PERCENT BATTER HANDLING LOSS FOR BUTTER CAKES

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CHAPTER I

INTRODUCTION

Rising food cost and increased demand for production control has made accurate recipe yield essential. To better facilitate predicting correct yield of standardized recipes the problem of handling loss needs to be resolved. With the advent of equipment, as the computer, more sophisticated calculation processes become possible. Former lengthy and time consuming mathematical processes are now performed with speed and accuracy. The further need for reliable yield input into recipe standardizing systems has become evident.

Recipe standardization has been ongoing for many years. Methods to produce a standard quality product have been developed but little exploration to determine standard handling loss has been undertaken. Agreement among researchers is that some handling loss is inevitable and that it ranges from three to five percent, depending on the product (1). Handling losses presently used were only a guide until more accurate tests were made. Some recipe files had no identifiable handling loss in their yield calculation (2) (3) (4). The food service industry needs to know what reasonable losses are and how they can be determined and effectively used.

This research was concerned with the exactness of handling loss assigned to the recipes in use at the Kansas State University Food Service. Accurate quality standardization has been accomplished at

K-State and with additional standardization of quantity the recipe file could be a valuable asset to be shared with other institutions. There is a responsibility to distribute only the most accurate information and to do this, a method of determining and calculating handling loss needed to be established.

The primary concern was to research handling loss of butter cakes and methods to minimize it. In doing this, a standard handling loss could be assigned.

Purpose of the Study

This study was undertaken to establish standard percentage handling loss for butter cakes. The research made it possible to predict the weight loss of batter, and result in more exact yield.

The purposes of this research were to: (1) identify predictable standard handling losses for butter cakes, (2) develop methods to minimize handling loss, and (3) establish standard percentage handling loss for butter cakes.

Significance of the Study

The food service industry is concerned about recipe yield standardization. Allowances must be made for normal handling losses in order to yield a product weight equal to the amount needed. The existing method of guessing at handling loss amounts can result in either increased food cost or unequal portion sizing, two practices that can not be afforded. Application of this research could allow for accurate calculation of handling loss into any cake recipe. In addition, a method for its use in the recipe standardization process will be

identified.

Kansas State University and the food service industry should be able to adapt the research to present recipes. This would be another step forward in producing a consistent quality as well as quality recipe yield.

Objectives of the Study

The objectives of this research were:

(1) to establish handling loss percent for butter cakes,

(2) to determine the effect of different personnel and size of batch on handling loss,

(3) to develop a procedure to minimize handling loss, and

(4) to present a method of incorporating handling loss into existing standardized recipes.

Assumptions of the Study

The following outlines the assumptions of this research:

(1) Some handling loss existed in the process of preparing a product.

(2) The handling loss was large enough to be recognizable, thus worthy of consideration in standardizing recipe yield.

(3) The sample used was large enough to obtain valid data.

(4) The handling loss assigned to recipes was established by applied research.

(5) The method of collecting data was valid.

Limitations of the Study

The study was limited by the following factors:

(1) The recipes used were butter cakes from the recipe file at Kansas State University Residence Hall Food Service.

(2) The institutional equipment and utensils were in use at Kansas State University Residence Hall Food Service.

(3) The implications of this study are for application specifically to the Kansas State University Residence Hall Food Service Recipe File but with adaptation to any standardized recipe.

Expected Outcomes of the Study

The researcher expected the following outcomes:

(1) a significant and consistent handling loss to be recognized for butter cakes,

(2) the methods of handling ingredients to have an effect on the percent handling loss,

(3) quantity batch size causes a variation in handling loss percent, and

(4) percent handling loss will accurately be assigned to butter cake standardized recipes.

CHAPTER II

REVIEW OF LITERATURE

A successful quantity food operation requires scientific management in the true sense of the word. It is far past the time when hit-and-miss methods can be relied on to give desired results. Efficient food service management requires many components, however, it has been recognized that the standardized recipe is one of the most important and effective of all tools (5).

Recipe Standardization

A standardized recipe is one in which procedures are standardized insuring that both quality of food is consistently high and the quantity produced is predictable (6) (7). It is a scientific method based on reliable principles that insures consistency in meeting specific production requirements (6).

Most food service operators know that standardizing recipes means an investment of time and labor. After weighing the benefits against the efforts required there is no doubt of the permanent values of a recipe standardization program. MacFarlane (5) outlines the values as follows:

1. Following standardized recipes assures high quality food day after day.
2. Employees benefit as the guesswork can be taken out of recipe production allowing application of scientific

procedures. The employee eventually becomes skilled in the production of quantity food and assists in maintaining or increasing business volume resulting in greater job security.

3. Management benefits by having established a definite and constant cost as well as a standard of quality.

4. Using standardized recipes prohibits leaving production to chance or development of haphazard methods. The danger of forgetting ingredients or using incorrect amounts is reduced.

5. With standards established, deviations can be quickly spotted and causes ascertained (p. 30).

Ericson (8) went on to add that standardized recipes assist in portion control and food cost control by providing a means of estimating yield to be expected, checking losses and making necessary adjustments. Ericson stresses recipe standardization as the major element of portion control or portion planning and that increased food and labor costs are forcing its increased use in the volume feeding industry.

Characteristics of Standardized Formulas

The requirements of a standardized formula according to Cranmore (9) must be highly acceptable to the patrons, simple as possible to prepare, nutritious, look as good as it tastes and come within the food cost allowance. Cranmore further stated that a recipe is only as good as the information it contains and that a formula should contain all of the useful information that may be needed, or referred to, during the production and service of the menu item.

Characteristics of a standardized formula, summarized from several sources (5) (8) (9) (10) (11), include a well arranged, neat and uncluttered format, and clarity of directions with chronological listing of ingredients for a predetermined quantity. Exact specifications of cooking

and serving containers and utensils and the expected yield and portion sizes should be specified (10).

Ericson (8) and MacFarlane (5) described some general principles to follow when standardizing formulas:

> Never use a measurement for which the worker does not have a measurement tool; specify all directions in detailed written form; transpose ingredients into weights whenever possible, as weights are more accurate than measurements; use edible portion weight unless both as purchased (AP) and edible portion (EP) are used; state weights in pounds or ounces or a standard portion; use common abbreviations; simplify measuring procedures; qualify type of product used; and write the procedure in the order in which the preparation is to be performed.

A recipe standardization program for production and cost control cannot be purchased but requires time to adapt the basic principles to individual food services (12). The tool can be developed through a well planned and systematically executed program of standardization of recipes and procedures for food production (12).

