaked batters tended to lose volume, become soggy, or develop large air holes. Baking powder biscuits were the poorest product in the quick bread group. They often developed an off-flavor associated with baking powder. Double-acting baking powder which reacted more slowly at room temperature yielded better products. Baking powder biscuits were baked without thawing. Muffins gave better volume when baked in individual paper cups in which they were frozen and stored. Transferring from carton into a baking tin resulted in the loss of some of the leavening gas.

Yeast Bread

Yeast rolls made from frozen dough may be soggy, the texture poor, and crust tough and leathery from drying out. Common causes of poor quality rolls are poor dough to begin with, poor packaging, too long a time between making them and freezing, too high a storage temperature, too long storage, and poor thawing and rising conditions.

Fenton and Darfler (1946) reported that baked bread may be kept fresh in freezer storage for several months, or if the temperature was sufficiently low, for several years. They said that frozen dough sometimes failed because it lost gas and became heavy. They suggested that frozen doughs be stored from two - eight weeks. Tressler (1947) said that formulas which were high in fat were less likely to dry out. Slightly more sugar than was ordinarily used in freshly made products was required because the yeast might digest some of the sugar during freezing and thawing. Protecting the surface of the dough with a coating of oil or fat helped to prevent toughening of the crust.

Sunderlin and Collins (1941) stored yeast roll dough for six weeks. Tests showed that yeast cells were not

destroyed by the freezing process. With longer storage, the rolls developed off flavors and odors, due either to rancidity or absorbed odors.

Cathcart (1939) reported that frozen baked bread could be stored for 41 days in the freezer. After this time, the off aroma became so pungent that the bread could not be regarded as salable. Kiene (1947) suggested a storage period of six months for baked bread.

Thiessen (1942) tested the effect of freezing upon yeast itself. He found that compressed yeast was well preserved for several months by freezing and resumed almost normal biological activity when mixed into bread dough and placed under favorable conditions.

Packaging

All precooked foods should be wrapped before freezing in moisture-vapor-proof materials. Cellophane or aluminum foil are both satisfactory. How to Freeze Foods (1947) suggested that cellophane be heat sealed. If heat sealing is not possible, fold edges tightly and tie or tape securely, using a special tape designed for frozen foods. Hutchings and Evers (1946) suggested that the packaging material should be grease-proof as well as vapor-proof for

products high in fat. They recommended waxed paper bags with laminated cellophane liners.

Tressler (1947) stated that containers of suitable size and shape for specific foods such as pies and cakes were needed. Containers in which the precooked food could be packaged, frozen, stored, reheated, and possibly served would be advantageous. The containers would have to be made of such material that it would withstand extremes of heat and cold, not absorb fats and not impart off flavors. It would also have to allow for quick penetration of heat, and be moisture-vapor-proof.

EXPERIMENTAL METHODS AND RESULTS

General Procedures

Preliminary experimental work was done on all of the products which were used in this study. Recipes were taken from Lowe (1943), America's Cook Book (1937) and General Foods Cook Book (1932). Recipes were adjusted until satisfactory products were made. After the recipes were standardized, the products were made and frozen to see how well they would withstand freezing. After two-five days storage at 0° F., they were tasted to see if they were acceptable. If the sample was satisfactory, the recipe was used in the frozen food storage problem.

The panel for scoring the products was composed of six members of the staff in the Foods and Nutrition Department. Members of the panel scored the products which were marked only by a code number. In addition to scoring for individual factors, the judges recorded comments concerning any outstanding features. The scoring was done in the foods research laboratory. Care was taken so that there were no foreign odors in the room at the time of the test. The judges were provided with glasses of cold water during the scoring period.

The methods and results have been grouped according to product, to avoid confusion.

Apple Pie

Whether to freeze pies before or after baking has been a controversial subject. The present study was undertaken to contribute more information on this issue, as well as to recommend storage time and type shortening for the crust.

Experimental procedure

The recipe for pastry was taken from Lowe (1943); recipe for filling was taken from America's Cook Book (1937).

Apple Pie

Ingredients	Measure	Weight
Crust:		
Flour	2 cups	225 grams
Salt	1 teaspoon	
Shortening	2/3 cup	149 grams
Water	about 1/4 cup	
Filling:		
Apples	1 pound	454 grams
Sugar	1/2 cup	100 grams
Salt	1/4 teaspoon	
Cinnamon	1/2 teaspoon	

Place flour and salt in bowl; add shortening and cut into flour with pastry blender. Add water; stir until liquid and dry ingredients are combined. Roll out pastry on lightly floured board; line 9-inch paper pie plate with pastry. Fill with sliced apples which have been mixed with sugar, salt and cinnamon. Moisten edge of crust with water; cover with top crust and press edges together. Bake in moderately hot oven (400°F.) for 45 minutes.

The pies were frozen in both the raw and baked form. In addition, apple filling was made and frozen for the fresh pies which were used as a control at each test period. All of the pies were made from MacIntosh apples. The apples were not peeled in order to eliminate a long processing time. The apples were sliced and mixed with sugar, salt and cinnamon. They were then packed in waxed tubs and frozen, or made into pies at once. A tub of apples was frozen with each set of two pies. This fruit was frozen in order to eliminate changes which might take place in cold storage and to avoid using apples from several sources for the control pies.

Steam vents were cut in the upper crust of the control pies and the pies which were baked before freezing. No steam vents were cut in the pies which were frozen raw. It has been suggested by Fenton and Darfler (1946) that by keeping as much air from the apples as possible, oxidizing and browning of the fruit would be reduced.

The pies were wrapped in cellophane, using a drugstore fold. They were then wrapped in stockinette and frozen.

When the pies were to be scored, steam vents were cut in the upper crust of the unbaked frozen pies. They were baked in a moderately hot oven (400°F.) for 1 1/2 hours or until done. The prebaked pies were baked in a moderate oven (350°F.) for 30 minutes.

Factors considered in this problem were the advisability of freezing the pies in the raw or baked form, the length of time the pies could be stored satisfactorily, and the effect of the type shortening, i.e., vegetable shortening, hydrogenated lard, and plain lard in the crust. A series of pies were made so that each type could be judged as a fresh product, in the fresh frozen state (two-five days), at two week intervals for the first two months, and then every month until the sixth month. The series was not replicated. Storage was at 0° F. At each sampling period a fresh pie was made, using the frozen apples, and scored with the frozen pies.

Discussion of results

Pie Crust: Figure 1 shows the general conclusion scores for the pie crust. The score card used, and the averages for all the scoring factors are included in the Appendix, Tables 1, 2, 3, 4.

The pies which were frozen raw scored consistently higher than those baked before freezing for each of the storage periods and for the three types of shortening used. On several occasions, the raw frozen product scored higher than the fresh control, indicating that the freezing process actually improved the product. Fenton and Darfler (1946) said that in general, pies that are frozen unbaked have a flakier, more tender crust, a fresher aroma and a fresher flavor than do those baked before freezing.

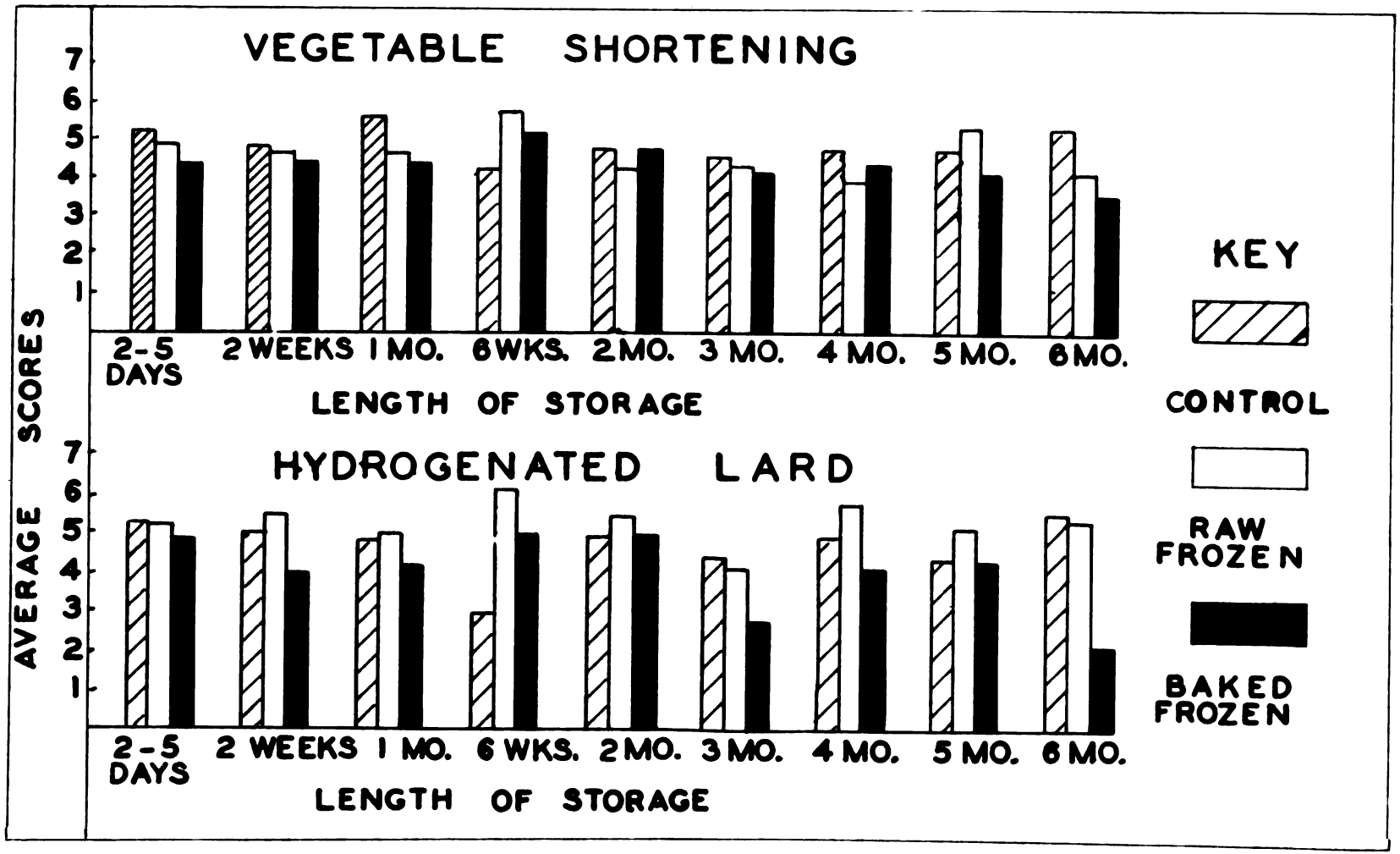

FIGURE 1 AVERAGE SCORES FOR GENERAL CONCLUSION ON CRUSTS OF APPLE PIES TESTED FRESH, RAW FROZEN, BAKED FROZEN.

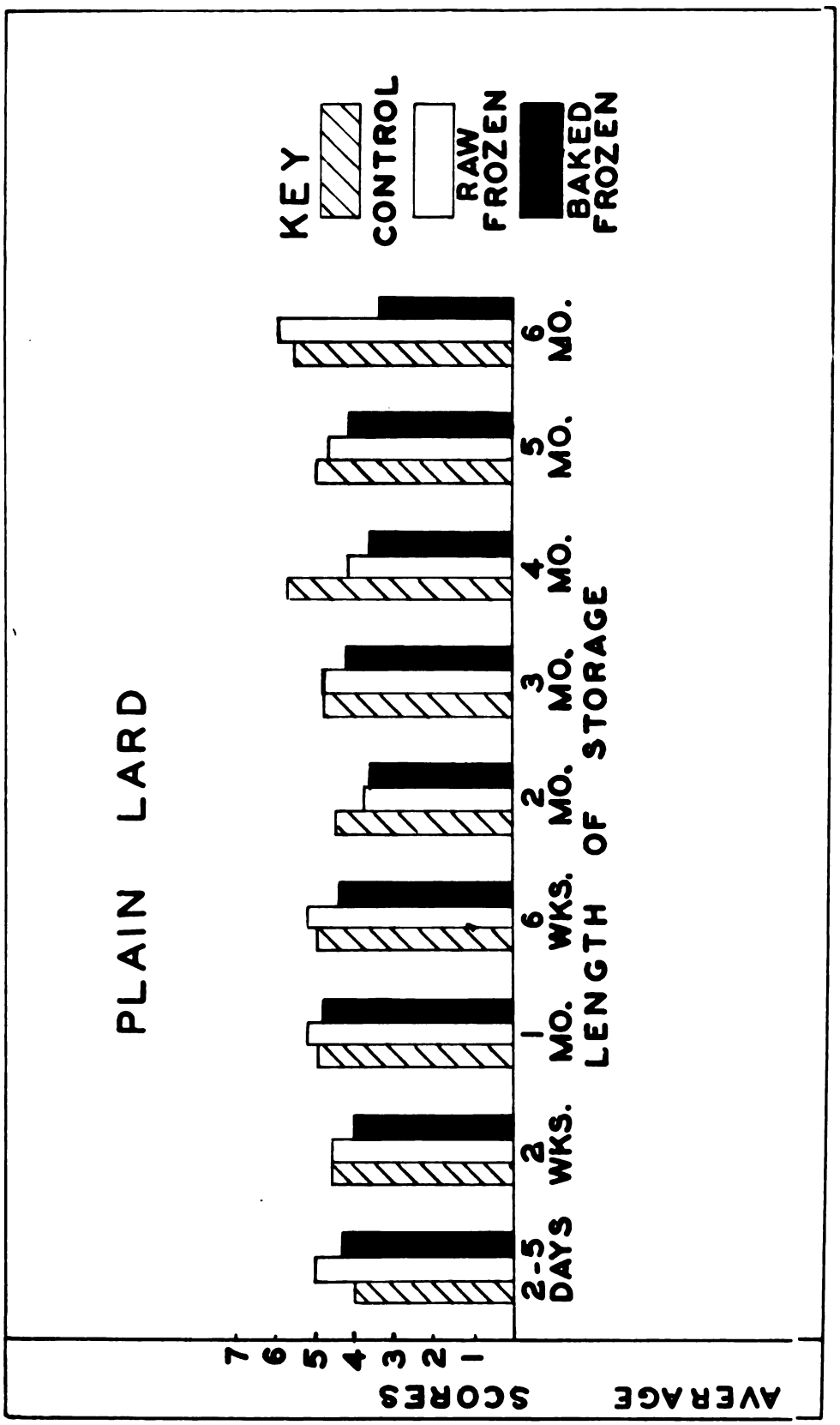

FIGURE 1 (CONT.) AVERAGE SCORES FOR GENERAL CONGLUSION ON CRUSTS OF APPLE PIES TESTED FRESH, RAW FROZEN, BAKED FROZEN.

Scores for all three shortenings show that the raw frozen pies changed very little during the six months storage period, whereas the prebaked pies dropped in score after five months' storage. The result of these tests indicate that apple pies frozen raw may be stored for at least six months without serious change in the eating quality. The prebaked frozen pies may be stored for five months. After five months, however, there was a decided drop in score no matter which type of shortening was used.

Figure 1, which compares the general conclusion scores for crusts made from vegetable shortening, hydrogenated lard and plain lard, indicates that either hydrogenated or plain lard is preferable to vegetable shortening. It is possible that the pies made from hydrogenated lard might have scored even higher if the lard had been in better condition. It was apparent that the hydrogenated lard was not of prime freshness, as it became rancid after a short period of refrigerated storage.

Filling: Figure 2 shows the general conclusion scores for the apple filling. Score card and averages for the other scoring factors appear in the Appendix. Tables 5, 6, 7, 8.

The apples for the pies which were frozen raw scored

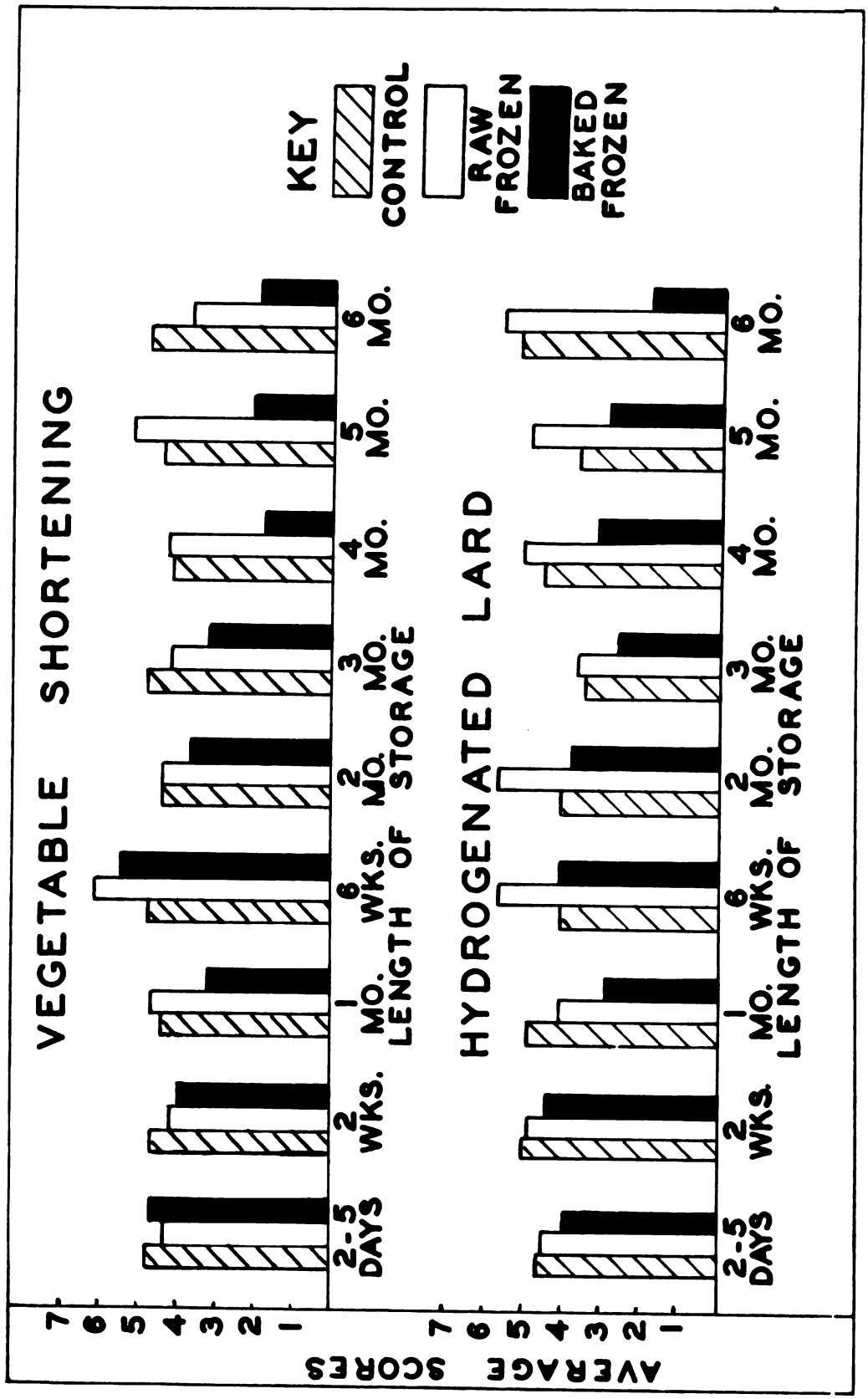

FIGURE 2 AVERAGE SCORES FOR GENERAL CONCLUSION ON APPLE FILLING FOR PIES TESTED FRESH, RAW FROZEN, BAKED FROZEN.

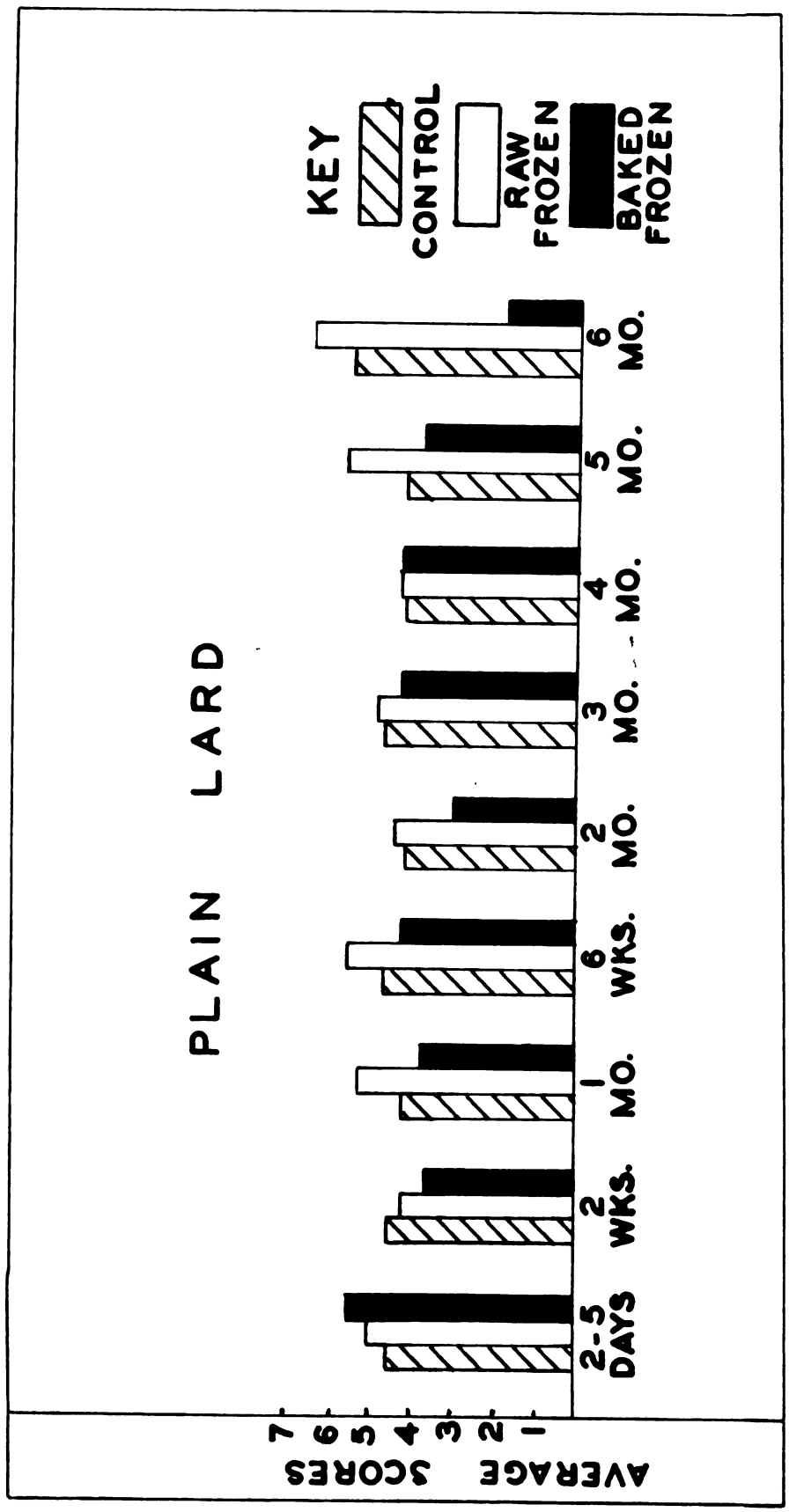

FIGURE 2 (CONT.) AVERAGE SCORES FOR GENERAL CONCLUSION ON APPLE FILLING FOR PIES TESTED FRESH, RAW FROZEN, BAKED FROZEN.

consistently higher than those frozen prebaked. The pies frozen raw were satisfactory after six months' storage, whereas those frozen prebaked were satisfactory for only three to four mohths. This was true for pies made from the three types of shortening. Frozen filling for the control pies was satisfactory after a six month storage period. Scores for filling for the control pies were very much like those of pies frozen raw, for the various storage periods.

Cakes and Frosting

Cakes may be frozen either before or after baking. In the present experiment, the cakes were frozen both ways. The kinds of cakes which were made were plain cake, chocolate cake, spice cake, and sponge cake.

Plain Cake

Experimental procedure: The recipe which was used was taken from Lowe (1943).

Plain Cake

Ingredients	Measure (single recipe)	Weight Used (3 X recipe)
Cake flour	2 cups	600 grams
Baking powder *	2 teaspoons	2 tablespoons
Salt	1/4 teaspoon	3/4 teaspoon
Shortening	1/3 cup	225 grams
Sugar	1 cup	200 grams
Egg	1	144 grams
Milk	3/4 cup	540 grams
Vanilla	1 teaspoon	1 tablespoon

Sift together flour, baking powder and salt. Turn mechanical mixer to speed #1. Beat shortening 1 minute; scrape down bowl. Add sugar and beat 3 minutes; scrape. Add eggs, beat 1 minute; scrape. Add 1/3 sifted dry ingredients; pour in 1/3 milk-vanilla mixture over 20 second period; beat 10 seconds more. Scrape down bowl. Repeat until all flour and milk are combined with other ingredients. Scrape down bowl. Turn mixer to speed #2; beat 30 seconds. Spread batter in greased 8-inch layer pans. Bake in moderate oven (350° F.) about 30 minutes.