Recipe Expansion

Callahan (13) sees that the advantages of standardized recipes are clear, but the recognized advantages can be quickly dissipated in the process of expanding the recipe yield. Because of the mathematics involved in changing recipe yields, errors can easily creep in, with resulting waste or poor products. To further illustrate, Callahan (14) elaborates on the expansion of chicken a'la king by the newer percentage method.

A recipe expanded by the factor method which has been used for some time, multiplies the weight of each ingredient by the factor obtained from dividing the desired new yield by the known or old yield of the recipe (Table I).

TABLE I

CHICKEN A'LA KING--FACTOR METHOD OF CONVERSION

Ingredients	Weight for 100 6-oz. Portions (Old) lb.	oz.	Original Multiplied by Factor	Calculated Weight for 170 Servings (New) lb.	oz.
Fowl, cooked and boned	16	3	1.7		
Green peas, drained	5	6	1.7		
Mushrooms	3		1.7		
Flour, soft	1	10	1.7		
Chicken fat	3	4	1.7		
Chicken stock	24	5	1.7		
Salt		4¼	1.7		
Total	54	¼		91	13½

New $\frac{170}{100}$ = 1.7 Factor

Source: J. Callahan and P. Aldrich, Preliminary Steps to Standardized Recipes, Institutions (1960).

Callahan (13) sees the task of adjusting a recipe in this manner as too time consuming and requiring mathematical abilities beyond many cooks and bakers. Furthermore, the entire procedure must be repeated each time the recipe is used to produce any amount over or under 100 servings.

Therefore, he suggests that even for those mathematically inclined the multiplication takes time and can be the stumbling block that leads to expansion by guesswork.

Callahan's new method lists each ingredient in terms of percentage of the total weight of the recipe (Table II). Percentage figures are obtained by dividing the weight of each ingredient by the total weight of all ingredients in the recipe.

TABLE II

CHICKEN A'LA KING--PERCENTAGE METHOD OF CONVERSION

Ingredients	Weight for 100 6-oz. Portions lb.	oz.	Percent Total Weight of Ingredients	Weight for 170 Servings (to be read from slide tool) lb.	oz.
Fowl, cooked and boned	16	3	30		
Green peas, drained	5	6	10		
Mushrooms	3		5½		
Flour, soft	1	10	3		
Chicken fat	3	4	6		
Chicken stock	24	5	45		
Salt		4¼	½		
Total	54	¼	100		

Example: Fowl, 16 lb. 3 oz. ÷ 54 lb. ¼ oz. = 30 percent.

Source: Callahan and Aldrich, Institutions (1960).

Using the portion size, number of portions forecasted and the percentage of each ingredient, the different ingredient weights are

calculated (13) (14) (15). This method allows adjustment to the portion size or a shift of ingredients without changing the entire recipe. The method Callahan outlines allows for the basic recipe to be calculated in percentage once, with no need to ever recalculate. The recipe now has a basis for any number of portions in any size batch (13).

To accompany the recipes used in this system are two tools. One is a "recipe magician" which converts pounds and ounces of the original recipe to percentage figures and converts percentage figures back to pounds and ounces at any desired production level (13). The second tool is the yield control guide which establishes the expansion factor of recipes (Appendix A). The factor is necessary in determining at what point the recipe magician should be set to adjust the recipe.

The Callahan system (14) uses an ingredient weight per portion table to automatically make allowances for normal cooking and handling losses. Only a guide for handling losses can be suggested, as there are variations with different production methods (Table III). Accurate total poundage in accordance with desired yield is not kept with Callahan's system (14). He recommends that total weight be rounded off to the closest full pound before individual ingredient weights are calculated.

McManis (15) adapted the Callahan system to recipes used at Kansas State University. The method employed bases total weight on per servings forecasted multiplied by desired serving size (Appendix B). The handling loss is not calculated on a per portion basis but on total batch weight. The method permits use of a desk calculator to facilitate faster, more accurate results.

TABLE III

GUIDE FOR HANDLING LOSSES

5 percent--for handling loss only
10 percent--salmon loaves, tuna loaves, bread dressings
15 percent--creole shrimp and similar dishes using cooked shrimp
20 percent--creamed tuna, salmon a'la king
25 percent--meat loaves
30 percent--chicken and turkey a'la king
45 percent--stews, ragouts

Sager and Ostenso (16) see formula adjustment methods requiring time consuming, repetitive mathematical calculations. MacFarlane (5) noted that if formula adjustment calculations are correct to the smallest fraction there should be no change in the percentages or portions of the ingredients when a formula is expanded to a larger quantity.

Computer Application to Recipe Adjustment

An electronic data processing system for recipe adjustment has been successfully developed and implemented by Kansas State University Residence Hall Food Service (17). The system is based on the accuracy of ingredients, recipe yield, and handling loss stored in the data file. In order for recipes to be processed by the computer, each coded formula must contain a recipe name, correct recipe code number, portion size, number of portions, handling loss percentage and type of transaction.

After the percentage method of formula conversion was completed, the KSU standardized formulas were entered into the recipe file (17). The formula printouts were judged for accuracy in yield and quality.

Product quality differences were small but recommendations were made for further study on handling losses.

Butter Cake Preparation Procedures

Butter cakes are perhaps the most widely used cakes (18). Cakes (butter cakes) containing shortening should produce a fine textured, soft, moist, velvety cake with good flavor and keeping qualities (19).

The essentials to good cake making, according to Treat and Richards (19) are primarily:

(1) a properly based formula,

(2) correct temperature of ingredients,

(3) accurate weights,

(4) controlled mixing of ingredients,

(5) proper relationship of batter to pan, and

(6) attention to correct oven temperature and baking time.

Mixing methods employed to attain quality butter cake products are outlined by various sources (18) (19) (20) (21) (22). In the "conventional" mixing method, fat and sugar are creamed together and the eggs and liquid are added (21). This was the most successfully used method prior to the availability of hydrogenated fats, to which an emulsifier was added, thus eliminating the necessity for creaming fat and sugar (23 (24). This mixing method takes a comparatively long time, a skilled worker and many utensils. The quality is second best only to the more commonly used "blended" cake method (18).

The "blending" method mixes flour and fat together before addition of other dry ingredients, eggs and liquid (18). Batters made by this method have a high tolerance to over- or under-mixing and result in more even grained and finer textured cakes than those achieved by other mixing methods (20). Fewer utensils are necessary using this method, resulting in less dishwashing and reduced handling loss (19).

One of the most common variations of the "blending" method is used with Kansas State University's standardized cake recipes (25). (See Appendix C.) Dry ingredients are mixed with fat, with subsequent additions of part of the liquid followed by the eggs and the remainder of liquid ingredients. Kotschevar (18) agrees that this is a reliable method that yields a high quality product.

"Conventional sponge" and "muffin" mixing methods are occasionally used in quantity food production of butter cakes (18). Quality cakes can be produced but soft or melted shortening should be used. Cakes made with these methods should be served soon after preparation as they stale quickly.

Research Methodology

The analysis of variance is a commonly used technique for analyzing experiments that involve several factors. It is applicable to many different experimental situations of varying degrees of complexity (26).

The objective of the analysis of variance is to identify the influence of each factor individually and in combination upon some response variable (26). The researcher is enabled by this design to carry on simultaneously two experiments with the same group of subjects

(27). In addition, the investigator can study possible interaction between the variables (27).

CHAPTER III

PROCEDURE

The first objective, to establish handling loss of butter cakes, was attained through production of seven different cake recipes. Each cake recipe was prepared four times from recipes selected from the Kansas State University Residence Hall Food Service recipe file and all contained similar ingredients and specified similar mixing methods. The recipe selection used was composed of a cross sample of all standardized butter cake recipes available at KSU. The recipes were extended to desired batch size (180, 360, or 600 servings) via the percentage method of extension. No handling loss was calculated into the recipes. The weight difference between the ingredients started with, and the batter ended with, gave data for determination of amount of handling loss. All data was collected in three residence hall kitchens and used identical recipes and procedures. Experienced bakery personnel were utilized.

In the initial step, a procedure for handling ingredients was designed. The specific ingredients and handling procedure, followed each time, allowed for accurate prediction of future butter cake handling losses. Consultation with employees and management plus visual observation provided guidelines for methods used in preparation. Final directions for recipe preparation were as follows:

Ingredient room procedure:

A. All ingredients weighed

1. Dry ingredients placed in individual containers and covered with plastic wrap or lids:
   Flour--20 lb. plastic bucket,
   Sugar--30 lb. plastic bucket,
   Salt--paper cup,
   Baking powder--paper cup, and
   Dry milk--5 lb. plastic container.

2. Remainder of ingredients, covered with plastic wrap or lids:
   Shortening--stainless steel baker's bowl,
   Water #1--weighed by baker at time of preparation,
   Water #2--weighed by baker at time of preparation,
   Frozen whole eggs--stainless steel baker's bowl, and
   Lemon extract--small glass jar.

B. Equipment procedure

1. Beater and bowl weight recorded before use.

2. Dip pan, pie pan and all scrapers weighed before use. (The dip pan is set in a pie pan.)

3. Beater and bowl weight recorded after the cake is mixed and batter put into weighed pans.

4. Weight of dip pan, pie pan and scrapers recorded after batter is panned.

C. Batter weighing procedure

1. Tare <u>each</u> pan.

2. Weigh batter directly into tared pans and record weight of each.

D. Scraping procedure

1. All ingredient containers scraped using a large rubber scraper.

2. Used beaters scraped with a large rubber spatula and used bowls with a baker's scraper.

The handling and preparation techniques were specifically discussed with the bakers and dietitians who were to be involved in data collection. It was emphasized that accuracy be employed in recording last pan weight as this was the data that would be used in handling loss calculations. A pilot project (Appendix D) followed this discussion. It

allowed the bakers to become acquainted with the method and procedures to be followed throughout the course of the research. The pilot project was completed in all three kitchens using the outlined procedure.

In the pilot project all the bakers who were to be involved in the research prepared one each of three butter cake recipes following the specific directions. The methods, equipment, recipes and forms that would be used later in the research data collection were utilized. After completion of the pilot study, alterations were made in procedure and a form prepared for accurate recording of data (Appendix E).

Data was collected from butter cakes prepared by more than one person and in three batch sizes. Kitchen D prepared butter cakes in a 600-size batch and by a specifically designated baker. This kitchen was the control. Kitchen K prepared the same batch size, but several bakers made the products. With this data a determination of the effect employees have on handling loss was ascertained. Kitchen B1 and B2 prepared the same recipe in batch sizes of 360 and 180. Comparison of handling loss on smaller batches was compared to the handling loss of the larger size batches. These procedures were set up in order to achieve Objective Two.

To achieve the third objective of developing a procedure to minimize handling loss, a standardized procedural method was determined and implemented in the research. The procedure was tested in the pilot project and found to be practical in institutional baking.

Objective Four was to present a method of incorporating handling loss into existing standardized recipes and was accomplished through use of research data results calculated into existing standardized recipes. A procedure for calculation of handling loss (KSU's) was employed and a

test was made to show the accuracy of this method (Appendixes F and G). The test was performed by bakers in all three kitchens producing a specified batch size. The recipe in the test was one of the same used for data collection with the research determined handling loss calculated (Appendix H).

The research extended over three months with cakes being worked into the existing menu pattern (Appendix I). During the course of the data collection, labor turnover caused a change in the control group baker. Another experienced baker was able to carry on with minimal effect on results.

CHAPTER IV

RESULTS AND DISCUSSION

The objectives of this research were to: (1) establish handling losses for butter cakes, (2) develop methods to minimize handling loss, (3) determine the effect of different personnel and size of batch on handling loss, and (4) present a method of incorporating handling loss into existing standardized recipes. Preceding chapters have outlined the design and procedural methodology to obtain results. This chapter will present the data obtained to meet those objectives.

Data of cake production are presented as they pertain to the fulfillment of the objectives established for the study. Table IV is a key which will be utilized throughout this chapter.

TABLE IV

KEY TO RESEARCH DISCUSSION

D 600	600/S prepared at D hall
K 600	600/S prepared at K hall
B1 180	180/S prepared at B hall
B2 360	360/S prepared at B hall
ns	nonsignificant
*	significant at 5 percent level
**	significant at 1 percent level
lsd	least significant difference
DF	degrees of freedom
sd	standard deviation
HXC	hall/cake interaction

Handling Loss Percent for Butter Cakes

To attain the objective of establishing handling loss, last pan weight data and batch size amounts were used in computations of average handling loss at all three residence halls. The average handling loss was 0.895 percent for all samples (Table V).