* Sodium-aluminum-sulphate baking powder. When tartrate or phosphate powders were used, the measure was 3 teaspoons for small recipe, 3 tablespoons for 3 X recipe.

Cake batter was mixed in a Hobart mixer, making three times recipe in one batch. The cake was frozen baked in the form of 8-inch layers and 2-inch cup cakes. The layers were frozen both plain and iced with Seven Minute Frosting. Cake batter was also frozen. Three types of baking powder, sodium-aluminum-sulphate, tartrate and phosphate baking powders were used in the frozen cake batter.

Since the cakes were made in large quantity, it was possible to carry through one storage series from one batch of batter except for the baking powder experiment. In that case, the tartrate and phosphate batters were frozen only in the raw state. Therefore it was possible to make sufficient batter in one mixing for three different storage periods. This insured a uniformity which would not have been possible if the cake batter had been made in smaller batches.

Thirteen ounces of batter was used for each layer; nine ounces for six cup cakes. A #20 scoop was used for dipping the batter for the cup cakes. The raw batter was stored in waxed tubs, thirteen ounces in each tub. The baked cakes were sealed in cellophane bags and then placed in cardboard boxes. The iced cakes were placed in cake

boxes, and the boxes were wrapped in cellophane and heat sealed.

Storage of the cakes was arranged so that the plain layers and cup cakes made with sodium-aluminum-sulphate baking powder were scored fresh, and after two-five days, one, two, four, six, eight, and eleven months' storage at 0° F. The cup cakes and layers made with tartrate and phosphate baking powders were scored fresh, and after two-five days, one, two, four and six months' storage at 0° F. The iced layers were scored fresh, and after two-five days, one, two, four, six, eight and eleven months' storage at 0° F. At each scoring period, a fresh cake was made and used as a control. The tests were done only once.

When the cakes were to be scored, the raw frozen batter was put in pans and allowed to stand one hour at room temperature. It was baked in a moderate oven (350° F.) 35-45 minutes. The baked cakes, both plain and iced, were thawed 1 1/2 hours at room temperature.

Discussion of results: Figures 3 and 4 show the general conclusion scores for Plain Cake. Score card and averages for all the scoring factors are included in the Appendix, Tables 9, 10, 11, 12.

For the first month of storage, the layer cakes baked before and after freezing scored very much the same. After two months, cake made from the raw batter dropped

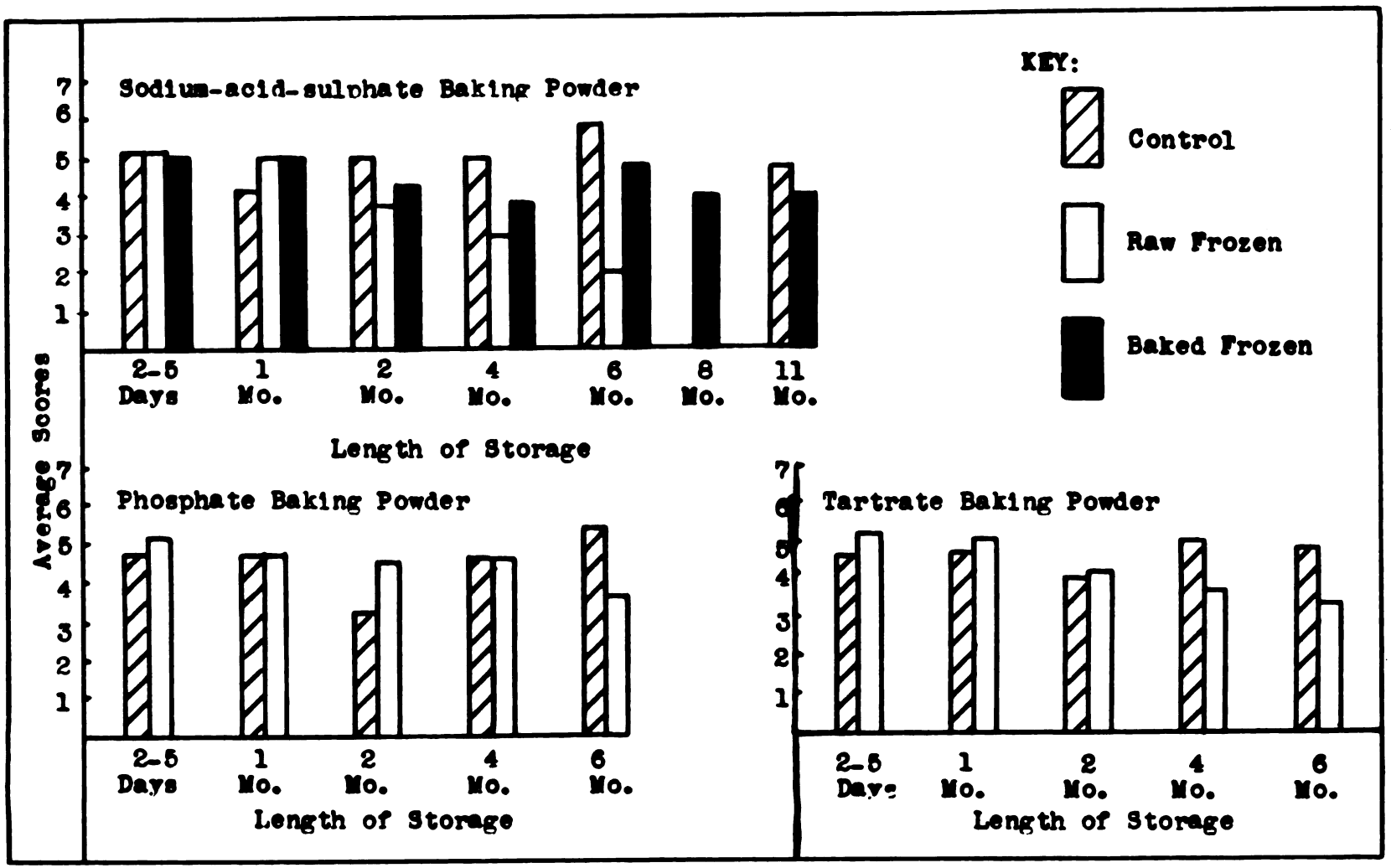

Figure 3. Average scores for general conclusion on Plain Cake frozen in layer form, using sodium-acid-sulphate, phosphate and tartrate baking powders.

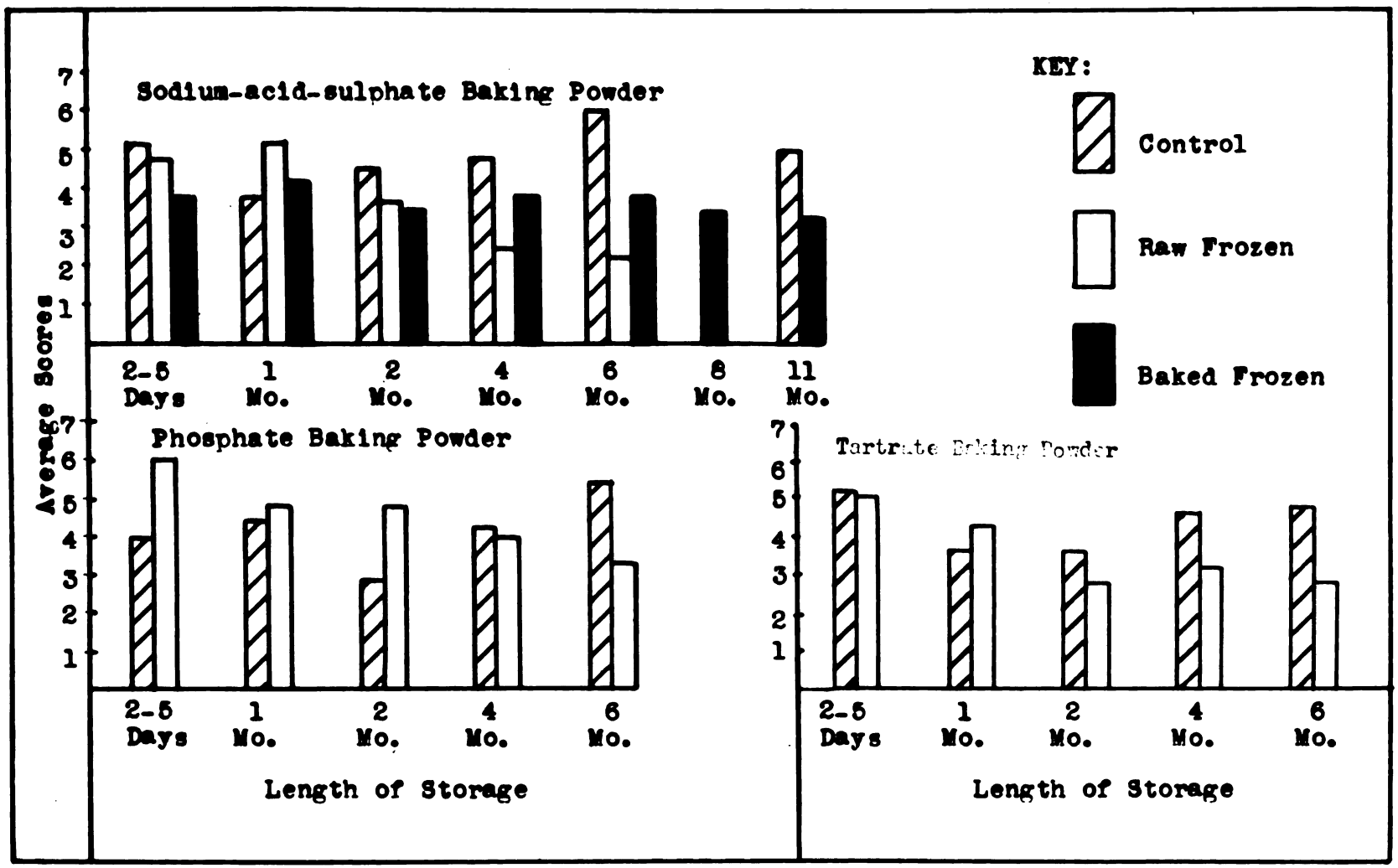

Figure 4. Average scores for general conclusion for Plain Cake frozen in cup cake form, using sodium-acid-sulphate, phosphate and tartrate baking powders.

slightly in score. After four and six months of storage, the scores dropped even more. This drop was especially apparent in the scores for odor and flavor as shown in Table 10, in the Appendix. It is possible that the baking powder may have developed an acrid off flavor and odor after this period of storage. After two months of storage, the prebaked cake scored much higher than the cake baked after freezing.

Cup cakes scores showed the same general trend as scores for layer cake. For the first two months, cake made from the raw frozen batter was slightly better than the prebaked cake. At the four and six months storage periods, the scores for the cake baked after freezing dropped considerably. This was particularly apparent in scores for flavor and odor.

Scores for both the layer and cup cakes show that cakes made from the raw batter were acceptable for only two months of storage at 0° F. The prebaked cakes were satisfactory for the entire eleven month storage period.

Scores for layers using all three types of baking powder were very much the same for the first month of storage. At the two, four and six month periods, cake made from phosphate scored first, tartrate scored second and sodium-acid sulphate scored the lowest. Cake made from sodium-acid-sulphate baking powder was not acceptable.

at the six month storage period.

Scores for the cup cakes showed a slightly different pattern. Cake made from phosphate baking powder scored first at the two-five day period, cake made from sodium-acid-sulphate scored first at one month, cake made from phosphate baking powder scored first after two months' storage. At the four and six month scoring periods, cake made from phosphate baking powder scored first, tartrate second and sodium-acid-sulphate the lowest.

An overall picture of all the storage periods shows that the layers had a higher score than the cup cakes when sodium-acid-sulphate or tartrate baking powders were used. When phosphate baking powder was used, the cup cakes scored slightly higher than the layers.

Spice Cake

Experimental procedure: The recipe used was taken from General Foods Cook Book (1932).

Spice Cake

Ingredients	Measure (single recipe)	Weight Used (2X recipe)
Cake Flour	2 1/2 cups	500 grams
Baking powder *	2 1/2 teaspoons	5 teaspoons
Salt	1/4 teaspoon	1/2 teaspoon
Cinnamon	1 teaspoon	2 teaspoons
Mace	1/2 teaspoon	1 teaspoon
Cloves	1/4 teaspoon	1/2 teaspoon
Shortening	1/2 cup	225 grams
Sugar	1 cup	400 grams
Eggs	2	192 grams
Molasses	1/3 cup	2/3 cup
Milk	3/4 cup	360 grams

Sift together dry ingredients. Set mixer on speed #1. Beat shortening 1 minute; scrape down bowl. Add sugar, beat 3 minutes, scrape down bowl. Beat 1 minute, scrape; beat 2 minutes, scrape. Add eggs, beat 1 minute; scrape down bowl. Add molasses and beat 1 minute; scrape down bowl. Add dry ingredients and milk as in Plain Cake. Turn mixer to speed #2, beat 30 seconds. Spread batter in greased 8-inch layer pans. Bake in moderate oven (350° F.) about 30 minutes.

* Sodium-aluminum-sulphate baking powder.

The cake was frozen baked in the form of 8-inch layers and 4 1/2 x 5-inch loaves. Raw batter was frozen in waxed tubs, 16 ounces in each tub. Sixteen ounces of batter was used for the layers and loaves also.

Storage periods for the Spice Cakes were two-five days, one, two, four, six, eight, and eleven months, at 0° F. Tests were done only once.

When the cake was to be scored, the raw frozen batter was placed in pans and allowed to stand at room temperature for one hour. It was baked in a moderate oven (350° F.) 35-40 minutes. The baked cake was thawed at room temperature for 1 1/2 hours before using.

Discussion of results: Figure 5 shows the general conclusion scores for the layer and loaf cakes. Score cards and averages for all the scoring factors are included in Appendix, Tables 13, 14.

Layer cake made from the raw frozen batter scored slightly higher than the prebaked cakes through the six months of storage.

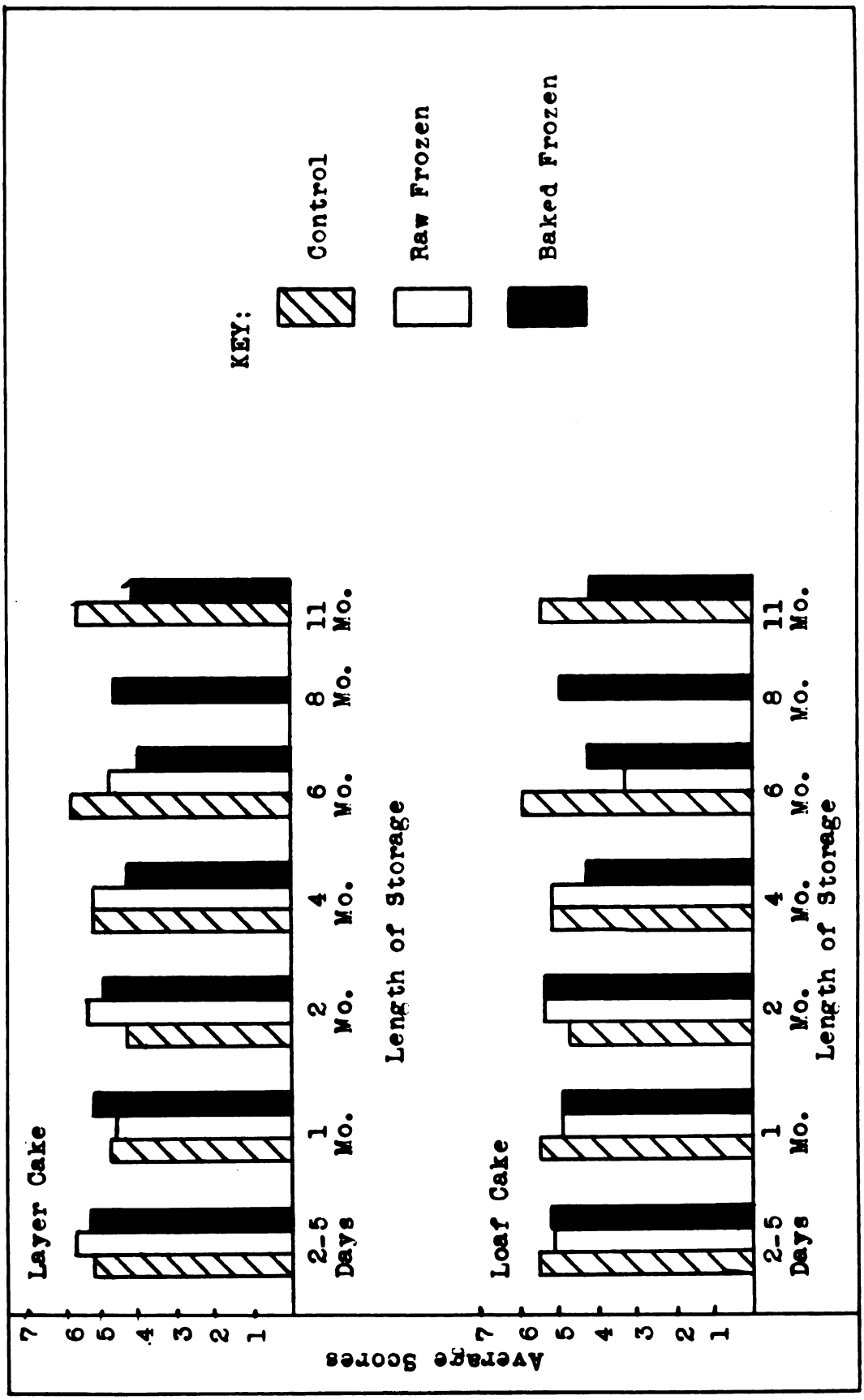

Figure 5. Average scores for general conclusion for Spice Cake frozen in layer and loaf form.

Scores for the prebaked and raw frozen loaf cakes were very much the same until the fourth month of storage. The cake made from the raw frozen batter scored higher at the fourth month; the prebaked cake scored higher after six months' storage. At this time, the cake made from the raw frozen batter was no longer acceptable.

The prebaked cakes were satisfactory for eleven months of storage at 0° F. both in the layer and the loaf form. Layers made from raw frozen batter were satisfactory for six months of storage; loaf cake made from raw frozen batter was satisfactory for four months' storage.

The shape of cake seemed to make little difference until the sixth month scoring period. At that time, the layer cake scored higher when made from the raw batter, but the prebaked loaf cake scored slightly higher than the layer made from frozen batter. After eleven months of storage, the layer and loaf cakes scored the same in the prebaked cake scores.

Chocolate Cake

Experimental procedure: The recipe was adapted from the recipe which appears on the Hershey Cocoa box.

Chocolate Cake

Ingredients	Measure (Single recipe)	Weight Used (2 X recipe)
Cake flour	2 1/2 cups	500 grams
Soda	1/4 teaspoon	1/2 teaspoon
Baking powder	2 1/2 teaspoons	5 teaspoons
Salt	1/2 teaspoon	1 teaspoon
Cocoa	1/2 cup	112 grams
Shortening	1/2 cup	224 grams
Sugar	1 1/2 cups	600 grams
Egg	2	192 grams
Milk	1 1/3 cups	640 grams
Vanilla	1 teaspoon	2 teaspoons

Sift together flour, soda, baking powder, salt and cocoa. Set mixer on Speed #1. Beat shortening 1 minute. Add sugar, beat 2 minutes, scrape down bowl; beat 2 minutes. Add eggs, beat 1 minute. Scrape down bowl. Set mixer on speed #2; beat 1 minute. Add sifted dry ingredients and milk as in Plain Cake. Set mixer on speed #1; beat for 1 minute. Spread batter in greased 8-inch layer pans. Bake in moderate oven (350°F.) about 30 minutes.

The cake was frozen baked in 8-inch layers, both plain and iced with Butter Frosting. Sixteen ounces of batter was used for each layer. The batter was stored in waxed tubs; sixteen ounces in each tub. The plain layers were heat sealed in cellophane bags, then placed in cardboard boxes. The iced layers were placed in boxes, wrapped in cellopnane and heat sealed.

The cakes were scored while fresh, after two-five days, two, three, five and eight months' storage at 0° F. The tests were done only once.

When the cakes were to be scored, the baked and baked iced layers were allowed to stand in their packages at room

temperature, for 1 1/2 hours. The raw batter was placed in pans and allowed to stand one hour at room temperature. The pans were then placed in a moderate oven (350° F.) for 35 minutes.

Discussion of results: Figure 6 shows the general conclusion scores for Chocolate Cake. Average scores for other factors appear in Appendix, Table 15.

The cake made from the raw frozen batter scored slightly higher than the prebaked cake at all of the scoring periods except two-five day period.

Both the cake made from the raw frozen and the prebaked cake were satisfactory for eight months of storage at 0° F.

Sponge Cake

Experimental procedure: Recipe for Sponge Cake was taken from America's Cook Book (1937)

Sponge Cake

Ingredients	Measure (single recipe)	Weight Used
Cake flour	2 cups	200 grams
Baking powder	3 teaspoons	
Salt	3/4 teaspoon	
Egg yolks	8	144 grams
Sugar	1 1/2 cups	300 grams
Lemon rind, grated	1 teaspoon	
Lemon juice	2 tablespoons	
Boiling water	3/4 cup	

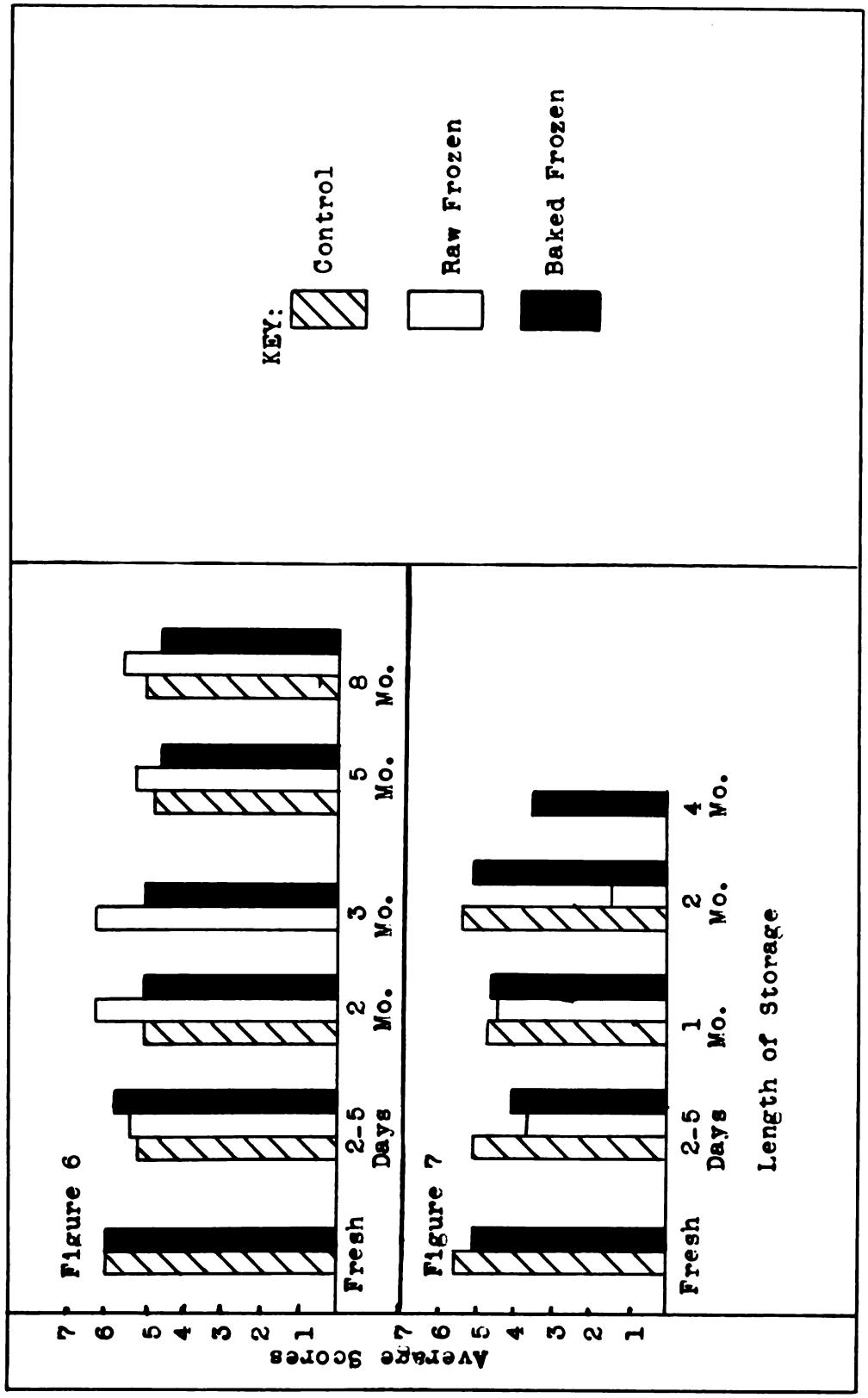

Figure 6. Average scores for general conclusion for Chocolate Cake frozen in layers, not iced.
Figure 7. Average scores for general conclusion for Sponge Cake.