TABLE V

AVERAGE BATCH LOSS AND HANDLING LOSS PERCENT OF ALL CAKES

Hall	Number Served	Weight of Batter	Average Batch Loss/lb.	Percent Batch Loss
D	600	80	0.71786	0.90
K	600	80	0.70536	0.88
B1	180	24	0.18072	0.75
B2	360	48	0.50286	1.06
Average				0.895

Effect of Personnel and Size of Batch on Handling Loss

Analysis of variance was used to identify the influence of factors individually and in combination with different variables. The data in Table VI provides results of bowl and beater, utensil, and batch size waste as compared to hall personnel, cake, and hall/cake interaction.

TABLE VI

EFFECT OF PERSONNEL AND SIZE OF BATCH ON HANDLING LOSS

Source of Variation		Mean Square and Significance		
		Bowl and Beater Waste	Utensil Waste	Last Pan Waste
Hall		0.00001266 ns	0.0000345**	0.0000204 ns
Cake		0.00000825 ns	0.00000040 ns	0.0000497*
HXC		0.00000790 ns	0.00000099 ns	0.0000498**
Error	54,55,56	0.00000670	0.00000222	0.0000219

*Significant at five percent level.

**Significant at one percent level.

There were no significant hall personnel, cake, or interaction effects on bowl and beater waste. The amount of batter lost be attributed to differences in hall personnel, providing specified preparation procedures were followed, in the kinds of cakes or in the interaction between the varieties. Utensil waste did show enough variance to be statistically significant at the one percent level (Table VI).

Table VII shows that D600 hall percent utensil waste was greater than K600 hall, less than B180 hall and was equal to B360. Results showed that the control (K) had a percent utensil waste less than any of the other hall situations studied. The data from B360 showed the greatest percent utensil waste.

TABLE VII

ORDERED ARRAY OF MEANS FOR UTENSIL WASTE

Hall	Mean Percent Waste	
K600	.113	lsd .01 = .126
	<*	
B360	.214	lsd .05 = .094
	<ns	
D600	.232	
	<**	
B180	.464	lsd .10 = .079

*Significant at five percent level.

**Significant at one percent level.

Cake Significant Mean Differences in

Percent Last Pan Waste

Data in Table VI, batch waste interaction, was shown between hall personnel and type of cake as regards the percent waste; hence it was necessary to study the hall/cake interaction (Appendix J). No cake differences were shown to exist at D600 or B180. However, at K600, the mixing of white cakes was more wasteful than with chocolate, applesauce, or banana cakes; and brown sugar cakes were more wasteful than banana cakes. B360 data showed applesauce and banana cakes to have more waste batter than all other types of cakes. White cakes also have more waste than chocolate at B360. This research indicated that kinds of cakes were a more important source of differences in batch waste than were the hall personnel.

Procedure to Minimize Handling Loss

The preparation procedure outlined for the bakers to follow (Appendix F) was reported to be concise, functional, and easy to follow. Percent handling loss indicated minimal and consistent loss on various batch sizes (Table V).

Method of Incorporating Handling Loss Into Existing Standardized Recipes

Average percent handling loss was determined and calculated for three butter cake recipes (white, chocolate, yellow) in three batch sizes and these were tested for accuracy. The recipes prepared, using 0.895 percent handling loss (Table V) calculated into the yield, gave an average yield slightly more or less than specified using the mathematical formula and handling loss percent determined by analysis of previous data. Average loss over or under that specified was +0.23 pounds, -0.03 pounds, +0.04 pounds, in 600/S, 180/S, and 360/S batches, respectively. The data in the following table shows the differences between all samples from the handling loss test data.

TABLE VIII

BUTTER CAKE TEST YIELDS--CALCULATED AND ACTUAL

Number of Servings and Cake Variety	Batter Weight Desired Yield	Calculated Weight of Batter Prepared (Including Handling Loss)*	Actual Weight Yield
180/S Chocolate	24 lb.	24.22 lb.	24.00 lb.
180/S White	24 lb.	24.22 lb.	23.98 lb.
180/S Yellow	24 lb.	24.22 lb.	23.95 lb.
360/S Chocolate	48 lb.	48.43 lb.	48.03 lb.
360/S White	48 lb.	48.43 lb.	48.20 lb.
360/S Yellow	48 lb.	48.43 lb.	47.90 lb.
600/S Chocolate	80 lb.	80.72 lb.	80.60 lb. 80.10 lb.
600/S White	80 lb.	80.72 lb.	80.00 lb. 79.90 lb.
600/S Yellow	80 lb.	80.72 lb.	80.40 lb. 80.40 lb.

*Calculation formula:

100 percent - 0.895 (HLP) X = desired weight yield depending on batch size.

X = weight to begin with to produce desired weight for specified batch size.

HLP = handling loss percent.

CHAPTER V

SUMMARY, IMPLICATIONS AND RECOMMENDATIONS

Data compiled from production of seven different butter cake recipes prepared in three various batch sizes at three locations at Kansas State University were presented in the previous chapter. Analysis of the data appears to present usable information pertaining to predictable handling loss in quantity food production.

The study was undertaken to establish a standard percent handling loss for butter cakes. It further sought to develop methods to minimize handling loss, find relationships, if any existed, between batch size and personnel on handling loss, and present a method of incorporating a predictable percent loss into existing standardized recipes.

Summary of Findings

Data indicated handling loss varied only slightly between samples. A percent handling loss of 0.895 percent was determined to be the average loss of the seven cake types prepared four times each in three batch sizes at different locations.

Data was analyzed to ascertain if there were any relationships between batch size and personnel in handling loss. Some loss variance occurred between samples prepared by different bakers and in different batch sizes. The researcher was able to isolate the most wasteful combinations by batch size, cake type and baker. Analysis of data

indicated it was generally true that cake types were a more important source of differences in last-pan waste than were bakers or batch size. Data showed that personnel, given specific handling procedures and proper equipment, could produce products with consistent and predictable losses with minimal relationship to batch size.

Handling loss percent was accurately calculated into existing standardized recipes by a mathematical formula employed to incorporate a 0.895 percent handling loss into recipe yield. This finding had implications for handling loss in all quantity recipes.

Implications

Implications for accurate assignment of handling loss percent to standardized recipes at Kansas State University were based on analysis of data. By the results of the study it was identified that the method employed in determining, assigning and calculating handling loss for butter cakes might be adapted to other quantity recipes.

It was concluded that handling losses may be predicted providing specified procedures are followed and proper equipment for batch size used. Critical analysis of procedural methods as they apply to handling loss must be evaluated constantly.