Sift together flour, baking powder and salt. Beat egg yolks until thick and lemon colored, about 150 strokes. Add sugar gradually, beating until very thick. (The sugar is added in five lots, with 20 strokes for each addition, plus 20 extra strokes). Beat in lemon rind, juice and boiling water, using 50 strokes. Fold in flour in three lots, using 40 strokes for each addition. Spread in cake pan. Bake in moderate oven (350°F.) 50-60 minutes. Invert pan 1 hour or until cool, before removing cake from pan.

Sponge cake was frozen baked in loaf form. Six ounces of batter was used for each loaf. The baked cakes were placed in cellophane bags, heat sealed and then placed in cardboard boxes. The raw batter was stored and frozen in waxed tubs.

The cakes were scored while fresh, after two-five days, one, two and four months' storage at 0° F. The tests were made only once.

When the cakes were to be scored, the raw batter was allowed to thaw at room temperature for one hour, then placed in the pans and baked in a moderate oven (350° F.) about 1 hour. The baked cake was allowed to thaw one hour at room temperature before scoring. At each scoring period, a fresh cake was made and used as a control.

Discussion of results: Figure 7 shows the general conclusion scores for Sponge Cake. Average scores for other scoring factors appear in Appendix, Table 16.

Both the cakes made from the raw frozen batter and the prebaked cake were satisfactory for one month of storage, although the prebaked cake scored slightly higher. After two months' storage, the cake made from the raw batter, frozen, was

no longer acceptable. The chief factors affected were volume, texture, and tenderness.

The cake made from the raw frozen batter was satisfactory for only one month of storage. The prebaked cake was satisfactory for four months' storage period.

Frostings

Experimental procedure: Recipe for Seven Minute Frosting was taken from General Foods Cook Book (1932).

Seven Minute Frosting

Ingredients	Measure
Egg whites	2
Sugar	1 cup
Water	1/3 cup
Cream of Tarter	1/8 teaspoon
Salt	dash
Vanilla	1 teaspoon

Beat egg whites, sugar, salt, water and cream of tarter together in top of double boiler. Place over boiling water and continue beating with rotary beater for seven minutes. Remove from water and add flavoring. Continue beating until cool or thick enough to spread.

Recipe for Butter Frosting was taken from America's Cook Book (1937).

Butter Frosting

Ingredients	Measure	Weight Used
Shortening	1/4 cup	56 grams
Confectioner's sugar	2 cups	260 grams
Vanilla	1 teaspoon	1 teaspoon
Salt	dash	dash
Milk	3 tablespoons	3 tablespoons

Cream shortening with 1 cup sugar. Add vanilla and salt. Stir in remaining sugar alternately with milk. Beat until smooth after each addition.

Seven Minute Frosting was used on the Plain Cake; Butter Frosting was used on the Chocolate Cake. The cakes themselves were the same as those used in the other experiments. The purpose of the iced cake was to determine the effect of freezing on the icing.

Discussion of results: General conclusion scores for the frosting on the Plain cake iced with Seven Minute Frosting appear in Figure 8. Average scores for other factors appear in Table 17, 18, in the Appendix. They show that freezing, even for two-five days affects the appearance, consistency, texture and general conclusion scores markedly. The score for that period was just acceptable (3.2). An extended period of storage did not lower the scores any more. After eleven months of storage, the frosting scored very much as it did at the two-five day period.

Figure 9 shows the general conclusion scores for the Butter Frosting. Average scores for other scoring factors appear in Appendix, Table 19. Through an oversight, the butter frosting was not scored separately until the two months' storage period. There was little change in the frosting between the two and eight month periods. Butter

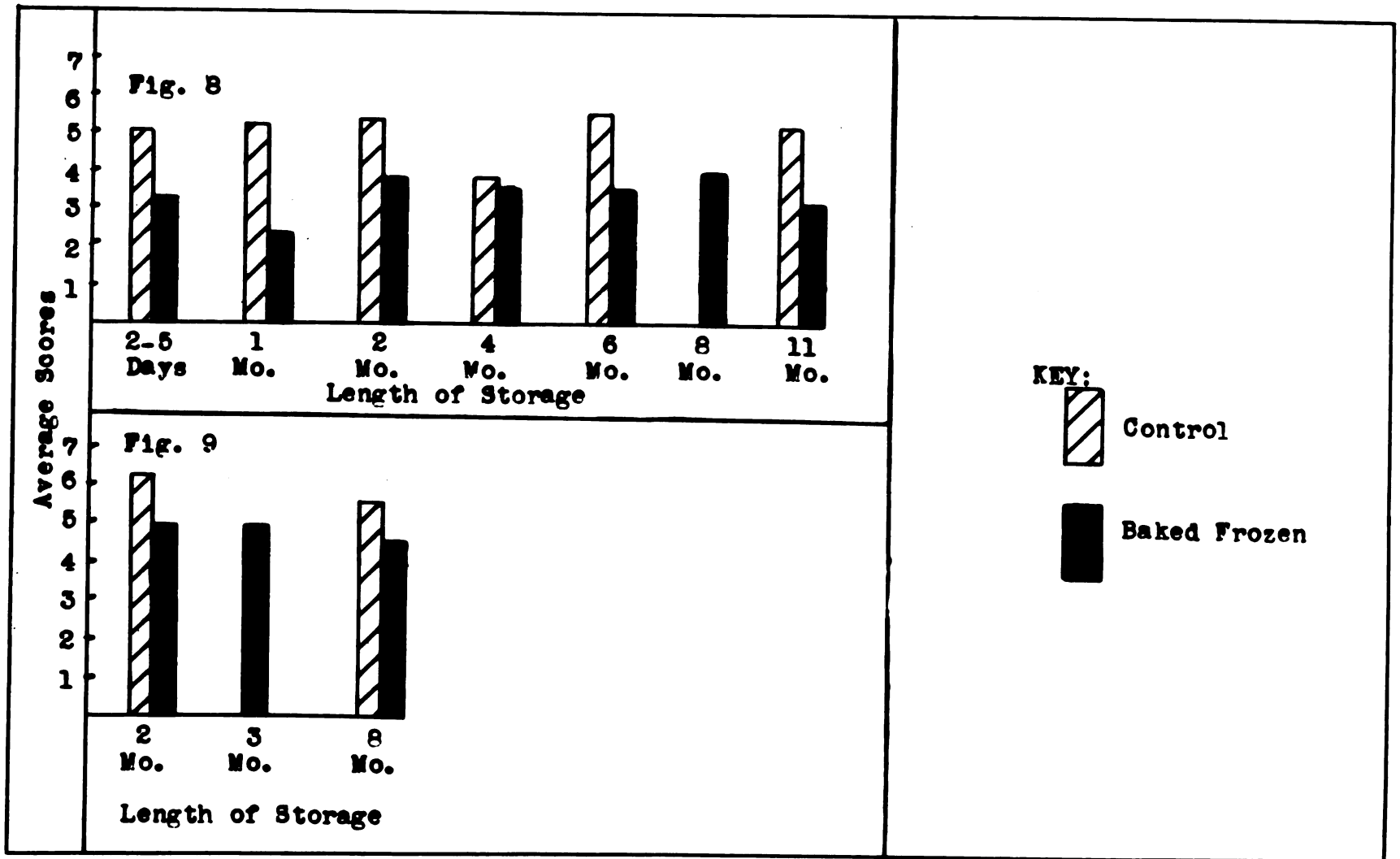

Figure 8. Average general conclusion scores for Seven Minute Frosting.
Figure 9. Average general conclusion scores for Butter Frosting.

Frosting freezes satisfactorily because the fat helps to prevent the frosting from drying out. Butter Frosting was much better for freezing purposes than the Seven Minute Frosting.

Cookies

Like cakes, cookies may be frozen either before or after baking. Cookie dough requires less freezer space and is easier to package than baked cookies. Probably there is less difference in cookies than in any other type of foods between those freshly baked from frozen dough and strictly fresh ones. Cookies for this experiment were frozen only in the dough form.

Experimental procedure

Two types of cookies were used in the frozen food project. The recipe for the Oatmeal Hermits was taken from America's Cook Book (1937); recipe for Icebox Cookies was taken from General Foods Cook Book (1932). After some adjustments, the following proportions were found satisfactory.

Oatmeal Hermits

Ingredients	Measure	Weight
Flour	1 1/2 cups	168 grams
Baking powder	2 teaspoons	
Salt	1/2 teaspoon	
Cinnamon	1/2 teaspoon	
Oatmeal	2 cups	
Raisins	1 cup	
Shortening	1/2 cup	112 grams
Sugar	1 cup	200 grams
Eggs	2	96 grams
Milk	1/2 cup	120 grams

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Sift together flour, baking powder, salt and cinnamon; stir in oatmeal and raisins. Cream shortening and sugar thoroughly; add eggs, beat until fluffy. Stir in dry ingredients alternately with milk. Drop from teaspoon onto greased pan. Bake in moderate oven (375°F.) about 15 minutes.

Icebox Cookies

Ingredients	Measure	Weight
Shortening	6 tablespoons	84 grams
Brown sugar	1/4 cup	57 grams
Sugar	1 cup	200 grams
Egg, well-beaten	1	48 grams
Milk	1 tablespoon	
vanilla	1 1/2 teaspoons	
Chopped nutmeats	1 cup	
Flour	2 cups	224 grams
Baking powder	1 1/2 teaspoons	
Salt	1/8 teaspoon	

Cream shortening. Add sugars gradually; cream until light and fluffy. Add egg, milk, vanilla and nutmeats. Stir in flour, which has been sifted with baking powder and salt; mix well. Shape into rolls 1 inch in diameter. Roll in cellophane. Chill overnight or until firm. Slice in 1/8 inch slices. Bake in hot oven (425° F.) for 5 minutes.

Dough for the Oatmeal Hermits was stored in waxed tubs, 12 ounces in each tub. Dough for the Icebox Cookies was wrapped in cellophane, using a drugstore fold, and then tied in stockinette.

Doughs for both types of cookies were frozen. At various storage periods, cookies were made from the dough and compared with fresh cookies. Oatmeal Hermits were scored when fresh, at two-five days, and two, three, five and seven months' storage. The Icebox Cookies were scored fresh, and after two-five days, and one, two, three and six

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Ingredients	[illegible]	[illegible]
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months' storage at 0° F. The tests were made only once for both types of cookies.

On the day the cookies were to be scored, the dough for the Icebox Cookies was thawed in the refrigerator for one hour, then sliced and baked. The drop cookie batter was allowed to stand at room temperature in the waxed tubs for one hour. The dough was then soft enough to drop from a spoon. The cookies were baked as directed in recipes.

Discussion of results

Oatmeal Hermits: Figure 10 shows the general conclusion scores for the various storage periods. Score card and average scores appear in the Appendix, Tables 20 and 21. The frozen cookies compared very favorably with the fresh cookies at the various scoring periods. In several instances, the general conclusion score was even higher for the cookies made from the frozen dough than it was for the fresh cookies.

The cookies made from the frozen dough were satisfactory after seven months' storage at 0° F. Fenton (1946), Kiene (1947), Tressler (1947), Sunderlin (1941) state that cookie doughs may be stored successfully three to twelve months depending on the type of cookie. Tressler (1947) states that cookie recipes which are high in fat and low in moisture will ordinarily give successful products.

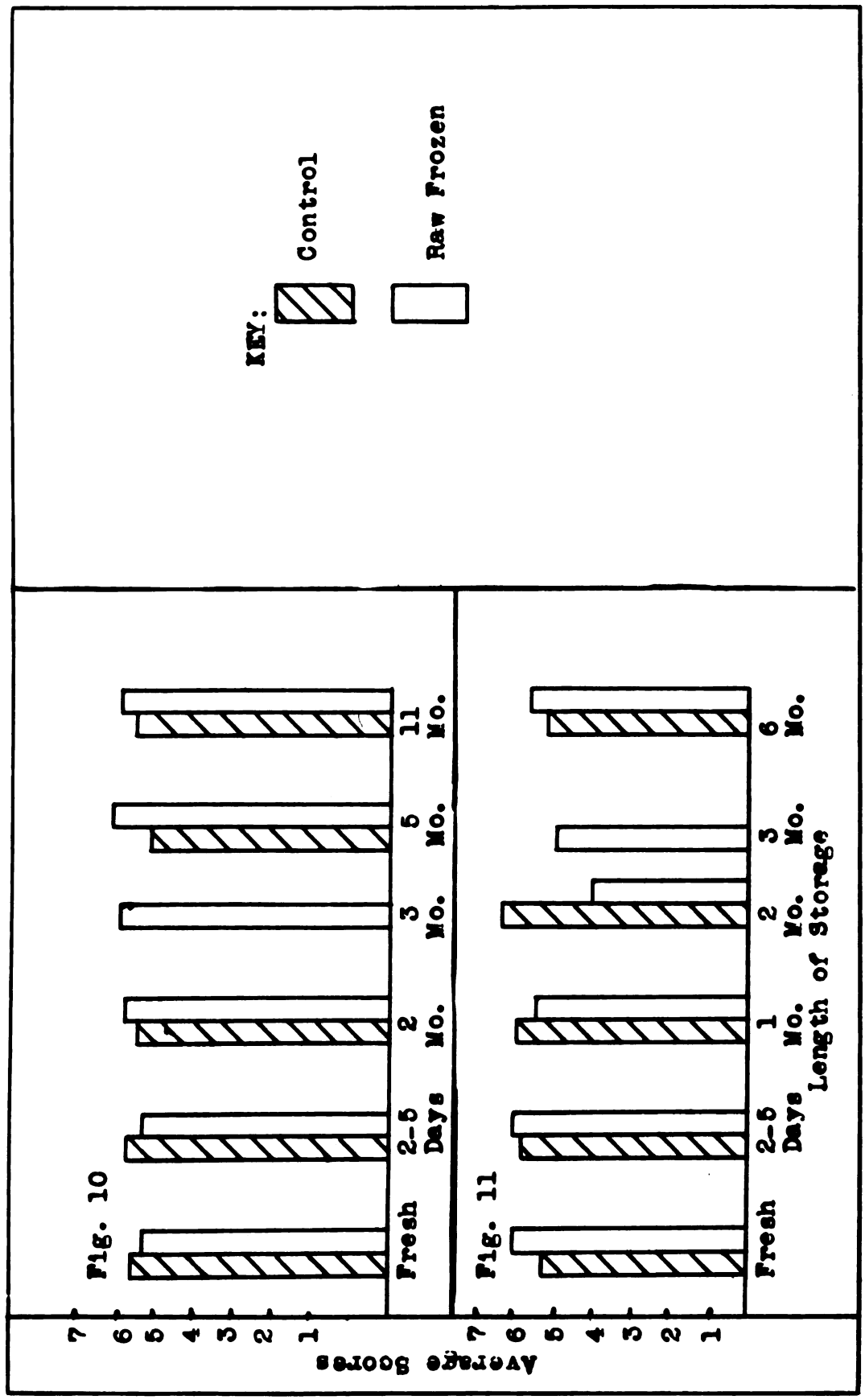

Figure 10. Average general conclusion scores for Oatmeal Hermits.
Figure 11. Average general conclusion scores for Icebox Cookies.

Icebox cookies: Figure 11 presents the general conclusion scores for the cookies frozen in the dough form and the fresh cookies. Average scores for other factors appear in Appendix, Table 22.

The cookies frozen and then baked scored as high as the fresh cookies except at the two month storage period. The cookies which were stored after two months storage were overbaked, explaining the lower scores.

The raw dough was stored successfully for six months. At the end of this time cookies made from the frozen dough were as good as the fresh cookies which were used as a control.

Quick Breads

Quick breads are another type of baked product which may be frozen either before or after baking. In this experiment, baking powder biscuits and muffins were used as representatives of the quick bread group.

Baking Powder Biscuits

Experimental procedure: The recipe for biscuits which was used in this project was taken from Lowe (1943).

Baking Powder Biscuits

Ingredients	Measure	Weight
Flour	2 2/3 cups	300 grams
Salt	1/2 teaspoon	
Baking powder *	3 teaspoons	12 grams
Shortening	4 tablespoons	50 grams
Milk	1 cup	240 grams

Sift together flour, salt and baking powder. Cut in shortening, using 25 strokes. Add milk; stir 30 strokes, Roll to 1/2 inch thickness; cut with 2-inch biscuit cutter. Bake in hot oven (425° F.) for 15 minutes.

* Amount refers to sodium-aluminum-sulphate baking powder. Four teaspoons tartrate and phosphate baking powders were used.

The biscuits were frozen both raw and prebaked. To ascertain the effect of baking powder, three types, sodium-aluminum-sulphate, tartrate, and phosphate baking powders were used in the biscuits.

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The biscuits which were to be frozen raw were rolled and cut. They were then placed in cardboard boxes, wrapped in cellophane and heat sealed. The baked biscuits were packed in the same manner.

Enough of each series of biscuits was made so that the product could be scored fresh, fresh frozen, (two-five days) and after one, two, four and six months of storage at 0° F. After four months' storage, however, it was decided to discard the biscuits which were frozen raw because they were no longer satisfactory. At each testing period, fresh biscuits were made and used as a control. Tests were made only once.

When the biscuits were to be scored, the ones which were frozen raw were removed from the carton, placed on a baking sheet and put into a hot oven (425° F.) for 25 minutes. To thaw and warm the prebaked frozen biscuits, they were placed in a very slow oven (250° F.) for 20 minutes. The biscuits were served hot to avoid any difference in palatability due to temperature.

Discussion of results: Figure 12 shows the general conclusion scores. Score card and average scores for other factors appear in Appeandix, Tables 23 and 24.

The prebaked frozen biscuits scored higher than those frozen raw at nearly every storage period. This was true for the biscuits made from all three types of baking powder. The only time the raw frozen biscuits

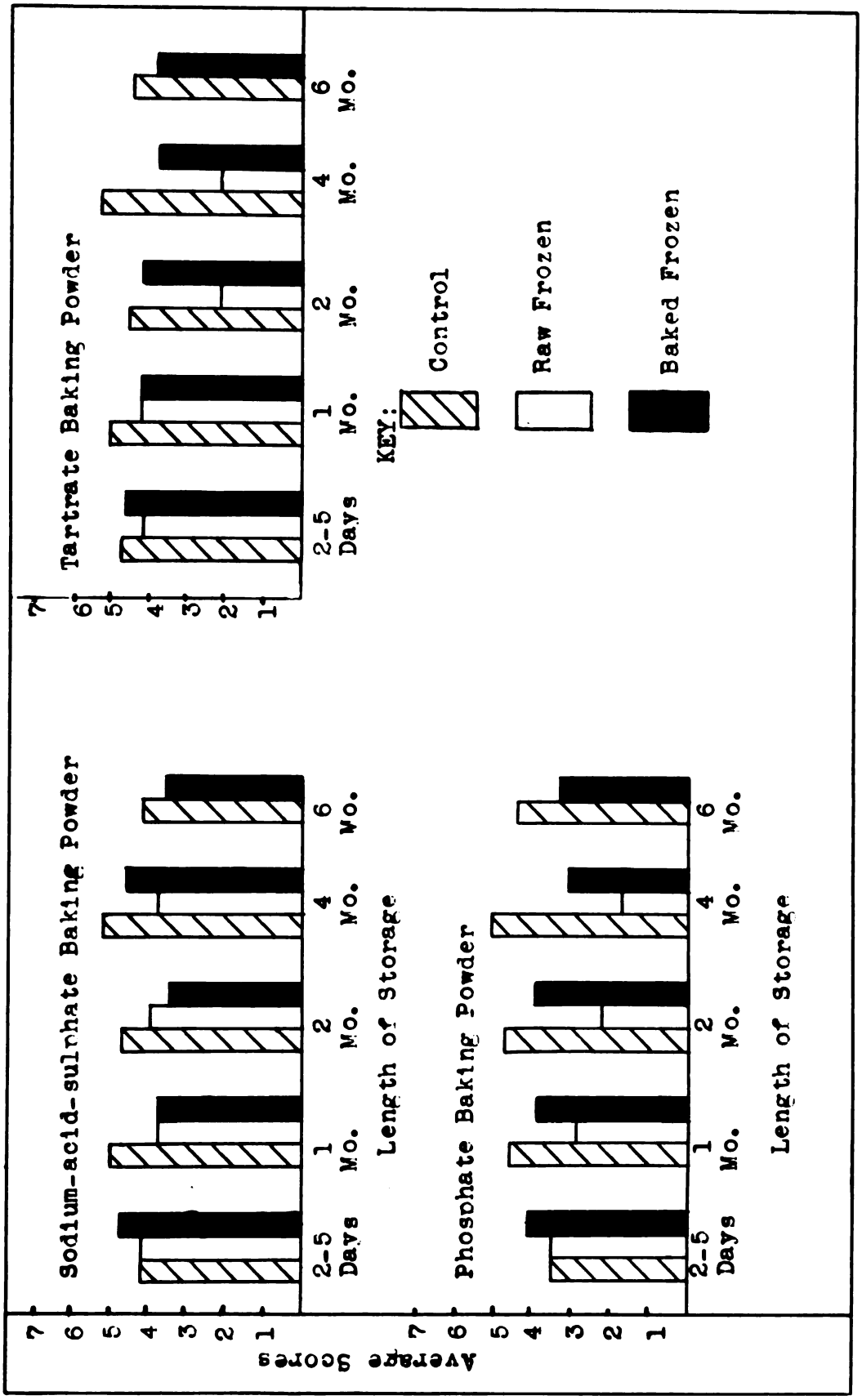


Figure 12. Average general conclusion scores for baking powder biscuits.

scored higher was at the two months storage period for the sodium-aluminum-sulphate baking powder. The texture and tenderness scores followed the same general trend as the general conclusion scores and were undoubtedly paramount in lowering the general conclusion scores for the raw frozen biscuits.

The biscuits made from sodium-aluminum-sulphate baking powder and frozen raw, were satisfactory after four months' storage. Raw frozen biscuits made from phosphate and tartrate baking powders had a shorter storage life. They could be stored for only one month, following which there was a decided drop in scores. All the pre-baked biscuits were satisfactory for the entire six months storage period. Tressler (1947) states that quick bread batters may be kept two-eight weeks, whereas the baked frozen products may be kept in freezer storage for four-six months. Sunderlin (1941) recommends that baking powder biscuits be kept only one month when frozen raw. Fenton (1946) recommends that unbaked baking powder biscuits be stored two-three weeks.

According to the general conclusion scores, biscuits made from sodium-aluminum-sulphate baking powder scored highest, tartrate second, and phosphate third when the biscuits were frozen raw. This is an overall picture of all the storage periods. When the biscuits were frozen

prebaked, the tartrate biscuits scored slightly higher than the sodium-aluminum-sulphate; the phosphate again scored the lowest.

Partial explanation for these scores may be the rate of reaction of the baking powders. Sodium-aluminum-sulphate is a double action baking powder, that is, it reacts partially when the liquid is added and partly when the product is baked. Tartrate is a fast acting baking powder and will react completely at room temperature.

Phosphate baking powder reacts less quickly, and requires heat for complete reaction. A double action baking powder which acts more slowly at room temperature than the single action powders proved more successful in the biscuits.

Muffins

Experimental procedure: The muffin recipe was taken from Lowe (1943).