Recommendations

From the data generated by this study the researcher proposes that:

1. A handling loss percent of 0.895 be assigned to all butter cake recipes at Kansas State University.

2. Preparation procedure methods be specifically taught to employees in order to minimize handling loss.

3. Handling loss percent be determined for other quantity recipes using similar methods and techniques.

4. Additional research be done on determining the effect product consistency has on handling loss. Research may be able to identify common losses among products with common characteristics.

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APPENDIXES

APPENDIX A

YIELD CONTROL ON PORTION SIZE

SELECTOR GUIDE

Percentage of Cooking and Handling Loss	Ready to Serve Portions in Ounces												
	2	2½	3	3½	4	4½	5	5½	6	6½	7	7½	8
None	.125	.16	.19	.22	.25	.28	.32	.35	.38	.41	.44	.47	.50
5	.14	.17	.20	.23	.27	.30	.33	.36	.40	.43	.46	.49	.53
10	.145	.175	.21	.24	.28	.31	.35	.38	.42	.45	.49	.52	.56
15	.15	.18	.22	.25	.30	.33	.37	.40	.44	.48	.52	.55	.59
20	.16	.20	.24	.28	.32	.36	.39	.43	.47	.51	.55	.59	.63
25	.17	.21	.25	.29	.34	.38	.42	.46	.50	.54	.59	.63	.67
30	.18	.22	.27	.31	.36	.39	.45	.49	.54	.58	.63	.67	.72
35	.20	.24	.29	.34	.39	.43	.48	.53	.58	.63	.68	.72	.77

APPENDIX B

STANDARDIZING RECIPES FOR KANSAS STATE UNIVERSITY RESIDENCE HALL FOOD SERVICE

The following was adapted from H. McManis, Standardizing Recipes for Kansas State University Residence Hall Food Service, 1972.

Step 1: Convert ingredients into institutionally used form.

A. If ingredients are marked for conversion to a different form (example: milk, eggs, broth, butter, buttermilk), refer to Item File. Make the changes by adding and subtracting the various ingredients to equal the exact amount called for. Go to Step 2.

B. If ingredients are not marked for conversion to a different form, go on to Step 2.

Step 2: Note the ingredients and quantity of each required in the recipe.

A. If the ingredient is a meat, fresh fruit or fresh vegetable item refer to Item File (sections 001 and 005, respectively). Observe the A.P. and E.P. weight or percentage for that item. Record both the A.P. and E.P. amounts required for that recipe. Go on to Step 3.

B. If the ingredient is anything other than a meat or fresh fruit or fresh vegetable item go on to Step 3.

Step 3: Observe the first ingredient.

A. If the measure of the ingredient is in pounds and/or decimals of a pound then go on to Step 4.

B. If the measure of the ingredient is in pounds and/or ounces refer to # conversion table. Observe the ounce or ounces it is and substitute the ounce measure with the equal decimal of a pound measure. Let this decimal of a pound be added to the whole pound measure of the ingredient (0, 1, 2, ...) and be the measurement for that ingredient from then on, round off to four decimal places. If the E.P. and A.P. weights are available from Step 1A, record both in pounds and decimals of a pound. Go on to Step 4.

C. If the measure of the ingredient is in a measured unit (cup, tablespoon, teaspoon), refer to Item File. If the ingredient is a fruit or vegetable, fresh, frozen, canned or dried, refer to sections 005, 006, 007, respectively. If the ingredient is a groceries item, refer to section 008. If the ingredient is a meat, cheese, cream, eggs, or milk, refer to sections 001, 002, 003, respectively. Note the weight or weight (pounds and decimals of a pound) per cup for that item or weight per item and substitute it for measure unit for that item, rounding off to four decimal

places. If the E.P. and A.P. weight of the ingredient is available from Step 1A, record both in pounds and decimals of a pound. Go on to Step 4.

Step 4: Observe the second ingredient in the recipe, and follow the same A or B or C in Step 3.

Step 5: Do the same (Step 4) for each ingredient.

Step 6: Add all of the ingredients (E.P.) weights, rounding off to four decimal places. (This is the net weight of the original recipe.) Go on to Step 7.

Step 7: Divide each individual ingredient weight by the net weight of the recipe, rounding off to the four decimal places. (This is the individual ingredients percent of the total recipe, stated as a decimal.) Go on to Step 8.

Step 8: Note the percentage of handling loss (stated as a decimal). Note the portion size, note the number of portions desired. Go on to Step 9.

Step 9: Multiply the number of servings (portions) desired by the size of the portion. (This will give the net weight needed.)

Step 10: Subtract the percent of handling loss, stated as a decimal from 100. (This will give the net weight percentage of the net weight of the recipe, stated as a decimal.)

Step 11: Divide the net weight of the desired sized recipe by the answer of Step 10. (This is the gross weight needed for the desired yield.)

Step 12: Multiply the answer of Step 11 (gross weight needed) by the answer of Step 7 (individual ingredient percent, stated as a decimal) for the first ingredient.

Step 13: Multiply the answer of Step 7 for the second ingredient by the answer of Step 11, following Step 12's instructions. Do the same with each ingredient.

APPENDIX C

RECIPES BEFORE HANDLING LOSS

APPLESAUCE SPICE CAKE

Portion Size: 1/60 (cut 6 x 10), 0.133 lb.
Suggested Serving Utensil: Spatula

Percent	Ingredients	No. Portions: 360 Pan Size: 18 x 26 x 2¼ Weights and Measures	180 18 x 26 x 2¼	Procedure
19.73	Cake flour	9.47	4.74	1. Mix 5 minutes to thoroughly blend.
1.04	Non fat dry milk	0.50	0.25	
15.82	Brown sugar	7.59	3.80	
9.88	Sugar	4.74	2.37	
0.59	Salt	0.28	0.14	
0.74	Baking powder	0.35	0.18	
0.26	Soda	0.12	0.06	
0.05	Cloves	0.02	0.01	
0.31	Cinnamon	0.15	0.07	
10.09	Shortening	4.84	2.42	2. Add to dry ingredients. Mix 2 minutes on #1 speed. Scrape down. Mix on #2 speed for 5 minutes.
7.86	Water	3.77	1.89	
13.80	Frozen whole eggs, thawed	6.62	3.31	3. Add in three portions. Mix smooth after each addition. Scrape down. Continue mixing 5 minutes on #1 speed.
4.01	Raisins, chopped	1.92	0.96	4. Add. Mix 3 minutes on #1 speed to evenly distribute throughout batter.
15.82	Applesauce	7.59	3.80	5. Scale 8 lb. into greased cake pan.
				6. Bake 35 minutes at 350 degrees F.
	Total Weight:	48.0	24.0	