Muffins

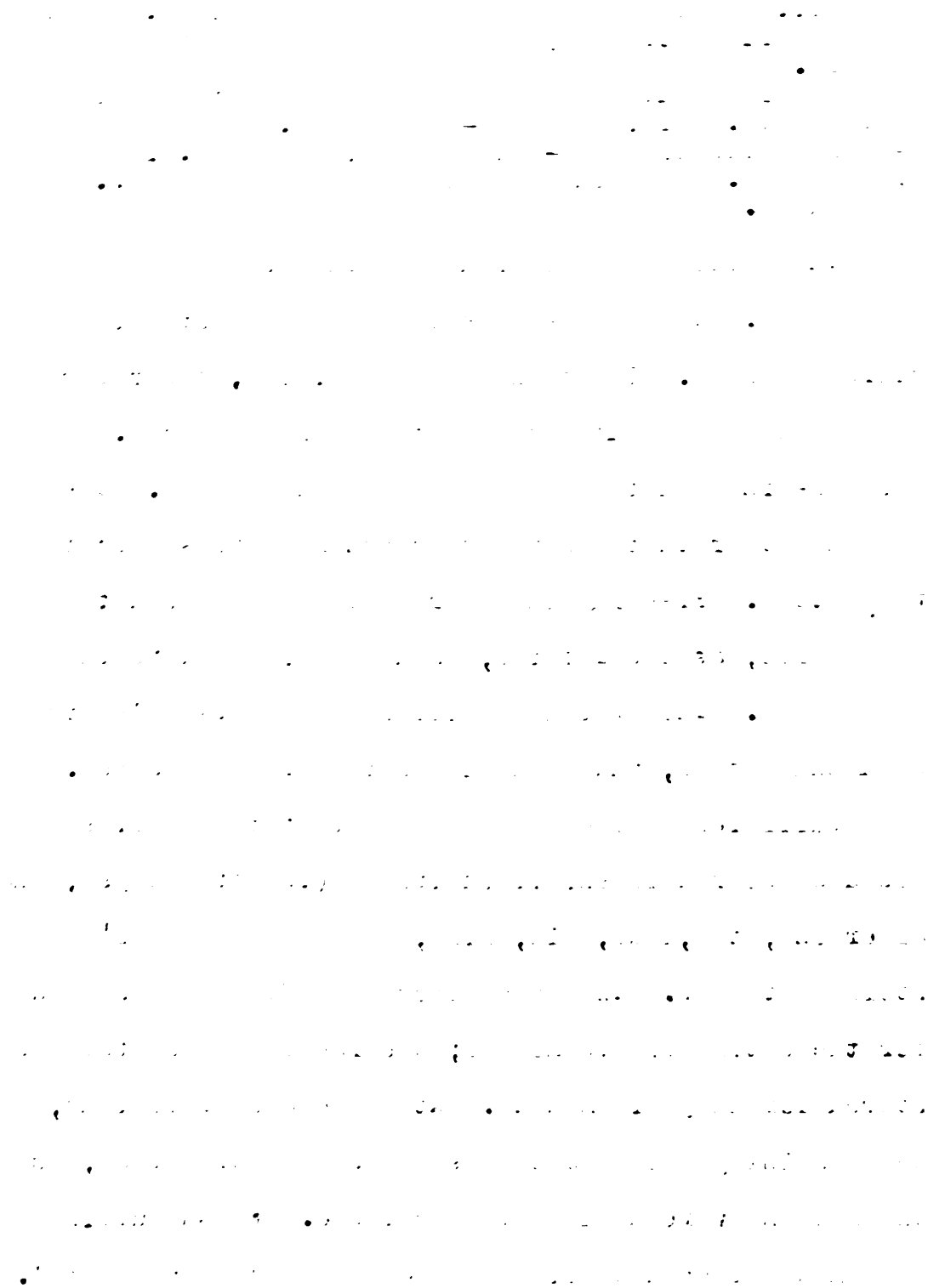
Ingredients	Measure	Weight
Flour	2 cups	224 grams
Baking powder	2 teaspoons	8 grams
Salt	1/2 teaspoon	
Sugar	2 tablespoons	25 grams
Milk	1 cup	240 grams
Egg	1	48 grams
Shortening, melted	2 tablespoons	25 grams

Sift dry ingredients together three times. Beat egg and milk thoroughly (1 1/2 minutes with rotary egg beater).

Combine melted shortening and liquids; add to dry ingredients. Mix, using 20-25 strokes. Fill greased 2-inch muffin tins two-thirds full, using No. 20 ice cream scoop. Bake in moderately hot oven (400° F.) about 30 minutes.

The muffins were frozen in both the baked and raw dough form. Tests were made in duplicate for each storage period. In making up the muffins, the recipe was doubled and half was used for each duplicate. This was done in both the raw and the baked samples. The muffin batter that was to be frozen raw was stored in waxed tubs. Freezing in paper baking cups was not successful, as the muffins, when baked, stuck to the paper cups. The prebaked muffins were heat-sealed in cellophane bags, and then placed in cardboard boxes.

Sufficient batter was made so that the muffins could be scored fresh, fresh frozen (two-five days), and after one, two, four, six, nine, and twelve months' storage at 0° F. The baked frozen muffins were stored for the entire twelve months; the raw frozen batter was stored for only six months. At the end of this time, the remaining frozen batter samples were discarded, as the muffins were no longer acceptable. Fresh muffins were made at each testing period and used as a control.



Raw batter was thawed at room temperature for one hour, then baked at (400° F.) for 35 minutes. Baked muffins were thawed in a very slow oven (250° F.) for 45 minutes.

Discussion of results: Figure 13 shows the general conclusion scores for the muffins. Table 26 which appears in the Appendix along with the score card, Table 25, shows the average scores for the other factors.

The muffins frozen raw scored as high or higher than those frozen prebaked for the first two months of storage. After two months, the raw frozen muffins dropped in score, while the prebaked muffins continued to be satisfactory. The drop in score was especially noticeable for flavor, tenderness and texture. The score for texture for the raw frozen product dropped after one month of storage. This could probably be accounted for by the loss of carbon dioxide from the baking powder after storage of the dough for that period.

The raw frozen muffins were satisfactory for a two months storage period. At the end of three months, they were no longer acceptable. The prebaked muffins were stored satisfactorily for the entire twelve month period. At the end of that time, the muffins scored as high as they did when freshly frozen.

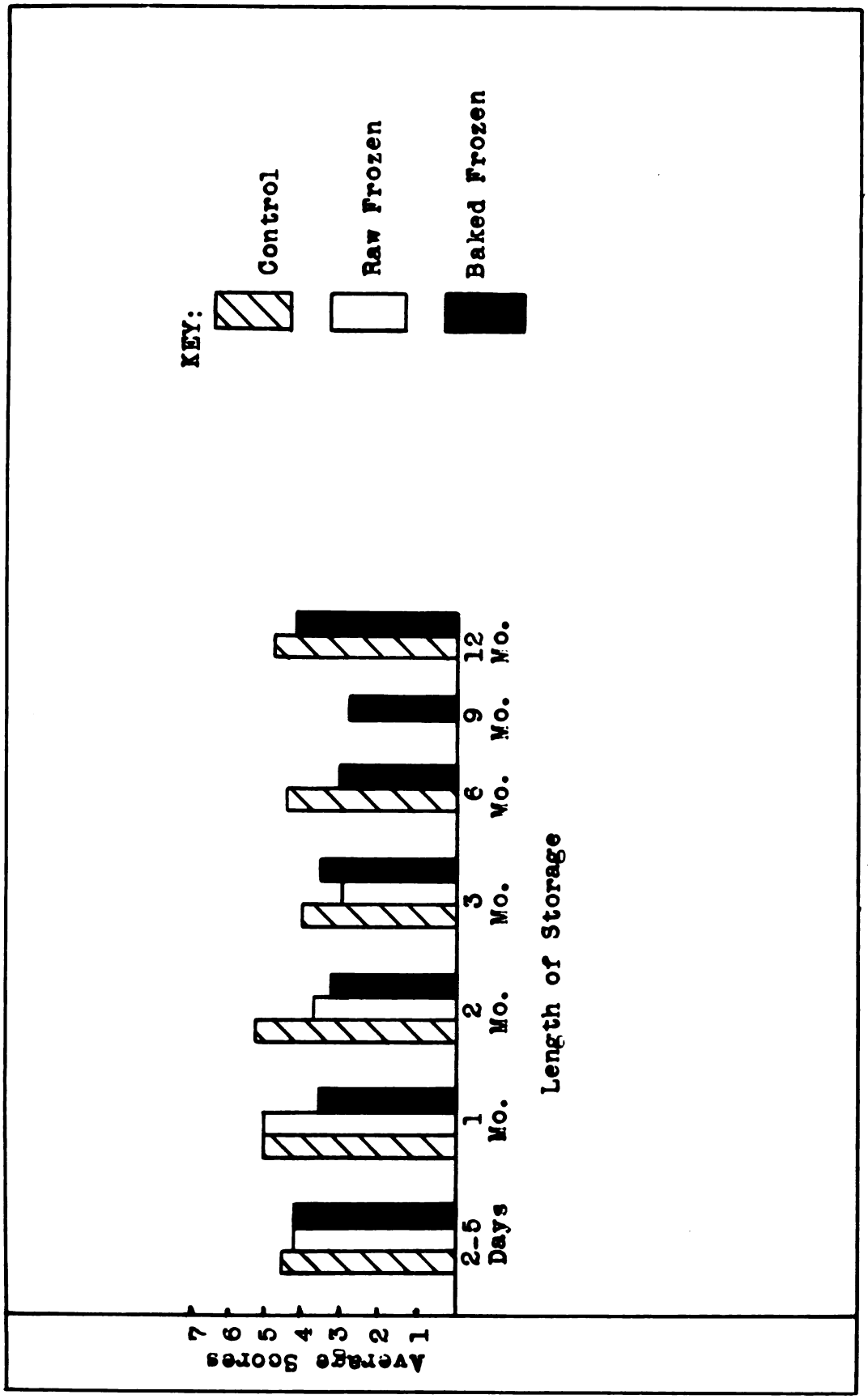


Figure 13. Average scores for general conclusion for muffins.

Yeast Bread

No frozen prepared food produces more conflicting reports than frozen, unbaked rolls and bread. Some are good, but many are not. On the other hand, freezing is an excellent method for preventing baked bread from becoming stale. Bread was frozen both raw and prebaked in this experiment.

Experimental procedure

The recipe for yeast bread was taken from Lowe (1943). The following proportions were found satisfactory.

Yeast Bread (Compressed yeast)

Ingredients	Measure	Weight
Milk	1 cup	240 grams
Yeast	1 cake	
Sugar	1 tablespoon	12.5 grams
Salt	1 1/2 teaspoons	
Shortening, melted	2 teaspoons	9 grams
Flour	3 1/2 cups	392 grams

Scald milk, cool to lukewarm (32°C.) Dissolve yeast in 1/2 milk. Combine sugar, salt and shortening with remaining milk. Pour liquids into flour; mix well. Knead. Put dough in greased bowl; place bowl in pan of water at 30° C. Allow to stand for 1 hour 45 minutes. Mold into loaves; place in greased loaf pan. Return pan to water; allow to stand for 1 hour. Bake in hot oven (425° F.) for 30 minutes.

Yeast Bread

No frozen preparation [illegible] more conflicting [illegible] frozen, [illegible] bread. [illegible] are good, but many are not. On the other hand, freezing is an excellent method for preventing baked bread from becoming stale. [illegible] frozen both raw and [illegible] in this experiment.

Experimental procedure

The recipe for yeast bread was taken from [illegible] (1949). The following proportions were found satisfactory.

Yeast Bread ([illegible])

Ingredients	Measure	Weight
Milk	1 cup	[illegible] grams
Yeast	1 cake	
Sugar	1 tablespoon	12.5 grams
Salt	1 1/2 teaspoons	
Shortening, melted	2 teaspoons	5 grams
Flour	3 1/2 cups	395 grams

Scald milk, cool to lukewarm ([illegible]°C.) dissolve yeast in 1/2 milk. Combine sugar, salt and shortening with remaining milk. Four liquids into flour; [illegible]. Knead. Put cough in greased bowl; place bowl in pan of water at 30° C. Allow to stand for 1 hour 45 minutes. Mold into loaves; place in greased loaf pan. Return pan to water; allow to stand for 1 hour. Bake in hot oven ([illegible]° F.) for 30 minutes.

Yeast Bread (Dry yeast)

Ingredients	Measure	Weight
Water	1/2 cup	120 grams
Sugar	2 teaspoons	
Dry yeast	1 package	
Milk, scalded, cooled	1/2 cup	120 grams
Salt	1 1/2 teaspoons	
Shortening, melted	2 teaspoons	9 grams
Flour	3 1/2 cups	392 grams

Combine water, sugar and yeast; allow to stand 5 minutes. Mix milk, salt and remaining sugar; proceed as for compressed yeast.

The baked bread was wrapped in cellophane, using a drugstore fold, then tied in stockinette. Raw bread was put in cellophane bags, then in cardboard cartons.

Breads were made with compressed and with dry yeast, and were frozen both raw and prebaked. They were scored when freshly baked, and after two-five days, and one, two, four, six, nine and eleven months' storage at 0° F. At each sampling period, fresh bread was made and used as a control. The entire series was done in duplicate.

When the breads were to be scored, the raw frozen bread was taken from the freezer and allowed to stand in a pan of water at 30° C. until it had thawed and risen to twice its bulk, about four and one half hours. It was then baked for 35 minutes in a moderately hot oven (400°F.) The baked frozen bread was allowed to stand at room temperature until thawed, about five hours.

Yeast bread (dry yeast)

Ingredients	Measure	Weight
Water	1/2 cup	120 grams
Sugar	4 teaspoons	
Dry yeast	1 [illegible]	
Milk, scalded, cooled	1/2 cup	120 grams
Salt	1 1/2 teaspoons	
Shortening, melted	2 teaspoons	9 grams
Flour	3 1/2 cups	7 3/8 grams

Combine water, sugar and yeast; allow to stand 5 minutes. Mix milk, salt and [illegible]; [illegible] for compressed yeast.

The bread [illegible] was [illegible] in [illegible], using a [illegible] foil, then tied in [illegible]. [illegible] was put in [illegible], [illegible] in [illegible].

[illegible] and with dry yeast, [illegible]. They were [illegible] when freshly [illegible], [illegible] days, [illegible], two, four, six, [illegible] at 0° F. At [illegible] and used as a control. [illegible].

When the [illegible] were to be [illegible], the [illegible] was taken from the [illegible] in a [illegible] of water at 30° C. until it had [illegible] to twice its bulk, about four and [illegible] hours. It was then [illegible] for [illegible] minutes in a [illegible] not [illegible] (60°F.) [illegible] bread was [illegible] [illegible] hours.

Discussion of results

Figures 14 and 15 show the general conclusion and volume scores for the bread. Average scores for other factors appear in the appendix, Tables 28 and 29.

The prebaked bread scored higher than the bread frozen raw at each storage period, regardless of the type of yeast used.

The prebaked bread was satisfactory for eleven months of storage whereas the bread frozen raw was satisfactory for only two months. This is in agreement with results obtained by Fenton (1946), who states that yeast bread frozen baked may be stored twelve or more months, whereas that frozen raw may be kept only one-half to two months.

At the end of two months, the scores for the bread frozen raw dropped considerably, particularly in the general conclusion and volume scores. The decrease in volume was probably due to the loss of viability of the yeast; also, freezer storage may have weakened the gluten in the flour.

All of the breads made with dry yeast scored slightly higher than those made with compressed yeast, with the exception of the baked frozen bread stored nine and eleven months. On the whole, the dry yeast produced a better loaf of bread for freezing purposes.

[illegible]

Figures 14 and 15 show the general conclusion and volume scores for the bread. Average scores for other factors are in the appendix, Tables 20 and 25.

The prebaked bread scored higher than the bread frozen raw at each storage period, regardless of the type of yeast used.

The [illegible] bread was satisfactory for eleven months of storage whereas the bread frozen raw was satisfactory for only two months. This is in a recent [illegible] by [illegible] (1946), [illegible] that [illegible] may be stored [illegible] or more months, whereas that frozen raw may be [illegible] only one-half to two months.

At the end of two months, the scores for the bread frozen raw [illegible] considerably, particularly in the general conclusion and volume scores. The decrease in volume was probably due to the loss of stability of the yeast; also, frozen storage may have [illegible] the gluten in the flour.

All of the [illegible] made with dry yeast scored slightly higher than those made with compressed yeast, with the exception of the baked frozen bread stored nine and eleven months. On the whole, the dry yeast produced a better loaf of bread for freezing purposes.

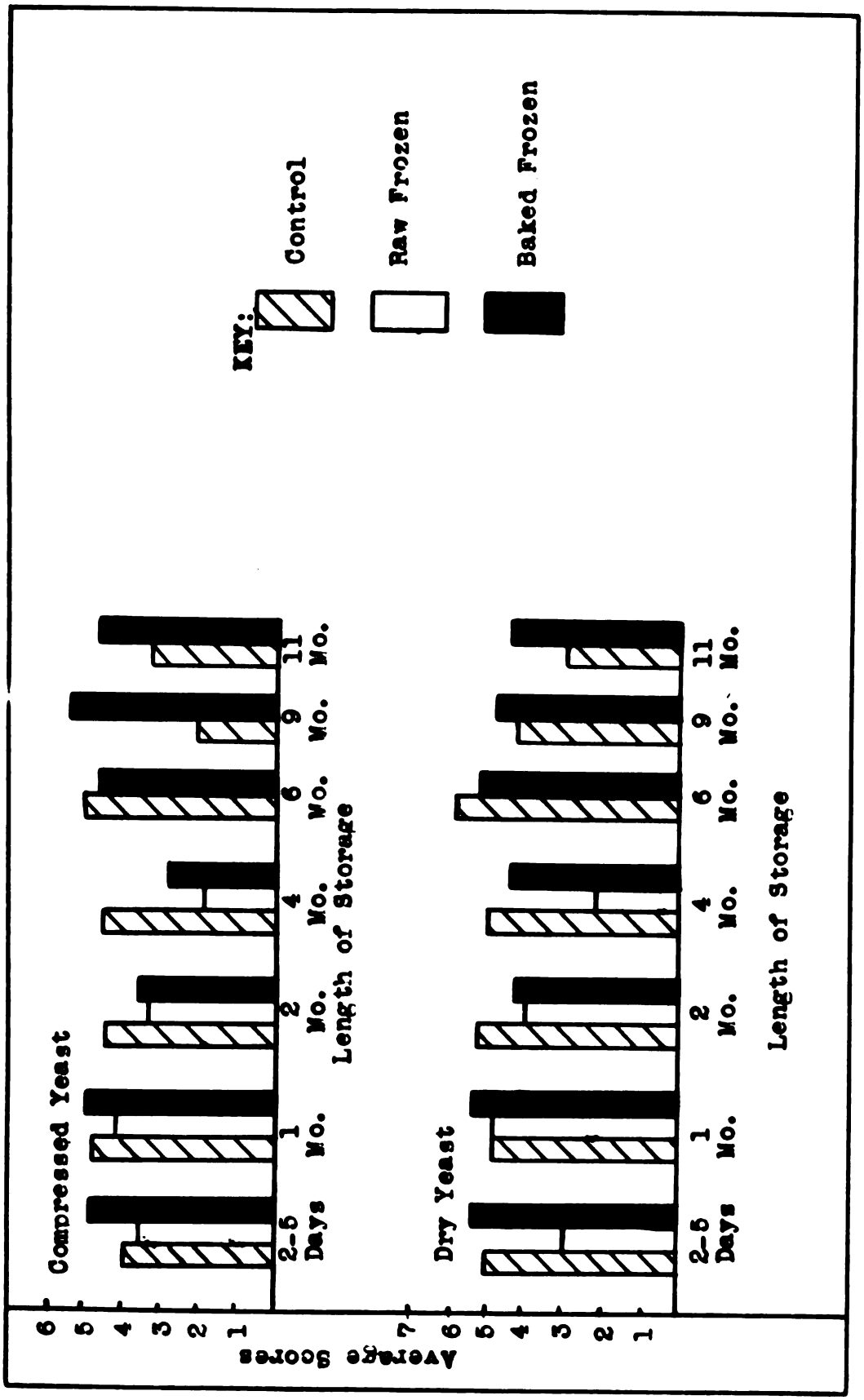


Figure 14. Average scores for general conclusion for bread made with compressed and dry yeast.

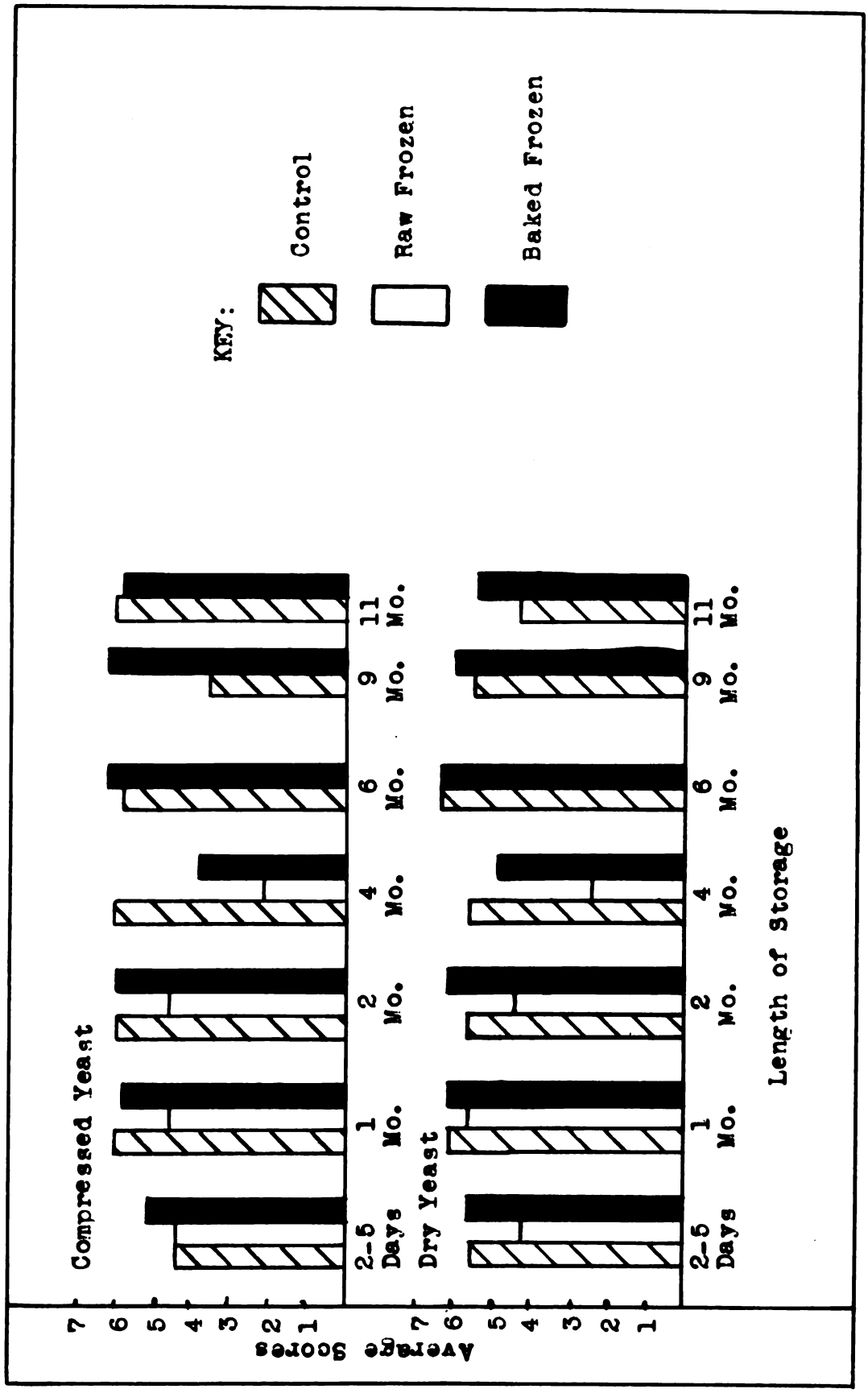


Figure 15. Average scores for volume for bread made with compressed and dry yeast.

SUMMARY AND CONCLUSIONS

A study was made of precooked and prepared baked frozen foods, including Apple Pie, Plain Cake, Spice Cake, Chocolate Cake, Sponge Cake, Seven Minute Frosting, Butter Frosting, Oatmeal Hermits, Icebox Cookies, Baking Powder Biscuits, Muffins, and Yeast Bread.

The products were baked both before and after freezing and stored for periods of from one to twelve months, depending on the product. The products were scored at various storage periods, using a fresh product as a control. Tests for muffins and yeast bread were done in duplicate. Tests for remaining products were done only once.

Objectives of this study were to determine whether the products were better frozen raw or prebaked; to determine changes that took place during storage and, if possible, when they took place; to determine the storage life of each product. In addition to the general objectives, tests were made to determine the effect of type shortening in pastry; to determine the effect of type baking powder in cake and biscuits; to determine the effect of type yeast in yeast bread; to determine the effect of shape of cake.

The material was written in two forms. The first was a technical description of the study; the second presented the information in a popular form and included recipes written for household use.

On the whole, the products which were leavened, either by baking powder or yeast, were better when frozen baked than when frozen in the batter or dough form. Exceptions to this were the Spice Cake which was frozen in layer form and the Chocolate Cake. The Apple Pie was better when frozen raw than when frozen prebaked.