APPLESAUCE SPICE CAKE

Portion Size: 1/60 (cut 6 x 10), 0.133 lb.
Suggested Serving Utensil: Spatula

No. Portions: 600
Pan Size: 18 x 26 x 2¼

Percent	Ingredients	Weights and Measures	Procedure
19.73	Cake flour	15.78	1. Mix 5 minutes to thoroughly blend.
1.04	Non fat dry milk	0.83	
15.82	Brown sugar	12.66	
9.88	Sugar	7.90	
0.59	Salt	0.47	
0.74	Baking powder	0.59	
0.26	Soda	0.21	
0.05	Cloves	0.04	
0.31	Cinnamon	0.25	
10.09	Shortening	8.07	2. Add to dry ingredients. Mix 2 minutes on #1 speed. Scrape down. Mix on #2 speed for 5 minutes.
7.86	Water	6.29	
13.80	Frozen whole eggs, thawed	11.04	3. Add in three portions. Mix smooth after each addition. Scrape down. Continue mixing 5 minutes on #1 speed.
4.01	Raisins, chopped	3.21	4. Add. Mix 3 minutes on #1 speed to evenly distribute throughout batter.
15.82	Applesauce	12.66	5. Scale 8 lb. into greased cake pan.
			6. Bake 35 minutes at 350 degrees F.
	Total Weight:	80.0	

BROWN SUGAR CAKE

Portion Size: 1/60 (cut 6 x 10), 0.133 lb. Meal Pattern Allowance: 1 or 2 Portions
Suggested Serving Utensil: Spatula

Percent	Ingredients	No. Portions: 360 Pan Size: 18 x 26 x 2¼ Weights and Measures	180 18 x 26 x 2¼	Procedure
21.37	Cake flour	10.26	5.13	1. Blend dry ingredients in mixer bowl on #1 speed 1 minute.
14.81	Sugar	7.11	3.55	
13.59	Brown sugar	6.52	3.26	
0.49	Salt	0.24	0.12	
1.21	Baking powder	0.58	0.29	
2.91	Non fat dry milk	1.40	0.70	
10.92	Shortening, room temperature	5.24	2.62	2. Add. Blend 2 minutes on #1 speed.
10.92	Water #1	5.24	2.62	3. Add. Mix 6 minutes on #2 speed. Scrape down bowl.
12.87	Water #2	6.18	3.09	4. Combine liquids.
10.68	Frozen eggs, thawed	5.13	2.56	5. Add in three parts, mixing smooth after each addition. Scrape down bowl after each addition.
0.23	Maple flavoring	0.11	0.06	6. Mix on #1 speed 6 minutes after last liquid is added.
				7. Scale 8.0 lb. per pan.
				8. Bake 25 to 30 minutes at 365 degrees F.
				9. Cool. Frost.
				10. Cut 6 x 10.
	Total Weight:	48.0	24.0	

BROWN SUGAR CAKE

Portion Size: 1/60 (cut 6 x 10), 0.133 lb.
Suggested Serving Utensil: Spatula

Meal Pattern Allowance: 1 or 2 Portions

No. Portions: 600
Pan Size: 18 x 26 x 2¼

Percent	Ingredients	Weights and Measures	Procedure
21.37	Cake flour	17.10	1. Blend dry ingredients in mixer bowl on #1 speed 1 minute.
14.81	Sugar	11.85	
13.59	Brown sugar	10.87	
0.49	Salt	0.39	
1.21	Baking powder	0.97	
2.91	Non fat dry milk	2.33	
10.92	Shortening, room temperature	8.74	2. Add. Blend 2 minutes on #1 speed.
10.92	Water #1	8.74	3. Add. Mix 6 minutes on #2 speed. Scrape down bowl.
12.87	Water #2	10.30	4. Combine liquids.
10.68	Frozen eggs, thawed	8.54	5. Add in three parts, mixing smooth after each addition. Scrape down bowl after each addition.
0.23	Maple flavoring	0.18	6. Mix on #1 speed 6 minutes after last liquid is added.
			7. Scale 8.0 lb. per pan.
			8. Bake 25 to 30 minutes at 365 degrees F.
			9. Cool. Frost.
			10. Cut 6 x 10.
	Total Weight:	80.0	

BANANA SPICE CAKE

Portion Size: 1/60 (cut 6 x 10), 0.133 lb.
Suggested Serving Utensil: Spatula

Meal Pattern Allowance: 1 or 2 Portions

Percent	Ingredients	No. Portions: 360 Pan Size: 18 x 26 x 2¼ Weights and Measures	180 18 x 26 x 2¼	Procedure
23.37	Cake flour	11.22	5.61	1. Blend dry ingredients on #1 speed 1 to 2 minutes.
23.37	Sugar	11.22	5.61	
0.69	Baking powder	0.33	0.17	
0.69	Salt	0.33	0.17	
0.34	Soda	0.16	0.08	
0.28	Nutmeg	0.13	0.07	
0.10	Cloves	0.05	0.02	
0.28	Cinnamon	0.13	0.07	
1.38	Non fat dry milk	0.66	0.33	
10.31	Shortening	4.95	2.47	2. Add. Blend 2 minutes on #1 speed.
10.66	Water	5.12	2.56	3. Add. Mix on #2 speed 6 minutes. Scrape down bowl.
7.22	Frozen eggs, thawed	3.47	1.73	4. Combine. Add in three parts mixing smooth after each addition.
21.31	Ripe bananas, mashed	10.23	5.11	5. Scrape down bowl after each addition. 6. Mix on #2 speed 6 minutes. 7. Scale 8.0 lb. per pan. 8. Bake 35 to 40 minutes at 375 degrees F. 9. Cool. Frost. 10. Cut 6 x 10.
	Total Weight:	48.0	24.0	