Storage times which were found satisfactory were:

Apple Pie Crust	Frozen raw	6 months *
	Frozen prebaked	5 months
Apple Pie Filling	Frozen raw	6 months *
	Frozen prebaked	2 months
Plain Cake	Frozen raw	2 months
	Frozen prebaked	11 months *
Chocolate Cake	Frozen raw	8 months *
	Frozen prebaked	8 months *
Spice Cake	Frozen raw	4 months *
	Frozen prebaked	11 months *
Sponge Cake	Frozen raw	1 month
	Frozen prebaked	4 months *
Oatmeal Hermits	Frozen raw	7 months *
Icebox Cookies	Frozen raw	6 months *

Baking powder Biscuits	Frozen raw	
	Sodium-acid-s.	4 months
	Tartrate, phosphate	1 month
	Frozen prebaked	6 months *
Muffins	Frozen raw	2 months
	Frozen prebaked	12 months *
Yeast Bread	Frozen raw	2 months
	Frozen prebaked	11 months *

* Tests were not conducted for longer periods.

Lard, either plain or hydrogenated, was found to be better in frozen pastry than vegetable shortening.

Baking powders found best for Plain Cake were, in order of preference, phosphate, tartrate, sodium-acid-sulphate. The biscuits showed a different pattern. When frozen raw, sodium-acid-sulphate rated first, tartrate second and phosphate third. When the biscuits were frozen prebaked, tartrate rated first, sodium-acid-sulphate second and phosphate third. Dry yeast was found to be superior to compressed yeast in frozen yeast bread.

Plain Cake made with sodium-acid-sulphate or tartrate baking powder was better when made in layer form; plain cake, made with phosphate baking powder scored higher when made in cup cake form. Layer and loaf forms of Spice Cake scored much the same except at the sixth

Baking powder Biscuits	Frozen raw	
	[illegible]	[illegible]
	[illegible]	[illegible]
	Frozen [illegible]	[illegible] *
Buffins	Frozen raw	[illegible]
	Frozen [illegible]	[illegible] *
Yeast bread	Frozen raw	[illegible]
	[illegible]	[illegible] *

* Tests were not [illegible] for longer period.

Lard, either plain or hydrogenated, was found to be better in frozen [illegible] than vegetable shortening.

Baking powders found [illegible] were, in order of preference, phosphate, tartrate, sodium-acid-sulphate. The biscuits showed a different pattern. When frozen raw, sodium-acid-sulphate rated first, tartrate second and phosphate [illegible]. When the biscuits were frozen [illegible], tartrate rated first, sodium-acid-sulphate second and [illegible] third. Dry yeast was found to be superior to compressed yeast in frozen yeast bread.

Plain Cake made with sodium-acid-sulphate or tartrate baking powder was better when made in layer form; plain cake, made with phosphate baking powder scored higher when made in cake [illegible] form. Layer and loaf forms of [illegible] cake [illegible] when the same except at the sixth

month scoring period. At that time, the layer cake scored higher when made from raw frozen batter; the loaf cake scored higher when prebaked.

Butter Frosting was found satisfactory for icing cakes. Seven Minute Frosting was barely acceptable and therefore not recommended for freezing purposes.

POPULAR SUMMARY

The purpose of this unit is to present in popular form, the technical information which appears in the main part of this thesis, as it might be used in an extension bulletin.

PRECOOKED OR PREPARED BAKED FROZEN FOODS

Considerable interest is being shown by homemakers in the freezing of precooked or prepared baked frozen foods. Chief reason for this interest has been that the foods are almost ready to serve when needed. Particularly good foods for freezing are dishes that require long preparation, dishes that require little more work when prepared in quantity than they do in small amounts, and dishes that require little attention between the freezer and table.

Preparing baked foods for freezer storage is not difficult, as can be seen by the directions given here. All of the recipes printed here were tested in the research laboratory at MICHIGAN STATE COLLEGE. The foods were frozen, stored, thawed and then carefully tasted before they were approved for publication.

The purpose of this bulletin is to help you to prevent failures in the preparation, freezing and storage of pre-

cooked and prepared baked foods, and to suggest foods that have been proven successful.

General Directions

Among the baked foods that can be successfully frozen are apple pie, plain cake, spice cake, chocolate cake, sponge cake, refrigerator or drop cookies, biscuits, muffins and yeast bread. Most of these products may be frozen either before or after they are baked. However, baked foods which are leavened by baking powder or yeast have a longer frozen storage life when frozen baked than when frozen raw. Apple pie was found to give a more satisfactory product, and had a longer storage life, if it was baked after freezing.

Ingredients and Preparation: Standard recipes which have been proven successful for freezing purposes should be used when preparing foods for freezer storage. The recipes which we have found successful appear in this bulletin. If you wish to use your own recipe, try a small batch to see if the product will freeze successfully before putting any large quantity into frozen storage.

Use only ingredients of the best quality. Lard or vegetable shortening may be used in frozen pastry; however, present tests have shown that lard gives a more successful product. While either dry or compressed yeast may be used in making yeast bread, dry yeast was found to make a better

loaf of bread for freezer storage. A double action baking powder (sodium-aluminum-sulphate) may be a little more satisfactory to use in cakes or biscuits which are frozen raw, because it reacts very slowly until it is put into the oven.

Packaging: Use packaging materials that are moisture-vapor-proof, to prevent the food from drying out. Suitable materials include moisture-proof cellophane, pliofilm, latex bags, aluminum foil, heavily waxed cartons or tubs and moisture-proof bags. For foods high in fat, use grease-proof containers.

Pies, baked un-iced cakes, baked muffins, biscuits and bread are easily packaged by wrapping in moisture-vapor-proof paper, heat sealing, and placing in stockinette, or cartons. Pies may be baked and frozen in paper pie plates with metal rims.

Refrigerator cookie dough may be made into rolls, wrapped in moisture-vapor-proof paper, and placed in stockinette. The cookies may be sliced and baked as needed.

Raw batters may be stored in waxed tubs, cartons or cellophane bags.

Storage Temperature: Precooked or prepared baked foods should be frozen and stored at 0° F. or below.

Storage Time: The longer food is stored, the less good it becomes. It is wise to use frozen foods while

they are still excellent, not just acceptable. The following table presents the storage times of products which have been found satisfactory in our tests. It should be used as a guide in storing foods.

Approximate Storage Life of Some Baked Foods

Food	Condition when Frozen	Storage Life
Apple Pie	Frozen raw	6 months *
	Frozen prebaked	2 months
Plain Cake	Frozen raw	2 months
	Frozen prebaked	11 months *
Spice Cake	Frozen raw	4 months
	Frozen prebaked	11 months *
Chocolate Cake	Frozen raw	8 months
	Frozen prebaked	8 months *
Sponge Cake	Frozen raw	1 month
	Frozen prebaked	4 months *
Oatmeal Hermits	Frozen raw	7 months *
Icebox Cookies	Frozen raw	6 months *
Baking Powder Biscuits	Frozen raw	1 months
	Frozen prebaked	6 months *
Muffins	Frozen raw	2 months
	Frozen prebaked	12 months *
Yeast Bread	Frozen raw	2 months
	Frozen prebaked	11 months *

* Tests were not conducted for longer periods.

[illegible]

[illegible]

[illegible]

Food	[illegible]	[illegible]
[illegible]	[illegible]	[illegible] *
[illegible]	[illegible]	[illegible] *
[illegible]	[illegible]	[illegible] *
[illegible]	[illegible]	[illegible] *
[illegible]	[illegible]	[illegible] *
[illegible]	[illegible]	[illegible] *
[illegible]	[illegible]	[illegible] *
[illegible]	[illegible]	[illegible] *
[illegible]	[illegible]	[illegible] *
[illegible]	[illegible]	[illegible] *

* [illegible]

Recipes

The following recipes give directions for freezing products both baked and raw. When preparing foods, keep in mind that some products can be stored for a longer period if prepared a certain way. Refer to the table on storage life when using these recipes.

Apple Pie

Pastry

2 cups flour
1 teaspoon salt
2/3 cup shortening
1/4 cup water

Place flour and salt in bowl; add shortening and cut into flour with pastry blender. Add water; stir until liquid and dry ingredients are combined. Roll out pastry on lightly floured board; line 9-inch pie plate with pastry. Roll out top crust. Fill pie crust with filling. Moisten edge of bottom crust with water; cover with top crust and press edges together.

Yield: 1 9-inch pie.

Apple Filling

1 1/2 pounds apples
1/2 cup sugar
1/4 teaspoon salt
1/2 teaspoon cinnamon

Peel apples, cut in quarters, core and slice. Sprinkle with mixture of sugar, salt and cinnamon.

Baking, freezing, serving: If pie is to be frozen baked, cut air vent in top crust. Bake in moderately hot oven (400° F.) for 45 minutes. Cool, package and freeze. When taken from freezer, place in moderate oven (350° F.) for 30 minutes.

If pie is frozen raw, cut air vent in top crust after taking from freezer. Bake in moderately hot oven(400° F.) 1 1/2 hours.

Plain Cake

2 cups sifted cake flour
2 teaspoons baking powder
1/4 teaspoon salt
1/3 cup shortening
1 cup sugar
1 egg
3/4 cup milk
1 teaspoon vanilla

Sift together flour, baking powder and salt. Cream shortening until soft; add sugar gradually, and cream together until light and fluffy. Add egg, beat well. Add 1/3 sifted dry ingredients, and stir until blended; add 1/2 milk-vanilla mixture and stir until smooth. Repeat until all the flour and milk have been added, ending with flour.

Yield: 2 8-inch layers or
18 2-inch cup cakes.

Baking, freezing, serving: If the cake is to be frozen baked, spread batter in greased 8-inch layer pans or greased 2-inch muffin pans. Bake in moderate oven (350° F.) about 20-30 minutes. Cool, package and freeze. When ready to serve, thaw at room temperature for 1 1/2 hours.

Store batter in waxed tubs; freeze immediately. To use batter, place in pans and allow to thaw for one hour at room temperature. Bake in moderate oven (350° F.) 35-45 minutes.

Spice Cake

2 1/2 cups sifted cake flour
2 1/2 teaspoons baking powder
1/4 teaspoon salt
1 teaspoon cinnamon
1/2 teaspoon mace
3/4 cup milk
1/4 teaspoon cloves
1/2 cup shortening
1 cup sugar
2 eggs
1/3 cup molasses

Sift together dry ingredients. Cream shortening until soft; add sugar gradually, and cream together until light and fluffy. Add eggs, beat well. Stir in molasses. Add 1/3 sifted dry ingredients, and stir until blended. Add 1/2 milk and stir until smooth. Repeat until all the flour and milk have been added, ending with flour.

Yield: 2 9-inch layers.

Baking, freezing, serving. If cake is to be frozen baked, spread batter in greased 9-inch layer pan. Bake in moderate oven (350° F.) about 30 minutes. Cool, package and freeze. Thaw at room temperature for 1 1/2 hours before using.

Store raw batter in waxed tubs; freeze immediately. When ready to use, place raw frozen batter in pans and allow to stand at room temperature for one hour. Bake in moderate oven (350° F.) 35-40 minutes.

Fudge Cake

2 1/4 cups sifted cake flour
1 teaspoon soda
1 teaspoon baking powder
1/2 teaspoon salt
1/2 cup cocoa
1/2 cup shortening
1 1/2 cups sugar
2 eggs
1 cup milk
1 teaspoon vanilla

Sift together flour, soda, baking powder, salt and cocoa. Cream shortening until soft; add sugar gradually, and cream together until light and fluffy. Add eggs, beat well. Add 1/3 sifted dry ingredients, and stir until blended; add 1/2 milk-vanilla mixture and stir until smooth. Repeat until all the flour and milk have been added, ending with flour.

Yield: 2 9-inch layers.

Baking, freezing, serving. If the cake is to be frozen baked, spread batter in greased 9-inch layers. Bake in moderate oven (350° F.) about 30 minutes; cool, package and freeze. Thaw at room temperature, in package, for 1 1/2 hour.

Store raw batter in waxed tubs; freeze immediately. Place raw frozen batter in pans and allow to stand one hour at room temperature. Bake in moderate oven (350°F.) for 35 minutes.

Sponge Cake

2 cups sifted cake flour
3 teaspoons baking powder
3/4 teaspoon salt
8 egg yolks
1 1/2 cups sugar
1 teaspoon grated lemon rind
2 tablespoons lemon juice
3/4 cup boiling water

Sift together flour, baking powder and salt. Beat egg yolks until thick and lemon colored. Add sugar gradually, beating until very thick. Beat in lemon rind, juice and boiling water. Fold in flour lightly.

Yield: 1 large cake.

Baking, freezing, serving. If the cake is to be frozen baked, spread batter in pan. Bake in moderate oven (350° F.) 50-60 minutes. Invert pan 1 hour or until cool, before removing cake from pan. Package and freeze. When ready to serve, allow to thaw one hour at room temperature.

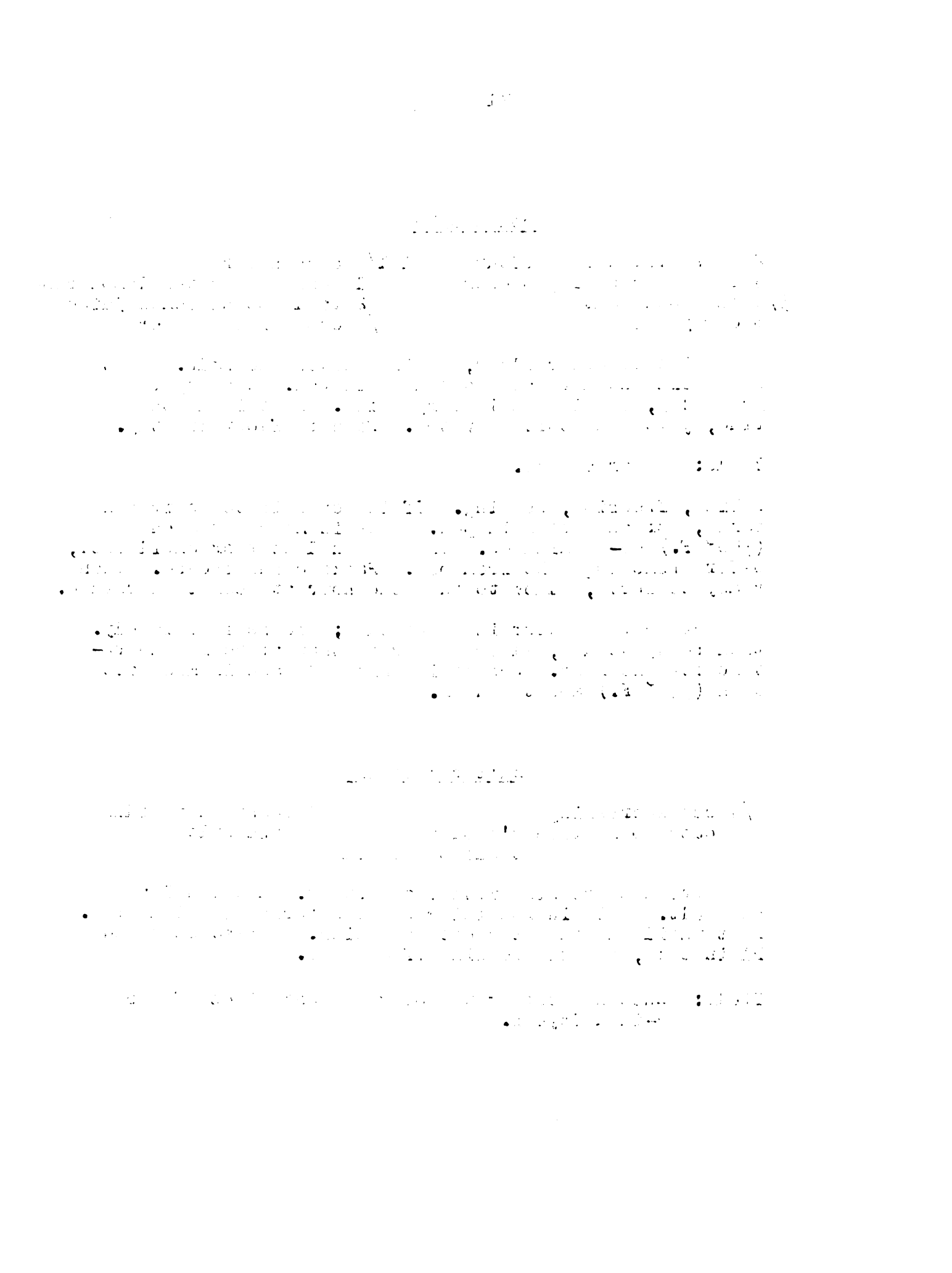
Store raw batter in waxed tubs; freeze immediately. When ready to use, allow batter to thaw at room temperature for one hour. Spread in pans and bake in moderate oven (350° F.) about 1 hour.

Butter Frosting

1/4 cup shortening
2 cups confectioner's sugar
1 teaspoon vanilla
dash salt
3 tablespoons milk

Cream shortening with 1 cup sugar. Add vanilla and salt. Stir in remaining sugar alternately with milk. Beat until smooth after each addition. Spread on baked Plain Cake, before freezing if desired.

Yield: Enough frosting to cover top and sides of two 9-inch layers.



Oatmeal Hermits

1 1/2 cups sifted flour
2 teaspoons baking powder
1/2 teaspoon salt
1/2 teaspoon cinnamon
2 cups oatmeal
1 cup raisins
1/2 cup shortening
1 cup sugar
2 eggs
1/2 cup milk

Sift together flour, baking powder, salt and cinnamon; stir in oatmeal and raisins. Cream shortening and sugar thoroughly; add eggs, beat until fluffy. Stir in dry ingredients alternately with milk.

Yield: 3 dozen cookies.

Baking, freezing, serving. Store batter in waxed tubs. When ready to use, allow batter to stand at room temperature in the waxed tubs for one hour. Drop from teaspoon onto greased pan. Bake in moderate oven (375° F.) about 15 minutes.

To freeze prebaked, drop batter onto greased pan. Bake in moderate oven (375° F.) about 15 minutes. Cool, package and freeze.

Icebox Cookies

2 cups sifted flour
1 1/2 teaspoons baking powder
1/8 teaspoon salt
6 tablespoons shortening
1/4 cup brown sugar
1 cup sugar
1 egg, well beaten
1 tablespoon milk
1 1/2 teaspoons vanilla
1 cup chopped nutmeats

Sift flour with baking powder and salt. Cream shortening. Add sugars gradually; cream until light and fluffy. Add egg, milk, vanilla and nutmeats. Stir in flour mixture; mix well. Shape into rolls 1-inch in diameter. Roll in cellophane.

Yield: 4 dozen cookies.

Freezing, baking, serving: Package, freeze. When ready to serve, thaw in the refrigerator for one hour. Slice in 1/8-inch slices. Bake in hot oven (425° F.) about 5 minutes.

To freeze baked, place rolls in refrigerator until firm. Slice in 1/8-inch slices. Bake in hot oven (425°F.) about 5 minutes. Cool, package, freeze.

Baking Powder Biscuits

2 2/3 cups sifted flour
1/2 teaspoon salt
3 teaspoons baking powder
1/4 cup shortening
1 cup milk

Sift together flour, salt and baking powder. Cut in shortening until mixture is like cornmeal. Add milk; stir only until liquid and dry ingredients are combined. Roll to 1/2 inch thickness on lightly floured board; cut with 2-inch biscuit cutter.

Yield: 20 2-inch biscuits.

Freezing, baking, serving: If biscuits are to be stored baked, place on baking sheet and bake in hot oven (425°F.) for 15 minutes. Cool, package, and freeze. When ready to serve, place in very slow owen (250° F.) for 20 minutes.

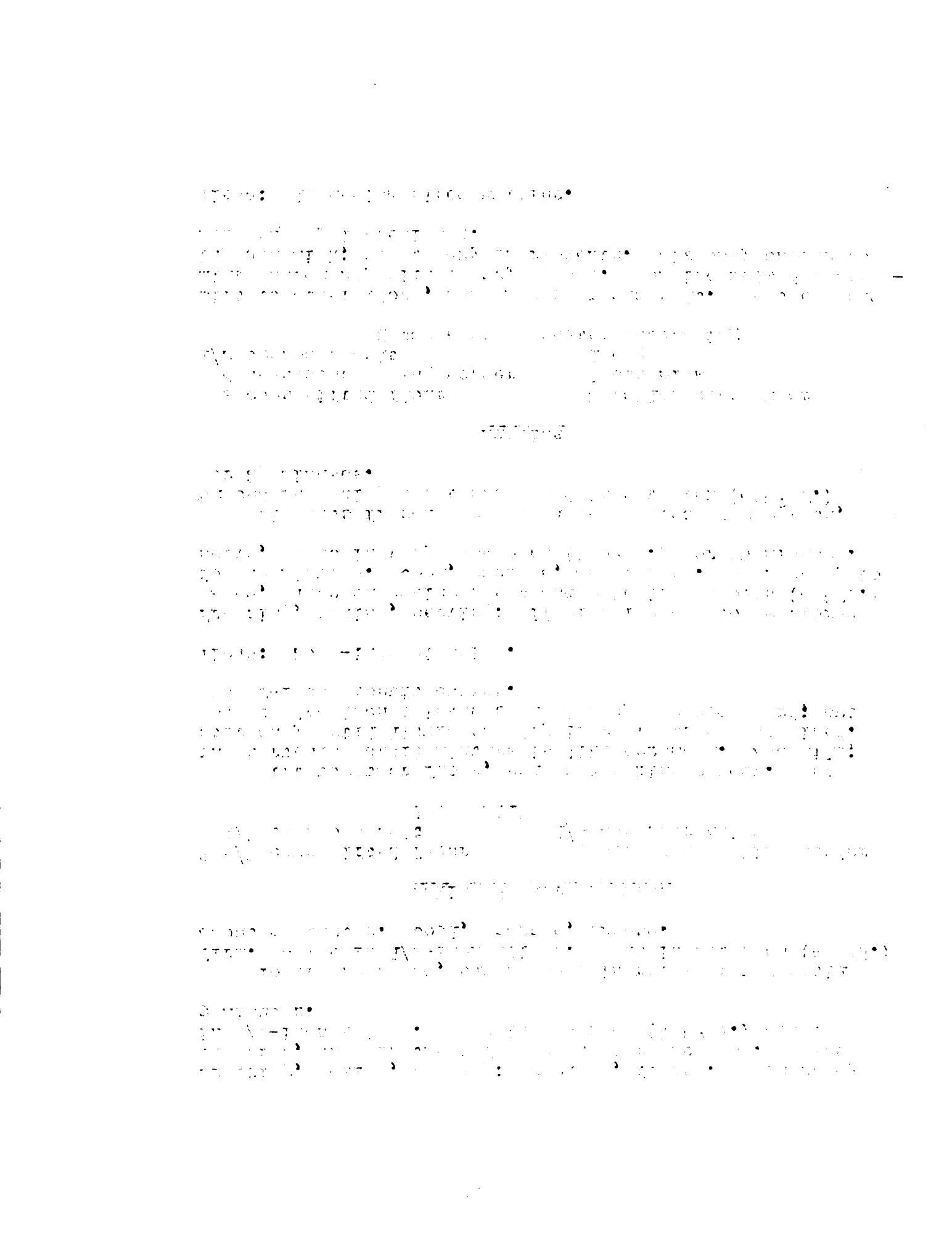
Biscuits frozen raw should be removed from carton, placed on baking sheet and baked in hot oven (425° F.) for 25 minutes.

Muffins

2 cups sifted flour
2 teaspoons baking powder
1/2 teaspoon salt
2 tablespoons sugar
1 cup milk
1 egg
2 tablespoons melted shortening

Sift together flour, baking powder and salt. Beat egg and milk thoroughly with rotary beater. Combine melted shortening and milk; add to dry ingredients. Mix only enough to moisten dry ingredients.

Yield: 12 medium sized muffins.



Baking, freezing, serving. If muffins are to be frozen baked, fill greased 2-inch muffin tins two-thirds full. Bake in moderately hot oven (400° F.) about 30 minutes. Cool, package, freeze. When ready to use, place in very slow oven (250° F.) for 45 minutes.

Store batter in waxed tubs; freeze. When ready to serve, thaw at room temperature for 1 hour. Fill greased 2-inch muffin tins two-thirds full. Bake in moderately hot oven (400° F.) for 35 minutes.

Yeast Bread

1/2 cup water
2 teaspoons sugar
1 package dry yeast *
1/2 cup scalded, cooled milk
1 1/2 teaspoons salt
2 teaspoons melted shortening
3 1/2 cups sifted flour

Combine water, sugar and yeast; allow to stand 5 minutes. Mix milk, salt, shortening and remaining sugar. Pour liquids into flour; mix well. Knead until smooth and elastic. Round up and place in greased bowl; cover. Keep dough in warm place, at 80°-85° F. Let rise until double in bulk, about 2 hours. Punch down dough; mold into loaves.

* If using compressed yeast: use 1 cake compressed yeast, omit water, use 1 cup milk.

Yield: 1 loaf bread.

Baking, freezing, serving. If bread is to be stored baked, place loaf in greased loaf pan; cover and let rise until double in bulk, about 1 1/2 - 2 hours. Bake in hot oven (425° F.) about 1 hour. Cool, package and freeze. When ready to use, allow to stand at room temperature until thawed, about 5 hours.

If bread is to be frozen raw, package; freeze. When ready to use, place in greased loaf pan and put in warm place at 80°-85° F. Let rise until thawed and double in bulk, about four and one half hours. Bake in moderately hot oven (425° F.) about 1 hour.

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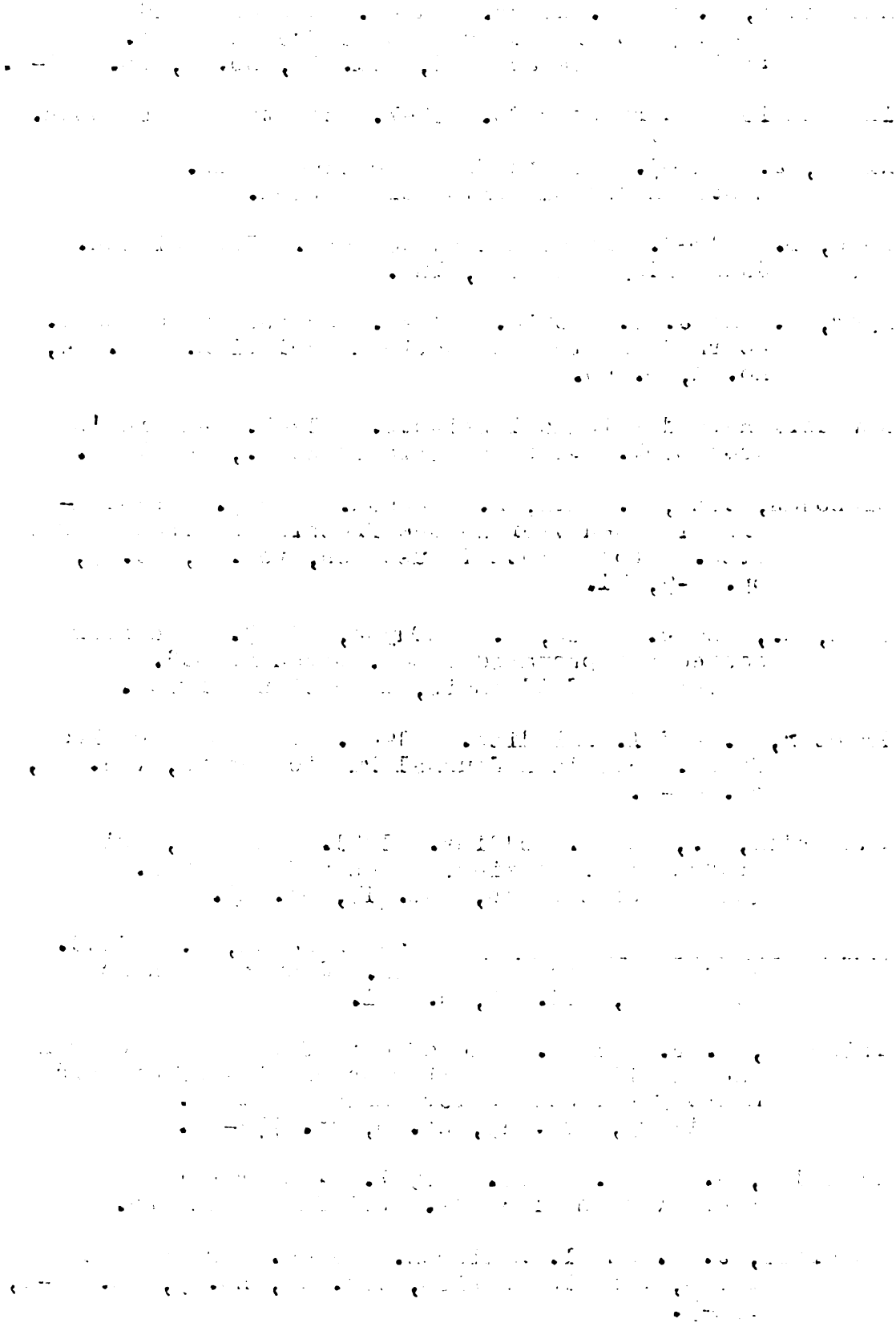

APPENDIX

Pie Crust Score Card

Name_____ Date_____

Table 1. Form used for scoring pie crust.

Sample Number							
Appearance							
Color Upper							
Color Lower							
Odor							
Flavor							
Tenderness							
Texture							
General Conclusion							
Acceptability Yes or No							

Key

1. Very Poor
2. Poor
3. Fair
4. Medium
5. Good
6. Very Good
7. Excellent

	Defects	Standard
Appearance:	Smooth, Large Bubbles, Greasy	Rough, Tiny Bubbles, Not Greasy
Color:	Pale, Gray, Too Dark	Well browned
Odor:	Rancid, Greasy, Lacking	
Flavor:	Flat, Rancin, Raw, Burned	
Tenderness:	Tough, Hard	Tender, crisp
Texture:	Compact, Crumbly, dry, soggy	Flaky, mealy

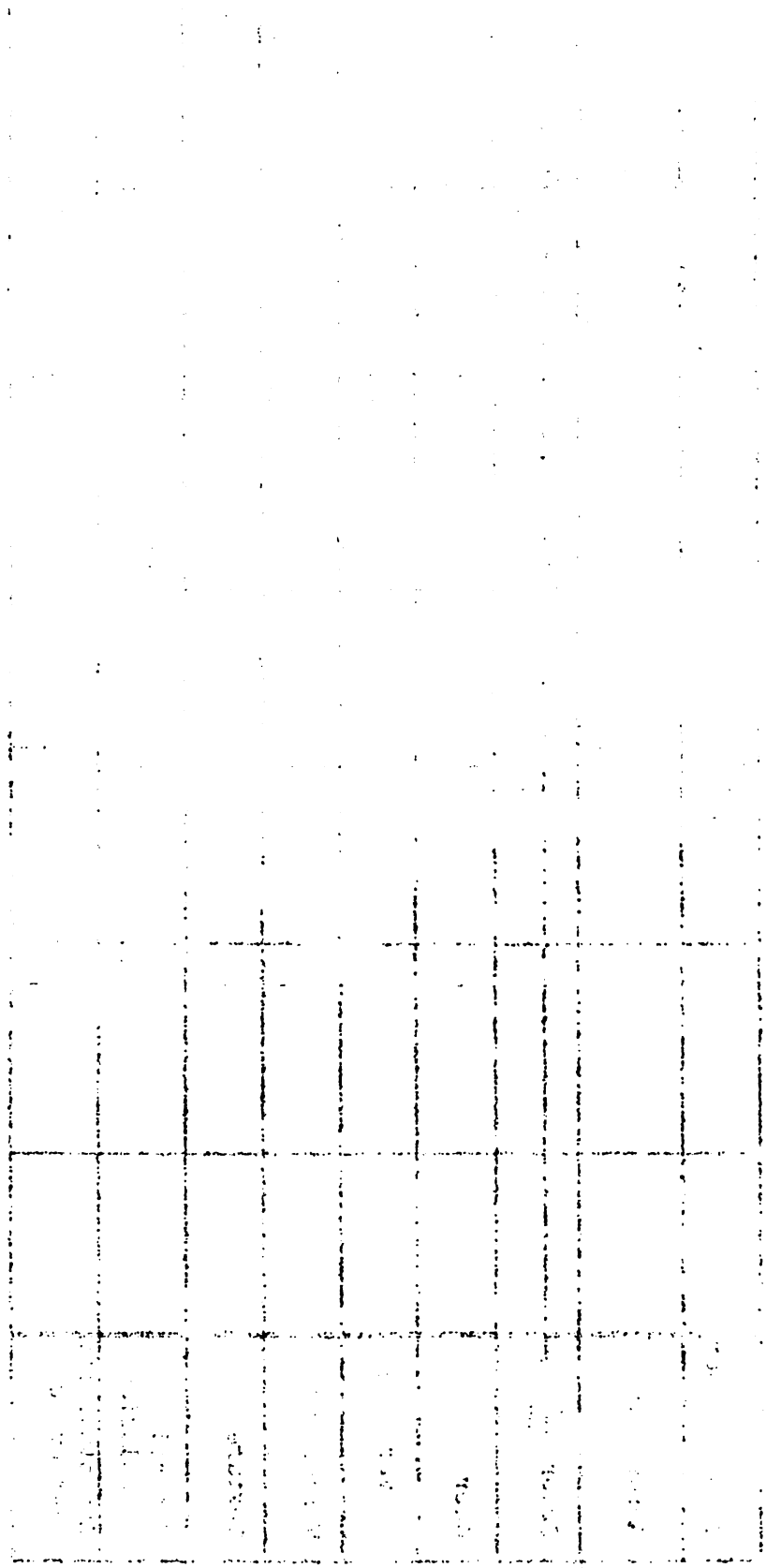

Table 2. Average scores for pie crust made with vegetable shortening.

Time Frozen	Method	Appearance	Color		Odor	Flavor	Tenderness	Texture	General Conclusion
			Upper	Lower					
Fresh	Control	5.3	5.2	5.2	5.7	5.8	4.7	5.0	5.0
2-5 days	Control	5.3	5.2	5.2	5.7	5.5	4.7	5.0	5.2
	Raw Frozen	5.5	5.2	5.0	5.8	5.8	4.3	5.7	4.8
	Baked Frozen	5.3	4.7	5.0	5.7	5.0	4.2	4.3	4.3
2 weeks	Control	5.2	5.5	5.7	5.7	5.0	4.8	4.7	4.8
	Raw Frozen	5.7	6.0	5.8	5.8	5.5	4.3	4.3	4.7
	Baked Frozen	5.8	6.3	5.8	6.2	5.3	3.7	4.5	4.5
1 month	Control	5.5	6.0	5.7	6.2	6.2	5.7	6.0	5.8
	Raw Frozen	4.8	5.5	5.2	6.2	5.3	5.0	5.3	4.7
	Baked Frozen	5.2	5.7	5.3	4.8	4.5	4.8	5.0	4.5
6 weeks	Control	5.0	4.8	5.8	5.5	4.5	5.5	5.2	4.3
	Raw Frozen	6.3	6.5	6.3	6.7	6.5	4.8	5.7	5.8
	Baked Frozen	6.0	6.0	6.0	6.0	5.7	5.2	5.2	5.2
2 months	Control	4.5	4.3	5.0	5.3	5.0	4.8	4.8	4.8
	Raw Frozen	5.0	5.3	5.5	6.0	5.3	4.2	4.3	4.3
	Baked Frozen	5.7	5.7	5.0	5.5	5.2	5.0	4.8	4.8
3 months	Control	4.0	4.2	5.2	5.5	5.2	5.2	5.0	4.7
	Raw Frozen	5.5	5.8	5.5	6.0	5.8	4.3	4.2	4.5
	Baked Frozen	5.3	5.5	5.7	5.2	4.7	4.5	4.5	4.2
4 months	Control	5.2	5.0	5.5	5.3	5.3	5.3	5.2	4.8
	Raw Frozen	5.3	5.5	5.0	5.8	5.5	3.8	4.3	4.0
	Baked Frozen	5.5	5.8	5.2	5.2	5.2	4.8	4.5	4.5
5 months	Control	5.0	5.2	5.0	5.0	5.0	6.2	5.6	4.8
	Raw Frozen	5.6	5.3	5.4	5.8	5.8	5.2	5.2	5.4
	Baked Frozen	4.4	4.2	4.6	4.8	5.0	4.2	4.2	4.2
6 months	Control	5.4	5.6	5.2	5.6	5.8	5.6	5.6	5.4
	Raw Frozen	5.8	5.8	6.0	6.0	5.0	4.2	4.4	4.2
	Baked Frozen	5.0	5.2	4.8	5.2	5.0	4.6	3.6	3.6

Table 3. Average scores for pie crust made with hydrogenated lard.

Time Frozen	Method	Appear-ance	Color Upper	Color Lower	Odor	Flavor	Tender-ness	Tex-ture	General Conclusion
Fresh	Control	5.5	4.8	5.2	5.8	6.2	6.0	5.7	5.7
2-5 days	Control	4.8	4.3	5.0	5.3	5.3	5.3	5.5	5.3
	Raw Frozen	4.3	4.2	5.7	5.7	5.5	5.8	5.7	5.2
	Baked Frozen	4.7	4.5	4.8	5.3	4.8	5.2	5.0	4.8
2 weeks	Control	5.3	5.3	5.7	5.5	5.3	5.2	4.7	5.0
	Raw Frozen	5.3	5.7	6.0	5.8	5.7	5.5	5.5	5.5
	Baked Frozen	5.2	5.3	5.7	5.2	4.0	5.3	5.2	4.0
1 month	Control	5.7	5.5	5.7	4.7	4.5	5.8	5.8	4.8
	Raw Frozen	5.3	5.3	5.2	5.2	5.0	5.7	5.5	5.0
	Baked Frozen	5.3	5.0	4.8	4.0	4.3	6.0	5.2	4.2
6 weeks	Control	5.3	5.0	5.3	4.5	2.7	4.2	4.3	3.0
	Raw Frozen	6.0	5.8	6.0	6.2	6.0	6.2	6.2	6.2
	Baked Frozen	5.7	5.8	6.0	5.5	5.5	5.7	5.3	5.0
2 months	Control	4.5	4.3	4.8	5.7	5.0	5.5	5.0	5.0
	Raw Frozen	5.7	4.8	5.7	6.2	5.7	5.7	5.5	5.5
	Baked Frozen	5.3	4.7	5.0	5.3	5.2	5.5	5.2	5.0
3 months	Control	4.7	5.3	5.3	5.0	4.7	4.8	4.8	4.5
	Raw Frozen	4.7	5.2	5.3	4.7	4.2	5.5	5.3	4.3
	Baked Frozen	4.3	4.0	5.0	3.5	3.2	5.3	4.5	2.8
4 months	Control	4.7	4.7	5.2	5.0	5.3	5.5	5.2	5.0
	Raw Frozen	5.8	5.7	6.0	6.0	6.0	5.8	5.8	5.8
	Baked Frozen	5.0	5.3	5.8	4.7	4.3	5.7	4.8	4.2
5 months	Control	5.2	4.8	5.4	5.2	4.4	5.6	5.2	4.4
	Raw Frozen	5.2	4.8	5.0	5.4	5.6	5.4	5.4	5.2
	Baked Frozen	4.8	5.0	5.2	5.0	4.4	5.2	4.6	4.4
6 months	Control	5.6	5.6	5.8	5.8	6.0	6.2	5.8	5.6
	Raw Frozen	5.0	5.2	5.2	6.0	6.0	6.0	5.4	5.4
	Baked Frozen	4.4	4.8	4.0	4.6	2.4	2.8	3.4	2.2

Table 4. Average scores for pie crust made with plain lard.

Time Frozen	Method	Appearance	Color		Odor	Flavor	Tenderness	Texture	General Conclusion
			Upper	Lower					
Fresh	Control	5.7	5.5	5.5	5.7	5.8	5.3	5.8	5.3
2-5 days	Control	4.3	5.2	4.7	5.2	4.5	3.8	4.3	4.0
	Raw Frozen	5.2	4.7	5.3	5.3	5.2	5.3	5.2	5.0
	Baked Frozen	5.2	4.8	4.7	4.8	4.5	4.7	5.0	4.3
2 weeks	Control	5.7	5.5	5.0	5.3	4.8	4.7	4.8	4.7
	Raw Frozen	4.8	5.0	5.0	5.3	4.5	4.2	4.3	4.7
	Baked Frozen	5.2	5.2	5.0	4.5	4.2	4.5	4.7	4.0
1 month	Control	5.7	5.5	5.8	5.7	4.8	5.5	5.2	5.0
	Raw Frozen	5.0	5.3	5.5	5.8	5.3	5.2	5.0	5.2
	Baked Frozen	5.5	6.0	5.2	5.3	4.7	5.7	5.0	4.8
6 weeks	Control	5.7	5.8	5.5	5.3	5.0	5.5	5.3	5.0
	Raw Frozen	6.2	6.3	5.3	6.2	5.7	4.7	5.5.	5.2
	Baked Frozen	5.8	6.0	5.8	5.3	5.2	4.7	4.7	4.5
2 months	Control	4.5	4.3	4.7	5.3	4.7	4.7	4.8	4.5
	Raw Frozen	4.8	5.3	5.5	5.7	4.3	3.5	4.0	3.8
	Baked Frozen	5.5	5.2	4.8	4.7	3.7	4.5	4.5	3.5
3 months	Control	4.3	4.2	4.8	5.2	5.2	5.7	5.3	4.8
	Raw Frozen	5.0	4.7	4.3	5.7	5.3	4.2	4.7	4.8
	Baked Frozen	5.0	4.8	5.0	5.2	4.3	5.5	5.2	4.3
4 months	Control	5.3	5.0	5.5	5.7	5.7	6.0	5.5	5.7
	Raw Frozen	5.7	5.2	5.5	5.3	5.0	5.0	5.3	4.3
	Baked Frozen	5.5	4.8	5.7	4.3	3.7	5.5	4.8	3.7
5 months	Control	5.2	5.3	5.5	4.8	5.2	5.5	5.3	5.0
	Raw Frozen	5.5	6.2	5.8	6.3	5.8	4.7	4.7	4.7
	Baked Frozen	6.0	6.2	5.3	5.3	4.5	4.0	4.2	4.3
6 months	Control	6.2	6.0	6.0	6.0	5.8	5.4	5.6	5.6
	Raw Frozen	6.0	6.0	5.8	6.6	6.0	5.8	5.6	5.0
	Baked Frozen	4.2	4.2	4.6	5.0	3.4	5.4	4.8	3.4

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Pie Filling Score Card

Name_____ Date_____

Table 5. Form for scoring pie filling.

Sample Number							
Color							
Consistency							
Odor							
Flavor							
Texture of Fruit							
General Conclusion							
Acceptability Yes or No							

Key

1. Very Poor
2. Poor
3. Fair
4. Medium
5. Good
6. Very Good
7. Excellent

	Defects	Standard
Color:	Brown, gray,	clear, pinkish yellow
Consistency:	Excessively juicy, dry pulp, too thick juice,	juice well retained in pulp
Texture of Fruit:	Hard, mushy,	Tender but holds shape
Flavor:	Flat, too sweet, too tart, oxidized, other off flavors	
Odor:	lacking, oxidized, foreign, hay	

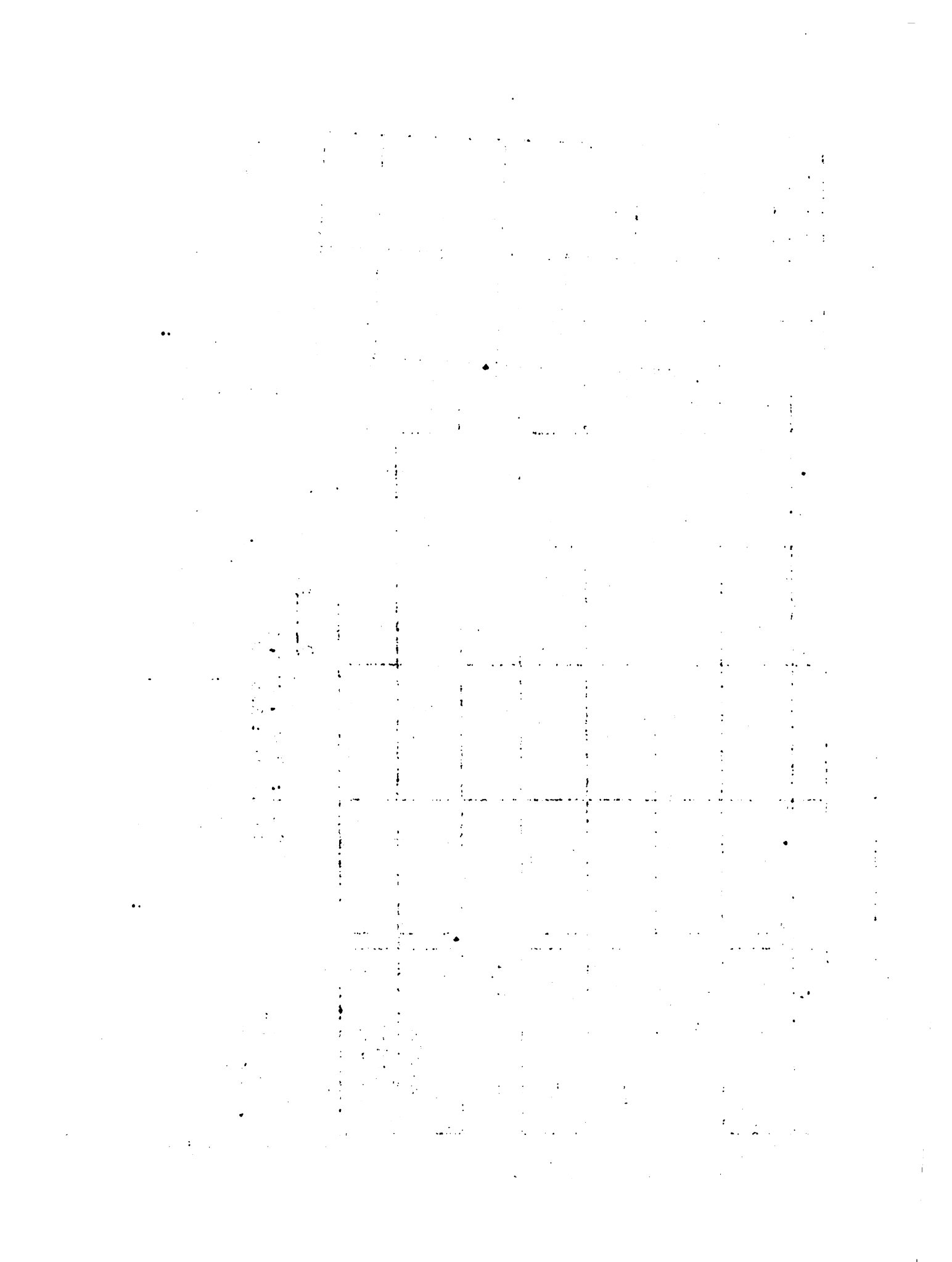


Table 6. Average scores for apple filling for pies made with vegetable shortening.

Time Frozen	Method	Color	Consistency	Odor	Flavor	Texture Fruit	General Conclusion
Fresh	Control	4.0	5.5	6.0	5.5	4.8	5.2
2-5 days	Control	4.7	4.8	5.7	5.0	5.0	4.8
	Raw Frozen	4.5	4.5	5.5	5.3	4.8	4.5
	Baked Frozen	5.0	4.8	5.5	5.0	4.3	4.7
2 weeks	Control	4.5	5.2	5.3	5.0	4.7	4.7
	Raw Frozen	4.0	4.7	5.0	4.3	4.3	4.2
	Baked Frozen	3.7	4.7	5.3	4.5	4.5	4.0
1 month	Control	5.0	5.3	4.8	4.8	4.5	4.5
	Raw Frozen	5.5	5.0	5.2	4.8	4.7	4.7
	Baked Frozen	4.7	4.5	4.7	3.2	4.3	3.3
6 weeks	Control	4.7	5.5	5.5	5.0	4.7	4.8
	Raw Frozen	6.7	6.5	6.5	6.2	6.3	6.2
	Bakd Frozen	5.8	5.8	6.0	5.3	5.3	5.5
2 months	Control	4.7	5.0	5.3	4.0	4.3	4.5
	Raw Frozen	4.8	5.2	5.5	4.5	4.8	4.5
	Baked Frozen	4.8	5.0	5.2	3.5	4.5	3.7
3 months	Control	5.2	5.5	5.7	4.8	5.0	4.8
	Raw Frozen	4.5	4.7	5.0	4.5	4.7	4.3
	Baked Frozen	3.7	3.8	4.3	3.2	3.8	3.2
4 months	Control	4.7	4.7	4.8	4.3	4.5	4.2
	Raw Frozen	4.0	4.3	5.0	4.7	4.7	4.3
	Baked Frozen	4.0	3.8	2.7	1.8	3.7	1.8
5 months	Control	4.8	5.6	4.8	4.6	4.8	4.4
	Raw Frozen	5.6	5.6	5.4	5.4	4.8	5.2
	Baked Frozen	3.4	3.8	3.2	1.8	4.6	2.0
6 months	Control	5.0	5.6	5.2	5.2	5.2	4.8
	Raw Frozen	5.2	5.2	5.4	3.4	5.2	3.8
	Baked Frozen	3.6	4.0	3.4	2.0	4.4	2.0

| | | |

Table 7. Average scores for apple filling for pies made with hydrogenated lard.