BANANA SPICE CAKE

Portion Size: 1/60 (cut 6 x 10), 0.133 lb.
Suggested Serving Utensil: Spatula

Meal Pattern Allowance: 1 or 2 Portions

No. Portions: 600
Pan Size: 18 x 26 x 2¼

Percent	Ingredients	Weights and Measures	Procedure
23.37	Cake flour	18.70	1. Blend dry ingredients on #1 speed 1 to 2 minutes.
23.37	Sugar	18.70	
0.69	Baking powder	0.55	
0.69	Salt	0.55	
0.34	Soda	0.27	
0.28	Nutmeg	0.22	
0.10	Cloves	0.08	
0.28	Cinnamon	0.22	
1.38	Non fat dry milk	1.10	
10.31	Shortening	8.25	2. Add. Blend 2 minutes on #1 speed.
10.66	Water	8.53	3. Add. Mix on #2 speed 6 minutes. Scrape down bowl.
7.22	Frozen eggs, thawed	5.78	4. Combine. Add in three parts mixing smooth after each addition.
21.31	Ripe bananas, mashed	17.05	5. Scrape down bowl after each addition.
			6. Mix on #2 speed 6 minutes.
			7. Scale 8.0 lb. per pan.
			8. Bake 35 to 40 minutes at 375 degrees F.
			9. Cool. Frost.
			10. Cut 6 x 10.
	Total Weight:	80.0	

SPICE CAKE

Portion Size: 1/60 (cut 6 x 10), 0.133 lb.
Suggested Serving Utensil: Spatula

Meal Pattern Allowance: 1 or 2 Portions

Percent	Ingredients	No. Portions: 360 Pan Size: 18 x 26 x 2¼ Weights and Measures	180 18 x 26 x 2¼	Procedure
21.23	Cake flour	10.19	5.10	1. Blend dry ingredients in mixer bowl on low speed (#1) 1 minute.
14.70	Sugar	7.06	3.53	
13.51	Brown sugar	6.48	3.24	
0.50	Salt	0.24	0.12	
0.35	Cinnamon	0.17	0.08	
0.23	Allspice	0.11	0.06	
0.15	Cloves	0.07	0.04	
0.15	Nutmeg	0.07	0.04	
1.20	Baking powder	0.58	0.29	
2.89	Non fat dry milk	1.39	0.69	
10.85	Shortening, room temperature	5.21	2.60	2. Add. Blend 2 minutes on low speed.
10.61	Water #1	5.09	2.55	3. Add. Mix 6 minutes on medium speed (#2). Scrape down bowl.
12.79	Water #2	6.14	3.07	4. Combine liquids.
	Whole eggs	5.09	2.55	5. Add in three parts, mixing smooth after each addition. Scrape bowl down after each addition.
	Vanilla	0.11	0.06	
				6. Mix on low speed 6 minutes. Scrape bowl down.
				7. Scale 8.0 lb. per pan.
				8. Bake 30 minutes at 365 degrees F.
	Total Weight:	48.0	24.0	9. Cool. Frost. Cut 6 x 10.

SPICE CAKE

Portion Size: 1/60 (cut 6 x 10), 0.133 lb.
Suggested Serving Utensil: Spatula

Meal Pattern Allowance: 1 or 2 Portions

No. Portions: 600
Pan Size: 18 x 26 x 2¼

Percent	Ingredients	Weights and Measures	Procedure
21.23	Cake flour	16.98	1. Blend dry ingredients in mixer bowl on low speed (#1) 1 minute.
14.70	Sugar	11.76	
13.51	Brown sugar	10.81	
0.50	Salt	0.40	
0.35	Cinnamon	0.28	
0.23	Allspice	0.18	
0.15	Cloves	0.12	
0.15	Nutmeg	0.12	
1.20	Baking powder	0.96	
2.89	Non fat dry milk	2.31	
10.85	Shortening, room temperature	8.68	2. Add. Blend 2 minutes on low speed.
10.61	Water #1	8.49	3. Add. Mix 6 minutes on medium speed (#2). Scrape down bowl.
12.79	Water #2	10.23	4. Combine liquids.
10.61	Whole eggs	8.49	5. Add in three parts, mixing smooth after each addition. Scrape down bowl after each addition.
0.23	Vanilla	0.18	6. Mix on low speed 6 minutes. Scrape down bowl.
			7. Scale 8.0 lb. per pan.
			8. Bake 30 minutes at 365 degrees F.
	Total Weight:	80.0	9. Cool. Frost. Cut 6 x 10.

PHILADELPHIA FUDGE CAKE

Portion Size: 1/60 (cut 6 x 10), 0.133 lb. Meal Pattern Allowance: 1 or 2 Portions
Suggested Serving Utensil: Spatula

Percent	Ingredients	No. Portions: 360 Pan Size: 18 x 26 x 2¼ Weights and Measures	180 18 x 26 x 2¼	Procedure
25.22	Sugar	12.11	6.05	1. Blend dry ingredients in mixer bowl on #1 speed 2 to 3 minutes.
22.07	Cake flour	10.59	5.30	
3.94	Cocoa	1.89	0.95	
2.10	Chef Lac	1.00	0.50	
0.49	Soda	0.24	0.12	
0.41	Baking powder	0.20	0.10	
0.17	Salt	0.08	0.04	
9.46	Shortening, room temperature	4.54	2.27	2. Add. Blend on medium (#2) speed 4 minutes. Scrape down bowl.
8.41	Frozen whole eggs, thawed	4.03	2.02	3. Combine liquids. Add in 2 parts, mixing smooth after each addition.
27.21	Water	13.06	6.53	Scrape down bowl.
0.53	Vanilla	0.25	0.13	4. Mix on medium (#2) speed 5 minutes after last liquid is added.
				5. Scale 8.0 lb. per pan.
				6. Bake 20 to 25 minutes at 375 degrees F.
				7. Cool. Frost.
				8. Cut 6 x 10.
	Total Weight:	48.0	24.0	

PHILADELPHIA FUDGE CAKE

Portion Size: 1/60 (cut 6 x 10), 0.133 lb.
Suggested Serving Utensil: Spatula

Meal Allowance Pattern: 1 or 2 Portions

No. Portions: 600
Pan Size: 18 x 26 x 2¼

Percent	Ingredients	Weights and Measures	Procedure
25.22	Sugar	20.18	1. Blend dry ingredients in mixer bowl on #1 speed 2 to 3 minutes.
22.07	Cake flour	17.66	
3.94	Cocoa	3.15	
2.10	Chef Lac	1.68	
0.49	Soda	0.39	
0.41	Baking powder	0.33	
0.17	Salt	0.14	
9.46	Shortening, room temperature	7.57	2. Add. Blend on medium (#2) speed 4 minutes. Scrape down bowl.
8.41	Frozen whole eggs, thawed	6.72	3. Combine liquids. Add in 2 parts, mixing smooth after each addition. Scrape down bowl.
27.21	Water	21.77	
0.53	Vanilla	0.42	4. Mix on medium (#2) speed 5 minutes after last liquid is added.
			5. Scale 8.0 lb. per pan.
			6. Bake 20 to 25 minutes at 375 degrees F.
			7. Cool. Frost.
			8. Cut 6 x 10.
	Total Weight:	80.0	