Time Frozen	Method	Color	Consistency	Odor	Flavor	Texture Fruit	General Conclusion
Fresh	Control	4.3	5.3	6.2	5.2	5.2	5.3
2-5 days	Control	4.7	5.0	5.2	5.2	4.8	4.8
	Raw Frozen	4.0	5.0	5.3	5.3	4.8	4.7
	Baked Frozen	4.2	4.7	5.2	4.3	4.7	4.2
2 weeks	Control	4.2	5.2	5.3	5.0	5.0	5.2
	Raw Frozen	5.0	5.5	5.3	5.2	5.2	5.0
	Baked Frozen	4.0	5.0	5.2	5.0	4.3	4.7
1 month	Control	5.3	5.7	5.0	5.2	4.8	5.0
	Raw Frozen	4.7	4.5	5.0	4.2	4.8	4.2
	Baked Frozen	4.3	4.2	4.5	2.7	4.2	3.0
6 weeks	Control	5.3	5.5	5.2	4.8	4.7	4.3
	Raw Frozen	6.2	6.0	6.3	6.0	5.8	5.8
	Baked Frozen	4.3	4.7	4.8	4.5	4.7	4.3
2 months	Control	4.2	5.0	4.8	4.3	4.8	4.3
	Raw Frozen	5.8	5.5	5.8	6.0	5.5	5.8
	Baked Frozen	5.5	4.8	5.2	3.8	5.0	4.0
3 months	Control	4.8	5.0	4.7	3.3	4.0	3.5
	Raw Frozen	3.2	4.5	4.5	3.8	4.7	3.8
	Baked Frozen	3.0	3.3	3.8	2.5	3.8	2.7
4 months	Control	5.0	5.0	5.3	4.7	5.2	4.7
	Raw Frozen	5.7	5.5	5.5	5.2	5.2	5.2
	Baked Frozen	5.0	4.5	4.2	3.5	4.2	3.3
5 months	Control	3.2	5.0	4.4	3.8	4.6	3.8
	Raw Frozen	5.4	5.4	5.6	5.0	4.8	5.0
	Baked Frozen	4.8	4.2	4.0	3.0	4.2	3.0
6 months	Control	5.8	6.0	5.6	5.2	5.0	5.4
	Raw Frozen	5.8	6.2	6.0	5.8	5.6	5.8
	Baked Frozen	2.8	3.0	3.0	2.4	3.0	2.0

Table 8. Average scores for apple filling for pies made with plain lard.

Time Frozen	Method	Color	Consistency	Odor	Flavor	Texture Fruit	General Conclusion
Fresh	Control	4.2	5.3	6.0	5.0	5.3	5.2
2-5 days	Control	4.3	4.8	5.2	4.7	4.8	4.7
	Raw Frozen	4.7	5.0	5.5	5.8	4.8	5.0
	Baked Frozen	5.7	5.5	5.8	5.3	5.2	5.5
2 weeks	Control	4.7	4.8	5.3	4.5	5.0	4.5
	Raw Frozen	5.0	5.0	5.2	4.5	4.8	4.2
	Baked Frozen	4.3	4.0	4.8	3.5	4.7	3.7
1 month	Control	4.8	5.0	5.3	3.8	4.3	4.2
	Raw Frozen	5.2	5.8	5.8	5.0	5.5	5.2
	Baked Frozen	4.5	4.0	4.2	4.0	4.2	3.7
6 weeks	Control	5.2	5.2	5.5	5.0	4.7	4.7
	Raw Frozen	5.8	5.5	5.8	5.7	5.3	5.5
	Baked Frozen	4.7	4.8	5.0	4.5	4.5	4.3
2 months	Control	4.2	4.5	5.0	4.0	4.5	4.2
	Raw Frozen	5.3	5.3	5.7	4.3	4.5	4.5
	Baked Frozen	4.2	4.3	4.7	2.7	3.8	3.0
3 months	Control	4.3	5.0	4.8	4.8	4.5	4.7
	Raw Frozen	4.5	5.2	5.7	5.2	4.7	4.8
	Baked Frozen	4.2	4.3	4.8	4.2	4.5	4.3
4 months	Control	5.0	5.0	4.7	4.3	4.7	4.3
	Raw Frozen	4.7	4.7	5.3	4.5	4.7	4.3
	Baked Frozen	5.0	4.3	4.7	4.3	4.5	4.2
5 months	Control	4.8	5.3	4.8	4.2	5.0	4.2
	Raw Frozen	5.7	5.8	5.8	5.8	5.7	5.7
	Baked Frozen	5.0	4.8	4.7	3.7	4.5	3.7
6 months	Control	6.2	5.8	5.4	5.2	5.6	5.6
	Raw Frozen	6.4	6.4	6.2	6.2	6.2	6.4
	Baked Frozen	2.8	3.0	3.2	1.6	3.6	1.8

Cake Score Card

Name_____ Date_____

Table 9. Form used for scoring cake.

Sample Number					
Appearance					
Color — Inside					
Color — Outside					
Odor					
Flavor					
Tenderness					
Texture					
General Conclusion					
Acceptability, yes or no					

Key:

1. very poor
2. poor
3. fair
4. medium
5. good
6. very good
7. excellent

	Defects:	Standard
Appearance:	fallen, uneven volume, sticky, sugary crust	even volume, slightly rounded smooth surface
Color:	outside - pale, drak brown inside - gray, white	evenly browned creamy, yellow white
Odor:	rancid, foreign odors	
Flavor:	rancid, foreign flavor, unevenly blended ingredients	
Tenderness:	tough, heavy, hard	light, fluffy, tender
Texture:	coarse, crumbly, soggy, dry	slightly moist, fine grain, velvety

Table 10. Average scores for Plain Cake frozen in layer form, using sodium-acid-sulphate, phosphate and tartrate baking powders.

Sodium-Acid-Sulphate baking powder

Time Frozen	Method	Appearance	Color		Volume	Odor	Flavor	Tenderness	Texture	General Conclusion
			Inner	Outer						
Fresh	Control	5.3	6.5	6.0	5.8	6.3	5.8	5.3	5.3	5.3
2-5 days	Control	5.2	5.8	6.0	5.8	6.2	5.8	5.8	5.0	5.2
	Raw Frozen	5.2	5.8	5.7	5.3	6.3	5.7	5.8	5.2	5.2
	Baked Frozen	4.8	5.8	5.5	5.2	6.0	5.5	5.5	4.8	5.0
1 month	Control	4.7	5.2	4.8	5.2	5.5	5.0	5.2	3.7	4.2
	Raw Frozen	5.2	6.2	6.0	5.2	6.0	5.8	5.7	4.8	5.0
	Baked Frozen	5.3	6.0	5.7	5.5	5.7	5.3	5.3	4.8	5.0
2 months	Control	4.8	5.8	5.7	5.8	5.7	5.5	5.2	4.7	5.0
	Raw Frozen	5.2	5.8	6.0	5.3	4.7	4.2	4.7	4.2	3.8
	Baked Frozen	5.2	5.8	6.0	4.7	5.3	4.8	4.2	3.8	4.2
4 months	Control	5.0	5.5	5.3	4.8	5.5	5.3	5.8	5.3	5.0
	Raw Frozen	3.8	5.3	3.5	4.0	4.3	2.8	4.5	3.8	3.0
	Baked Frozen	5.5	5.5	5.5	5.0	5.0	4.0	4.3	4.3	3.8
6 months	Control	5.8	6.3	5.5	5.0	6.5	6.3	6.3	5.8	5.8
	Raw Frozen	5.3	6.5	5.3	6.3	2.8	2.0	5.5	5.5	2.0
	Baked Frozen	5.8	5.3	5.0	5.8	5.8	5.3	5.5	5.5	4.8
8 months	Baked Frozen	5.0	4.0	6.0	5.4	5.8	4.2	5.0	4.2	4.0
11 months	Control	4.8	5.7	4.3	5.2	5.3	5.0	5.8	3.5	4.7
	Baked Frozen	3.5	4.8	4.5	3.7	4.8	5.0	4.2	3.8	4.0

Table 10. (Continued)

Phosphate baking powder

Time Frozen	Method	Appearance	Color		Volume	Odor	Flavor	Tenderness	Texture	General Conclusion
			Inner	Outer						
Fresh	Control	5.5	6.7	6.2	5.7	6.4	5.8	5.3	5.0	5.0
2-5 days	Control	5.8	6.3	6.5	6.0	6.5	5.5	5.3	4.5	4.8
	Raw Frozen	5.8	6.5	6.7	5.8	6.5	5.5	5.7	5.2	5.3
1 month	Control	4.7	5.5	4.8	5.5	6.0	6.0	5.5	4.2	4.7
	Raw Frozen	5.3	6.2	6.2	5.8	6.0	5.3	5.0	4.3	4.8
2 months	Control	4.2	5.4	4.8	5.6	5.6	4.6	4.6	3.0	3.2
	Raw Frozen	4.0	6.2	5.6	5.2	5.6	5.8	5.0	5.0	4.6
4 months	Control	5.3	5.3	6.0	5.3	5.7	5.3	5.2	4.2	4.7
	Raw Frozen	5.7	6.2	5.8	5.5	5.2	4.7	5.5	5.3	4.7
6 months	Control	5.3	6.0	5.5	6.0	6.3	5.8	5.8	5.3	5.5
	Raw Frozen	5.0	6.3	5.8	5.5	4.5	3.3	6.0	5.3	3.5
Tartrate baking powder										
Fresh	Control	6.0	6.7	6.3	6.2	6.2	6.0	5.2	4.8	5.0
2-5 days	Control	4.8	6.3	5.7	4.7	6.2	5.8	5.2	4.8	4.7
	Raw Frozen	5.5	6.5	6.0	5.5	6.5	5.5	5.3	4.7	5.2
1 month	Control	3.8	5.7	4.2	5.0	6.0	5.8	4.7	4.3	4.7
	Raw Frozen	4.7	6.3	6.0	5.0	6.0	5.3	4.5	4.5	5.0
2 months	Control	4.7	5.5	5.3	4.5	5.3	4.7	4.8	4.2	4.0
	Raw Frozen	4.7	6.0	5.2	4.8	5.3	4.3	5.0	4.5	4.2
4 months	Control	5.2	6.2	5.7	5.0	6.0	5.8	5.3	4.5	5.0
	Raw Frozen	4.2	6.0	5.2	3.2	4.3	3.7	4.7	4.2	3.7
6 months	Control	4.8	5.8	5.3	5.0	5.5	5.3	5.5	5.0	4.8
	Raw Frozen	3.8	5.8	4.5	4.0	3.5	3.5	5.5	4.0	3.3

Table 11. Average scores for Plain Cake frozen in cup cake form, using sodium-acid-sulphate, phosphate and tartrate baking powders.

Sodium-acid-sulphate baking powder.

Time Frozen	Method	Appear-ance	Color Inner	Color Outer	Vol-ume	Odor	Flavor	Tender-ness	Tex-ture	General Conclusion
Fresh	Control	5.3	6.5	6.2	6.0	6.3	6.2	5.5	5.2	5.3
2-5 days	Control	5.0	6.2	5.7	5.7	6.3	5.7	5.7	5.0	5.2
	Raw Frozen	4.8	6.2	5.7	5.7	6.3	5.5	5.5	4.8	4.8
	Bkd. Frozen	3.7	5.7	4.5	5.3	5.2	6.0	5.0	3.5	3.8
1 month	Control	3.3	5.2	3.8	5.2	5.5	5.2	5.0	3.7	3.8
	Raw Frozen	5.5	6.0	5.7	6.0	6.3	6.0	4.8	5.0	5.2
	Bkd. Frozen	4.8	5.8	4.7	5.3	5.8	4.7	4.8	4.2	4.2
2 months	Control	3.5	5.7	4.8	4.5	5.8	5.3	5.0	4.3	4.5
	Raw Frozen	5.2	5.8	5.2	5.7	4.8	4.3	4.2	4.2	3.7
	Bkd. Frozen	4.7	5.7	5.2	5.3	5.2	4.5	3.5	3.5	3.5
4 months	Control	4.3	5.3	4.8	4.5	5.5	5.0	4.8	4.5	4.8
	Raw Frozen	3.3	5.3	4.0	3.0	4.3	2.5	3.5	2.5	2.5
	Bkd. Frozen	5.3	5.3	5.0	5.3	5.3	4.3	4.3	3.5	3.8
6 months	Control	5.0	6.5	6.3	6.5	6.5	6.0	6.8	5.5	6.0
	Raw Frozen	6.0	5.5	5.8	6.3	3.0	2.0	5.8	5.3	2.3
	Bkd. Frozen	4.5	4.8	4.8	6.3	5.3	4.5	5.0	3.5	3.8
8 months	Bkd. Frozen	4.0	4.4	5.4	5.3	4.2	3.2	3.2	3.8	3.4
11 months	Control	5.0	5.8	4.8	5.3	5.7	5.5	5.2	3.7	5.0
	Bkd. Frozen	3.8	4.8	4.2	4.8	4.7	3.8	3.5	3.2	3.3

Table 11. (Continued)

Phosphate baking powder

Time Frozen	Method	Appearance	Inner	Outer	Volume	Odor	Flavor	Tenderness	Texture	General Conclusion
Fresh	Control	5.3	6.7	6.0	6.2	6.3	6.0	5.3	5.0	5.2
2-5 days	Control	4.0	6.5	5.3	5.2	6.5	5.0	4.8	3.2	4.0
	Raw Frozen	5.7	6.5	6.7,	6.0	6.5	6.3	6.0	5.3	6.0
1 month	Control	4.0	5.5	4.7	5.2	5.8	6.0	5.5	4.0	4.5
	Raw Frozen	5.8	6.2	6.3	5.8	6.2	5.5	4.8	3.8	4.7
2 months	Control	3.0	5.2	4.2	5.2	5.0	5.0	4.2	3.0	2.8
	Raw Frozen	5.2	6.2	5.8	5.8	5.6	5.8	4.6	4.2	4.8
4 months	Control	4.5	5.3	5.5	5.0	5.5	5.0	4.5	3.7	4.2
	Raw Frozen	5.2	6.2	5.7	5.2	4.7	4.2	4.5	4.7	4.0
6 months	Control	4.3	6.0	5.3	5.5	6.0	5.8	5.8	5.0	5.5
	Raw Frozen	5.5	5.8	6.0	6.3	4.0	3.0	5.0	4.8	3.3

Tartrate baking powder

Fresh	Control	5.5	6.7	6.3	6.0	6.3	5.8	5.3	4.8	5.2
2-5 days	Control	6.0	6.2	6.3	6.0	6.5	5.7	5.3	5.2	5.2
	Raw Frozen	5.5	6.5	6.5	5.7	6.5	6.0	4.8	4.3	5.0
1 month	Control	3.8	5.3	4.2	5.0	5.7	5.5	4.0	3.5	3.7
	Raw Frozen	5.5	6.2	6.2	5.5	5.8	5.5	4.0	4.0	4.3
2 months	Control	3.5	5.3	4.3	3.5	5.3	5.0	4.0	3.7	3.7
	Raw Frozen	4.3	5.8	5.3	3.5	4.5	3.8	4.0	3.5	2.8
4 months	Control	4.5	6.0	5.5	5.2	6.0	5.5	4.8	3.8	4.7
	Raw Frozen	5.3	6.0	5.3	4.8	3.8	3.7	4.2	4.2	3.2
6 months	Control	5.8	5.5	5.8	6.5	5.5	5.3	5.5	5.0	4.8
	Raw Frozen	4.5	5.7	4.5	5.8	3.3	3.3	4.3	3.0	2.8

Table 12. Average scores for Plain Cake frozen in layers and iced with Seven Minute Frosting.

Time Frozen	Method	Appearance	Color		Volume	Odor	Flavor	Tenderness	Texture	General Conclusion
			Inside	Outside						
Fresh	Control	5.8	6.3		6.2	6.3	6.2	6.2	5.3	5.7
2-5 days	Control	5.8	5.7	6.2	5.8	6.3	5.8	5.8	4.8	5.3
	Baked Frozen	5.2	5.7	6.2	6.0	6.2	5.8	5.8	4.7	5.2
1 month	Control	5.3	6.0	6.0	5.7	6.3	5.8	5.0	4.5	4.8
	Baked Frozen	4.3	6.0	6.0	6.2	5.5	5.0	5.2	4.7	4.3
2 months	Control	6.0	5.8		5.7	5.8	5.7	5.8	4.7	5.3
	Baked Frozen	5.0	5.2		5.3	5.8	5.2	5.5	4.7	4.8
4 months	Control	6.2	6.3	6.3	5.8	6.0	6.2	6.3	5.7	6.0
	Baked Frozen	4.2	5.3	6.5	5.6	4.7	4.3	4.7	4.5	4.0
6 months	Control	5.8	6.5	6.0		6.3	6.3	6.3	5.5	5.8
	Baked Frozen	5.0	5.5	6.0		5.3	5.0	4.5	4.5	4.5
8 months	Baked Frozen	4.4	4.3	5.2	5.4	6.0	4.8	5.0	4.6	4.8
11 months	Control	5.2	5.7		5.0	6.0	5.8	6.2	5.7	5.5
	Baked Frozen	3.8	4.5		5.3	5.3	4.3	4.5	4.2	3.8

Table 15. Average scores for Plain Jake Frozen in Layers and Iced with Seven Dinute Frosting.

Time Frozen	Method	Appearance	Color Inside	Color Outside	Volume	Color	Flavor	Tender-ness	Texture	General Acceptance
[illegible]	Control	5.6	[illegible]		0.2	0.3	0.2	[illegible]	[illegible]	[illegible]
[illegible]	Control	[illegible]	[illegible]	0.2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Baked Frozen	[illegible]	[illegible]	0.2	0.0	0.2	[illegible]	[illegible]	[illegible]	[illegible]
1 month	Control	[illegible]	0.0	0.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Baked Frozen	4.3	0.0	0.0	0.2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Control	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Baked Frozen	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4 months	Control	[illegible]	[illegible]	0.3	[illegible]	0.0	[illegible]	[illegible]	[illegible]	0.0
	Baked Frozen	4.2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6 months	Control	[illegible]	[illegible]	0.0		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Baked Frozen	[illegible]	[illegible]	0.0		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] months	Baked Frozen	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
11 months	Control	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Baked Frozen	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Table 13. Average scores for Spice Cake frozen in layer form.

Time Frozen	Method	Appearance	Color		Volume	Odor	Flavor	Tenderness	Texture	General Conclusion
			Inside	Outside						
Fresh	Control	5.7	6.3	6.3	5.5	6.5	6.0	6.0	5.2	5.7
2-5 days	Control	5.5	6.2	6.3	6.0	6.2	5.7	5.2	4.7	5.2
	Raw Frozen	5.3	6.2	6.0	5.7	6.0	6.3	6.2	5.5	5.7
	Baked Frozen	5.3	6.3	6.0	5.7	6.2	5.3	6.0	5.3	5.3
1 month	Control	5.7	6.3	6.3	6.2	5.5	5.5	4.8	4.2	4.8
	Raw Frozen	5.5	6.2	5.7	5.5	5.7	5.0	4.5	4.3	4.7
	Baked Frozen	5.8	6.2	6.3	6.0	5.7	5.7	4.7	4.7	5.2
2 months	Control	5.2	5.5	5.5	5.7	5.7	4.2	4.3	3.5	4.3
	Raw Frozen	6.0	6.0	6.2	6.0	6.2	5.7	5.7	5.2	5.3
	Baked Frozen	4.7	6.3	5.5	5.2	5.8	5.2	3.8	4.5	4.8
4 months	Control	5.5	6.2	6.2	5.7	5.8	5.3	5.5	5.3	5.3
	Raw Frozen	5.0	5.8	5.8	5.3	5.7	5.5	5.8	4.5	5.2
	Baked Frozen	5.0	5.8	5.8	5.2	5.3	4.2	5.2	4.2	4.3
6 months	Control	6.8	6.8	6.8	6.8	5.8	6.3	6.5	5.8	5.8
	Raw Frozen	5.0	5.5	5.8	5.5	6.0	5.5	6.0	4.5	4.8
	Baked Frozen	4.0	5.3	3.8	4.3	5.3	5.5	5.3	4.0	4.0
8 months	Baked Frozen	5.2	6.2	6.0	5.0	6.0	5.4	5.4	4.8	4.6
11 months	Control	5.7	6.3	6.3		6.3	6.2	6.0	5.8	5.7
	Baked Frozen	4.5	5.5	5.3		6.0	5.5	4.5	3.8	4.2

Table 14. Average scores for Spice Cake frozen in layer form.

Time Frozen	Method	Appearance	Color		Volume	Odor	Flavor	Tenderness	Texture	General Conclusion
			Inner	Outer						
Fresh	Control	4.5	6.3	6.0	5.7	6.5	5.7	5.8	5.3	5.3
2-5 days	Control	5.0	6.5	5.8	6.2	6.2	5.8	6.2	5.3	5.7
	Raw Frozen	5.0	6.2	5.5	5.8	6.2	5.8	6.3	5.2	5.2
	Bkd.Frozen	5.3	6.5	6.2	5.8	6.2	5.3	6.0	5.2	5.3
1 month	Control	5.5	6.3	6.3	6.0	5.7	6.0	5.7	5.2	5.5
	Raw Frozen	5.7	6.2	6.2	6.5	5.8	5.3	5.5	4.8	5.0
	Bkd.Frozen	5.5	6.3	6.3	5.7	5.7	5.8	4.7	4.7	5.0
2 months	Control	5.0	6.0	6.0	6.2	6.2	5.3	5.2	4.7	4.8
	Raw Frozen	5.3	6.2	5.8	6.2	6.2	6.0	5.8	5.2	5.5
	Bkd. Frozen	5.2	6.3	5.5	6.0	6.0	5.8	5.8	5.2	5.5
4 months	Control	5.3	6.0	6.2	5.5	5.7	5.5	5.5	5.2	5.2
	Raw Frozen	5.0	5.8	5.8	6.0	6.2	5.7	6.2	5.2	5.3
	Bkd.Frosen	4.5	5.8	5.3	5.5	5.3	4.5	5.0	4.2	4.3
6 months	Control	5.5	7.0	6.5	7.0	6.8	6.5	6.5	6.0	6.0
	Raw Frozen	4.0	5.0	5.0	4.8	5.5	5.5	5.0	2.8	3.3
	Bkd.Frozen	4.8	5.3	4.5	5.8	4.8	4.5	5.3	4.5	4.3
8 months	Bkd.Frozen	5.8	6.4	6.2	5.6	5.6	5.4	5.6	5.0	5.0
11 months	Control	5.0	6.3	6.3		6.0	5.8	5.8	5.5	5.5
	Bkd.Frozen	4.5	5.8	5.8		5.5	5.0	4.8	3.5	4.2

Table 15. Average scores for Chocolate Cake frozen in layer form; plain and iced with Butter Frosting.

Time Frozen	Method	Appearance	Color		Odor	Flavor	Tenderness	Texture	Volume	General Conclusion
			Inside	Outside						
Plain layer										
Fresh	Control	6.5	6.2	6.5	6.2	5.8	6.3	5.8	6.5	6.0
	Baked Frozen	6.7	6.2	6.5	6.3	6.0	6.3	5.8	6.7	6.0
2-5 days	Control	5.8	6.4	5.8	6.0	5.4	5.4	5.2	5.6	5.2
	Raw Frozen	5.8	6.4	6.0	5.8	5.2	5.6	5.0	5.8	5.4
	Baked Frozen	6.0	6.4	6.2	6.2	5.8	5.8	5.2	6.0	5.8
2 months	Control	6.0	6.0	6.3	5.5	5.0	6.5	5.8	6.3	5.0
	Raw Frozen	6.3	6.5	6.5	6.5	6.5	6.3	6.0	6.3	6.3
	Baked Frozen	5.8	6.5	6.3	5.8	5.0	6.0	5.0	6.3	5.0
3 months	Raw Frozen	6.3	6.3	6.3	5.8	6.3	6.5	6.5	6.3	6.3
	Baked Frozen	4.8	6.0	5.5	5.8	4.8	6.5	5.3	5.0	5.0
5 months	Control	5.8	5.4	5.8	6.0	4.8	5.0	4.8	6.0	4.8
	Raw Frozen	5.0	5.8	5.6	6.4	5.0	5.4	5.0	6.0	5.2
	Baked Frozen	5.0	5.6	5.4	5.4	4.6	5.4	4.6	6.0	4.6
8 months	Control	5.6	6.0	5.2	5.6	4.4	5.6	4.2	5.8	5.0
	Raw Frozen	5.0	5.8	6.0	6.6	6.4	6.6	6.0	5.2	5.6
	Baked Frozen	4.0	5.4	6.0	6.0	5.2	5.8	4.6	5.4	4.6
Iced layer										
Fresh	Control	6.7	6.3	6.6	6.3	6.0	6.0	5.5	6.5	5.7
2-5 days	Control	5.8	6.4	6.3	5.8	5.8	5.8	5.8	5.6	5.6
	Baked Frozen	6.2	6.4	6.3	5.8	6.0	6.0	5.8	6.2	5.8
2 months	Control	6.3	6.5	7.0	6.5	6.3	6.8	6.5	6.8	6.5
	Baked Frozen	6.0	6.0	6.5	5.8	5.0	6.3	5.8	6.3	5.3
3 months	Baked Frozen	6.0	5.5	5.0	5.5	4.8	5.8	5.0	6.3	4.8
5 months	Control	5.8	5.2	5.8	6.4	5.4	5.4	5.2	6.0	5.2
	Baked Frozen	4.6	5.8	5.8	6.4	5.2	5.6	5.4	6.0	5.2
8 months	Control	5.0	4.8		5.0	4.6	5.0	4.0	5.8	4.2
	Baked Frozen	5.8	6.0		6.2	4.8	6.0	5.2	5.8	4.8

Table 16. Average scores for Sponge Cake.

Time Frozen	Method	Volume	Crust		Interior		Texture	Tenderness	Moisture	General Conclusion
			Color	Tender.	Color	Flavor				
Fresh	Control	5.7	6.0	4.7	5.7	6.0	5.7	5.2	5.3	5.5
	Baked Frozen	5.2	5.8	4.8	5.7	6.0	4.8	4.8	5.3	5.0
2-5 days	Control	6.2	5.6	5.0	6.4	5.6	5.2	5.4	5.6	5.0
	Raw Frozen	3.6	5.6	5.2	5.8	5.4	3.6	4.0	5.0	3.6
	Baked Frozen	4.2	5.4	4.8	5.8	5.6	4.0	4.2	5.0	4.0
1 month	Control	5.0	5.2	5.2	6.2	5.8	4.8	5.0	4.6	4.6
	Raw Frozen	4.4	5.4	4.8	6.0	5.4	5.0	4.8	5.0	4.4
	Baked Frozen	5.8	5.8	5.2	6.4	5.2	4.6	4.8	4.8	4.6
2 months	Control	6.3	5.8	5.3	6.0	6.3	5.5	6.0	5.8	5.3
	Raw Frozen	2.3	6.0	5.3	6.0	5.3	1.0	2.8	4.5	1.5
	Baked Frozen	5.8	6.5	6.0	5.8	5.8	4.8	4.8	4.8	5.0
4 months	Baked Frozen	4.0	5.2	5.2	5.4	5.0	4.2	3.4	4.0	3.4

7 Minute Frosting Score Card

Name_____ Date_____

Table 17. Form used for scoring Seven Minute Frosting and Butter Frosting.

Sample No.					
Appearance					
Color					
Odor					
Consistency					
Texture					
Flavor					
Gen'l.Conclusion					
Acceptability, yes or no					

Key:
1. Very poor
2. poor
3. fair
4. medium
5. good
6. very good
7. excellent

	Defects:	Standards
Appearance:	Dull, cracked, grainy	shiny, glossy
Color:	yellow, gray	creamy white
Odor:	rancid	
Consistency:	crust, runny, sticky	
Texture:	grainy	fluffy, fine grain
Flavor:	too sweet, not sweet enough, foreign flavor	

Table 18. Average scores for Seven-minute Frosting.

Time Frozen	Method	Appearance	Color	Odor	Consistency	Texture	Flavor	General Conclusion
Fresh	Control	5.8	6.5	6.5	4.7	5.3	5.7	5.0
2-5 days	Control	6.2	6.3	6.3	4.8	5.3	5.3	5.0
	Baked Frozen	3.3	5.7	6.2	2.7	2.7	5.2	3.3
1 month	Control	5.5	6.3	6.2	5.3	5.2	6.0	5.2
	Baked Frozen	2.8	6.3	6.0	2.5	2.5	6.0	2.3
2 months	Control	6.0	6.2	6.2	4.8	5.5	5.3	5.3
	Baked Frozen	4.8	5.7	6.2	3.7	4.5	5.3	3.8
4 months	Control	4.5	6.0	6.0	3.8	3.7	5.5	3.8
	Baked Frozen	2.8	5.7	5.5	3.5	3.7	5.2	3.5
6 months	Control	6.7	6.2	6.8	5.5	5.5	6.5	5.5
	Baked Frozen	3.0	4.5	5.8	3.8	3.5	4.2	3.5
8 months	Baked Frozen	3.4	5.8	6.2	4.6	4.6	4.8	4.0
11 months	Control	5.3	6.0	6.2	5.2	5.2	6.0	5.3
	Baked Frozen	3.5	5.3	5.8	2.8	3.3	4.5	3.2

Table 19. Average scores for Butter Frosting.

Time Frozen	Method	Appearance	Color	Odor	Consistency	Texture	Flavor	General Conclusion
2 months	Control	6.5	6.5	6.5	6.8	6.3	6.5	6.3
	Baked Frozen	6.5	6.8	6.5	6.8	5.0	5.3	5.0
3 months	Baked Frozen	5.5	6.0	6.3	6.0	4.5	5.5	5.0
8 months	Control	6.0	6.2	6.4	5.0	5.2	6.2	5.6
	Baked Frozen	5.8	6.2	6.4	4.8	4.2	5.8	4.6

• • • •

Cookie Score Card

Name _____ Date _____

Table 20. Form used for scoring cookies.

Sample Number									
Color									
Odor									
Flavor									
Tenderness									
Texture									
General Conclusion									
Acceptability, yes or no									

Key:
1. very poor
2. poor
3. fair
4. medium
5. good
6. very good
7. excellent

Table 21. Average scores for Oatmeal Hermits.

Time Frozen	Method	Color	Odor	Flavor	Tender-ness	Text-ture	General Conclusion
Fresh	Control	5.7	6.2	6.0	6.0	5.8	5.7
	Raw Frozen	6.2	6.2	6.0	5.8	5.7	5.5
2-5 days	Control	6.0	6.4	6.0	6.0	5.4	5.8
	Raw Frozen	5.8	6.4	6.0	5.2	4.8	5.4
2 months	Control	5.5	6.5	6.3	5.0	4.5	5.5
	Raw Frozen	6.3	6.3	6.3	5.8	5.5	5.8
3 months	Raw Frozen	6.5	6.3	6.0	5.8	6.0	6.0
5 months	Control	6.2	6.0	5.3	5.8	4.8	5.3
	Raw Frozen	5.8	6.5	6.5	6.5	6.3	6.3
6 months	Control	5.3	5.7	5.5	5.8	5.7	5.7
	Raw Frozen	6.2	6.0	5.8	5.7	6.0	6.0

Table 22. Average scores for Ice Box Cookies.

Time Frozen	Method	Color	Odor	Flavor	Tender-ness	Text-ture	General Conclusion
Fresh	Control	5.5	6.2	6.2	5.2	5.5	5.3
	Raw Frozen	6.2	6.5	6.5	5.7	5.7	6.0
2-5 days	Control	5.6	6.2	6.4	5.6	5.6	5.8
	Raw Frozen	5.6	6.8	6.6	5.0	5.6	6.0
1 month	Control	6.0	6.8	6.3	6.0	5.5	6.0
	Raw Frozen	5.8	6.3	6.3	6.3	5.5	5.5
2 months	Control	6.0	6.3	6.3	6.0	6.0	6.3
	Raw Frozen	3.3	3.3	3.7	5.3	5.5	4.0
3 months	Raw Frozen	6.3	6.7	6.3	5.8	6.0	5.0
6 months	Control	5.3	6.0	5.7	4.8	5.2	5.2
	Raw Frozen	6.2	6.3	6.0	5.5	5.7	5.7

Baking Powder Biscuits Score Card

Name_____ Date_____

Table 23. Form used for scoring Baking Powder Biscuits.

Sample Number					
Appearance					
Color Inside					
Color Outside					
Odor					
Flavor					
Tenderness					
Texture					
General Conclusion					
Acceptability, yes or no					

Key:
1. very poor
2. poor
3. fair
4. medium
5. good
6. very good
7. excellent

	Defects:	Standards:
Appearance:	very rough, too smooth top	level top, fairly smooth, symmetrical
Color:	outside - pale, dark brown, spotted	golden brown
	inside - gray, yellow, spotted	creamy white
Odor:	foreign odors	
Flavor:	tastes of unblended ingredients, foreign flavors	
Tenderness:	crust tough and hard, tough inside	crisp, tender
Texture:	coarse grain, crumbly, heavy, soggy dry	fine grain, light, slightly moist

Table 24. Average scores for baking powder biscuits made with sodium-aluminum-sulphate, phosphate and tartrate baking powder.

Sodium-acid-sulphate baking powder.

Time Frozen	Method	Appearance	Inner	Outer	Odor	Flavor	Tenderness	Texture	Volume	General Conclusion
Fresh	Control	4.3	4.8	4.5	5.8	5.3	4.8	4.8		5.0
2-5 days	Control	4.2	5.2	4.8	5.3	4.7	4.0	4.0		4.2
	Raw Frozen	3.7	4.8	4.8	5.2	4.5	4.0	4.0		4.2
	Baked Frozen	5.2	5.7	5.0	5.5	5.3	4.2	4.8		4.8
1 month	Control	5.3	5.7	5.3	5.7	5.7	4.7	4.7		5.0
	Raw Frozen	3.5	5.0	5.3	5.5	5.3	3.5	3.3		3.7
	Baked Frozen	4.5	5.0	5.7	5.8	4.7	3.5	3.3		3.8
2 months	Control	4.8	5.0	4.7	5.5	5.0	5.3	4.8	5.5	4.7
	Raw Frozen	3.7	5.0	4.7	5.3	4.8	4.5	3.8	4.7	4.0
	Baked Frozen	4.3	5.0	5.2	5.2	4.0	3.2	3.0	4.8	3.5
4 months	Control	5.4	5.8	5.6	5.2	5.2	5.2	5.0	5.4	5.2
	Raw Frozen	3.8	5.2	5.0	5.6	5.4	3.8	3.4	4.4	3.8
	Baked Frozen	5.0	5.4	5.4	5.0	4.8	4.4	4.4	5.0	4.6
6 months	Control	5.0	5.2	5.0	5.2	4.8	4.8	4.6	5.5	4.2
	Baked Frozen	4.0	4.8	5.0	5.6	5.8	3.2	3.8	5.0	3.6

Table 24. (Continued)

Phosphate baking powder

Time Frozen	Method	Appearance	Color		Odor	Flavor	Tenderness	Texture	Volume	General Conclusion
			Inner	Outer						
Fresh	Control	4.2	5.7	5.2	6.0	5.0	4.0	4.3		4.3
2-5 days	Control	4.2	4.7	4.7	5.3	4.3	3.5	3.3		3.7
	Raw Frozen	4.7	5.5	5.3	5.8	4.5	3.5	3.5		3.7
	Baked Frozen	4.7	5.0	5.3	6.0	5.5	4.0	4.3		4.3
1 month	Control	5.2	5.5	5.3	5.8	5.0	5.0	4.8		4.7
	Raw Frozen	3.3	3.7	5.2	5.2	4.5	3.0	2.8		3.0
	Baked Frozen	4.7	5.3	5.2	5.8	4.8	4.5	4.2		4.0
2 months	Control	5.0	5.3	4.8	5.7	5.5	5.2	5.2	5.5	4.8
	Raw Frozen	3.3	3.2	4.5	4.3	3.7	2.2	2.0	2.7	2.3
	Baked Frozen	5.0	4.8	4.5	5.3	4.3	4.2	4.2	5.5	4.0
4 months	Control	4.6	5.0	4.8	5.6	5.4	5.6	5.0	5.4	5.2
	Raw Frozen	3.4	3.8	4.8	4.0	3.6	2.4	1.8	3.0	1.8
	Baked Frozen	4.0	4.8	5.2	5.0	3.8	4.0	3.8	5.6	3.2
6 months	Control	4.4	5.4	5.0	5.6	5.2	4.4	4.6	5.2	4.4
	Baked Frozen	4.4	5.0	4.6	5.4	5.0	3.0	3.2	5.2	3.4
Tartrate baking powder										
Fresh	control	3.5	4.8	4.3	5.5	4.8	4.3	4.3		4.0
2-5 days	Control	4.8	5.5	5.0	5.7	4.8	4.5	4.7		4.7
	Raw Frozen	4.8	4.8	5.5	6.0	4.8	4.3	4.3		4.3
	Baked Frozen	4.8	5.2	5.2	6.0	5.5	4.3	4.2		4.7
1 month	Control	4.5	5.3	5.5	5.8	5.5	4.8	4.2		5.0
	Raw Frozen	4.3	5.2	5.3	5.5	5.0	3.8	3.7		4.2
	Baked Frozen	5.2	5.3	5.5	6.0	4.5	4.2	4.2		4.2
2 months	Control	3.8	4.7	4.3	5.2	5.5	4.8	5.0	5.2	4.5
	Raw Frozen	3.2	3.7	4.7	4.8	3.5	2.0	2.2	3.7	2.3
	Baked Frozen	5.0	4.7	4.7	5.0	4.0	4.2	3.5	5.7	4.2
4 months	Control	5.6	5.2	5.2	5.6	5.2	5.4	4.8	5.2	5.2
	Raw Frozen	4.0	4.2	4.8	4.6	3.4	2.6	2.0	3.4	2.2
	Baked Frozen	5.2	4.6	4.8	4.6	3.6	3.8	3.8	5.8	3.8
6 months	Control	5.2	5.0	4.8	5.4	5.0	5.0	4.6	5.3	4.4
	Baked Frozen	5.0	5.2	4.6	5.8	5.2	3.8	3.8	5.2	3.8

Muffin Score Cards

Name _____ Date _____

Table 25. Form used for scoring muffins.

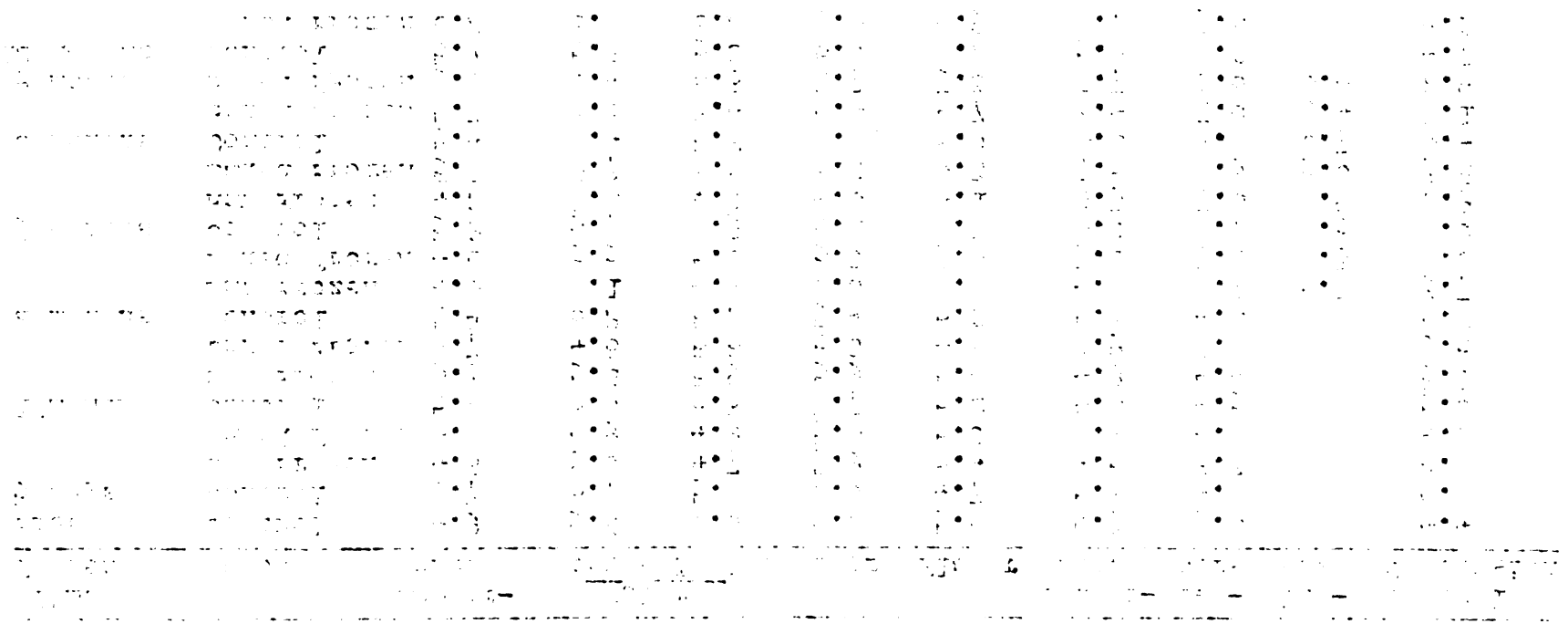
Sample No.				
Appearance				
Color — Outside				
Color — Inside				
Odor				
Flavor				
Tenderness				
Texture				
General Conclusion				
Accept. Yes or no				

Key:
1. Very poor
2. poor
3. fair
4. medium
5. good
6. very good
7. excellent

	Defects	Standard
Appearance:	peaked, smooth surface	symmetrical, rounded tops, pebbled surface
Color:	outside, dark brown, pale; inside, spots of unmixed ingredients, waxy spots.	outside - golden brown inside - creamy white
Odor:	foreign odor	
Flavor:	flavors of unblended ingreds. foreign flavors	
Tenderness:	Hard, tough, solid	springy, slightly crisp
Texture:	dry, soggy, tunnels	medium uniform holes, slightly moist.

Table 26. Average scores for muffins.

Time Frozen	Method	Appear-ance	Color		Odor	Flavor	Tender-ness	Tex-ture	Vol-ume	General Conclusion
			Outside	Inside						
Fresh	Control	4.9	5.8	6.0	5.8	5.5	4.7	3.6		4.4
5 days	Control	5.7	5.7	5.2	6.0	4.7	5.3	4.8		4.5
	Raw Frozen	4.3	5.0	4.7	5.9	5.4	4.5	3.7		4.2
	Baked Frozen	4.8	4.9	4.9	5.6	5.0	4.2	4.2		4.2
1 month	Control	5.2	6.0	5.3	5.7	5.2	4.8	4.5		5.0
	Raw Frozen	5.3	5.8	5.9	5.9	5.8	4.9	4.4		5.0
	Baked Frozen	4.7	4.6	5.5	5.0	4.8	3.9	3.2		3.5
2 months	Control	5.4	6.2	5.2	5.4	5.2	5.6	4.6		5.2
	Raw Frozen	4.6	6.1	4.9	6.0	4.8	4.5	2.7	5.3	3.7
	Baked Frozen	4.6	5.5	5.0	5.0	3.4	3.6	3.2	5.3	3.2
3 months	Control	5.2	5.7	5.3	5.2	4.3	4.0	3.7	5.5	4.0
	Raw Frozen	4.2	5.8	5.1	4.6	4.1	3.3	3.6	3.9	2.9
	Baked Frozen	5.0	5.7	5.5	5.3	4.3	3.5	3.3	5.0	3.5
6 months	Control	5.4	4.4	5.8	5.8	5.0	4.8	4.0	6.7	4.4
	Baked Frozen	5.3	5.6	5.4	5.4	4.7	3.4	3.0	5.4	3.1
9 months	Baked Frozen	5.2	6.4	6.3	5.7	3.8	2.7	2.6	6.4	2.9
12 months	Control	5.7	5.3	5.8	6.0	5.2	5.2	4.2		4.7
	Baked Frozen	6.2	6.3	6.2	5.5	4.9	4.7	3.8		4.2



Bread Score Card

Name _____ Date _____

Table 27. Form used for scoring bread.

Sample Number		
Appearance	Outside	
	Inside	
Color	Outside	
	Inside	
Odor		
Flavor		
Tenderness		
Texture		
General Conclusion		
Accept. Yes or No.		

Key:
1. very poor
2. poor
3. fair
4. medium
5. good
6. very good
7. excellent

	Defects:	Standard:
Appearance:	outside - flat, cracked, dry	rounded, good break on side
	inside - crust thick, streaked	moist
Color:	outside, pale or dark	evenly browned
	inside, gray, yellow	creamy white
Odor:	foreign odors	
Flavor:	foreign flavors, yeasty, sour flat	
Tenderness:	compact, tough	light, tender crust and interior
Texture:	coarse, crumbly, dry, soggy, gummy	springy, fine grain, uniform

Table 28. Average scores for bread made with compressed yeast.

Time Frozen	Method	Appearance		Color		Odor	Flavor	Tender-ness	Text-ure	Vol-ume	General Conclusion
		Outer	Inner	Outer	Inner						
Fresh	Control	5.6	5.8	5.7	6.1	5.8	5.3	4.9	4.8		5.2
2-5 days	Control	4.8	4.9	4.5	5.7	5.1	4.4	4.3	4.0	4.4	4.0
	Raw Frozen	5.3	4.5	5.2	5.4	5.0	4.6	4.3	3.8	4.4	3.6
	Bkd. Frozen	5.5	5.0	5.6	5.6	5.3	5.5	5.1	4.9	5.2	4.9
1 month	Control	6.0	5.0	6.1	6.1	5.7	5.4	5.4	4.5	6.0	4.8
	Raw Frozen	5.5	5.0	6.2	5.9	5.3	4.8	4.5	3.4	4.6	4.2
	Bkd. Frozen	4.6	5.5	5.3	6.1	5.7	5.6	5.5	4.9	5.9	5.0
2 months	Control	5.6	4.9	6.0	5.8	5.2	4.5	4.3	4.4	5.9	4.4
	Raw Frozen	4.2	4.3	4.9	4.8	4.6	3.9	3.9	3.0	4.7	3.4
	Bkd. Frozen	5.1	5.1	5.8	5.7	5.5	5.0	5.3	4.4	5.9	4.7
4 months	Control	6.1	5.2	6.3	5.8	5.4	4.9	4.7	4.7	6.0	4.6
	Raw Frozen	2.5	3.0	3.0	3.9	3.9	2.6	2.2	1.6	2.2	1.9
	Bkd. Frozen	3.7	4.5	3.8	5.4	4.8	3.1	4.0	3.1	3.8	2.9
6 months	Control	5.7	5.3	5.8	6.3	6.0	6.0	5.3	5.1	5.8	5.1
	Bkd. Frozen	5.5	6.1	6.1	6.6	6.3	5.3	4.8	4.9	6.2	4.7
9 months	Control	3.8	3.4	4.7	4.3	3.6	2.2	3.4	2.3	3.6	2.3
	Bkd. Frozen	6.1	5.8	6.5	6.4	6.2	5.6	5.3	5.0	6.3	5.4
11 months	Control	4.2	4.7	5.7	5.5	4.7	3.7	3.7	3.5	6.0	3.3
	Bkd. Frozen	5.9	5.8	5.7	5.9	5.6	4.7	5.1	4.8	5.7	4.7

Table 29. Average scores for bread made with dry yeast.

Time Frozen	Method	Appearance		Color		Odor	Flavor	Tender-ness	Tex-ture	Vol-ume	General Conclusion
		Outer	Inner	Outer	Inner						
Fresh	Control	5.7	5.0	5.8	5.8	6.0	5.5	4.7	4.7		4.9
2-5 days	Control	6.0	5.7	5.7	5.8	5.3	5.3	5.1	5.0	5.6	5.0
	Raw Frozen	5.2	3.8	5.0	5.2	5.0	4.4	3.8	2.8	4.3	3.0
	Bkd. Frozen	5.3	5.4	6.0	5.8	5.5	5.7	5.5	5.5	5.7	5.4
1 month	Control	5.8	5.3	6.2	6.2	5.7	5.4	5.4	4.7	6.1	4.9
	Raw Frozen	5.8	5.6	6.2	6.3	5.9	5.6	5.1	4.7	5.7	4.9
	Bkd. Frozen	5.4	5.7	5.4	6.2	5.9	5.9	5.6	5.0	6.3	5.4
2 months	Control	5.5	5.3	6.0	5.8	5.8	5.5	5.2	5.3	5.7	5.3
	Raw Frozen	4.4	4.7	4.8	4.9	5.3	4.7	4.1	3.7	4.5	4.0
	Bkd. Frozen	5.2	5.6	5.6	5.9	5.5	4.5	5.2	4.3	6.2	4.3
4 months	Control	5.9	5.7	6.0	5.9	5.5	5.2	5.1	4.9	5.7	5.0
	Raw Frozen	3.1	3.4	3.8	4.1	4.1	3.0	2.4	1.9	2.4	2.2
	Bkd. Frozen	5.4	5.4	5.8	5.8	5.3	4.8	5.1	4.6	4.9	4.4
6 months	Control	6.4	6.1	6.2	6.5	6.4	6.0	5.9	5.5	6.4	5.8
	Bkd. Frozen	5.6	5.2	6.0	6.4	5.7	5.7	4.7	4.9	6.4	5.2
9 months	Control	5.6	4.8	5.8	5.2	4.6	4.7	4.6	4.2	5.5	4.3
	Bkd. Frozen	5.8	5.5	6.2	5.7	5.9	5.0	5.0	4.4	6.1	4.8
11 months	Control	3.7	4.2	5.2	5.3	4.3	3.2	3.5	3.2	4.3	3.0
	Bkd. Frozen	5.9	5.9	5.5	6.1	5.7	4.3	5.0	4.7	5.4	4.5

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