WHITE CAKE

Portion Size: 1/60 (cut 6 x 10), 0.133 lb.
Suggested Serving Utensil: Spatula

Meal Pattern Allowance: 1 or 2 Portions

Percent	Ingredients	No. Portions: 360 Pan Size: 18 x 26 x 2¼ Weights and Measures	No. Portions: 180 Pan Size: 18 x 26 x 2¼ Weights and Measures	Procedure
22.94	Cake flour	11.01	5.51	1. Blend dry ingredients in mixer bowl on low speed (#1) 2 minutes.
22.83	Sugar	14.32	7.16	
2.29	Non fat dry milk	1.10	0.55	
1.15	Baking powder	0.55	0.28	
0.73	Salt	0.35	0.18	
10.33	Shortening, room temperature	4.96	2.48	2. Add. Blend 2 minutes on #1 speed.
9.18	Water #1	4.41	2.20	3. Add, mix 6 minutes on medium speed (#2). Scrape down bowl.
9.18	Water #2	4.41	2.20	4. Combine liquids.
13.77	Frozen egg whites, thawed	6.61	3.30	5. Add in two parts, mixing smooth after each addition. Scrape down bowl.
0.60	Vanilla	0.29	0.14	6. Mix on low speed (#1) 5 minutes after last liquid is added.
				7. Scale 8.0 lb. per pan.
				8. Bake 20 to 25 minutes at 375 degrees F.
				9. Cool. Frost.
				10. Cut 6 x 10.
	Total Weight:	48.0	24.0	

WHITE CAKE

Portion Size: 1/60 (cut 6 x 10), 0.133 lb.
Suggested Serving Utensil: Spatula

Meal Pattern Allowance: 1 or 2 Portions

No. Portions: 600
Pan Size: 18 x 26 x 2¼

Percent	Ingredients	Weights and Measures	Procedure
22.94	Cake flour	18.35	1. Blend dry ingredients in mixer bowl on low speed (#1) 2 minutes.
29.83	Sugar	23.86	
2.29	Non fat dry milk	1.83	
1.15	Baking powder	0.92	
0.73	Salt	0.58	
10.33	Shortening, room temperature	8.26	2. Add. Blend 2 minutes on #1 speed.
9.18	Water #1	7.34	3. Add, mix 6 minutes on medium speed (#2). Scrape down bowl.
9.18	Water #2	7.34	4. Combine liquids.
13.77	Frozen egg whites, thawed	11.02	5. Add in two parts, mixing smooth after each addition. Scrape down bowl.
0.60	Vanilla	0.48	6. Mix on low speed (#1) 5 minutes after last liquid is added.
			7. Scale 8.0 lb. per pan.
			8. Bake 20 to 25 minutes at 375 degrees F.
			9. Cool. Frost.
			10. Cut 6 x 10.
	Total Weight:	80.0	

YELLOW CAKE

Portion Size: 1/60 (cut 6 x 10), 0.133 lb.
Suggested Serving Utensil: Spatula

Meal Pattern Allowance: 1 or 2 Portions

Percent	Ingredients	No. Portions: 360 Pan Size: 18 x 26 x 2¼ Weights and Measures	180 18 x 26 x 2¼	Procedure
21.80	Cake flour	10.46	5.23	1. Blend dry ingredients on low speed (#1) 2 minutes.
26.50	Sugar	12.72	6.36	
0.30	Salt	0.14	0.07	
1.40	Baking powder	0.67	0.34	
2.56	Non fat dry milk	1.23	0.61	
10.83	Shortening	5.20	2.60	2. Add. Blend 2 minutes on #1 speed.
13.26	Water #1	6.36	3.18	3. Add. Mix 6 minutes on medium speed (#2). Scrape down bowl.
16.57	Frozen whole eggs, thawed	7.95	3.98	4. Combine. Add in three parts mixing smooth after each addition.
6.38	Water #2	3.06	1.53	5. Scrape down bowl after each addition.
0.40	Lemon extract	0.19	0.10	6. Mix on medium speed (#2) 6 minutes.
				7. Scale 8.0 lb. per pan.
				8. Bake 35 minutes at 375 degrees F.
				9. Cool. Frost.
				10. Cut 6 x 10.
	Total Weight:	48.0	24.0	

YELLOW CAKE

Portion Size: 1/60 (cut 6 x 10), 0.133 lb.
Suggested Serving Utensil: Spatula

Meal Pattern Allowance: 1 or 2 Portions

No. Portions: 600
Pan Size: 18 x 26 x 2¼

Percent	Ingredients	Weights and Measures	Procedure
21.80	Cake flour	17.44	1. Blend dry ingredients on low speed (#1) 2 minutes.
26.50	Sugar	21.20	
0.30	Salt	0.24	
1.40	Baking powder	1.12	
2.56	Non fat dry milk	2.05	
10.83	Shortening	8.66	2. Add. Blend 2 minutes on #1 speed.
13.26	Water #1	10.61	3. Add. Mix 6 minutes on medium speed (#2). Scrape down bowl.
16.57	Frozen whole eggs, thawed	13.26	4. Combine. Add in three parts mixing after each addition.
6.38	Water #2	5.10	5. Scrape down bowl after each addition.
0.40	Lemon extract	0.32	6. Mix on medium speed (#2) 6 minutes.
			7. Scale 8.0 lb. per pan.
			8. Bake 35 minutes at 375 degrees F.
			9. Cool. Frost.
			10. Cut 6 x 10.
	Total Weight:	80.0	

APPENDIX D

SCHEDULE FOR PILOT PROJECT

November 12--Yellow Cake

Derby----600/S
Kramer---600/S
Boyd-----180/S

November 15--Devil's Food Cake

Derby----600/S
Kramer---600/S
Boyd-----180/S

November 19--White Cake

Derby----600/S
Kramer---600/S
Boyd-----180/S

APPENDIX E

PREPARATION INSTRUCTIONS AND RECORD SHEET

1. Weight all ingredients into specified containers.
2. Weigh and record empty bowl and beaters, record on form provided. Weigh and record weight of dip pans and scrapers.
3. Mix ingredients using specified procedures.
4. Tare cake pans.
5. Weigh batter into pans using specified weighing and scraping procedures. Record number of pans and batter weight on forms provided.
6. Weigh beater and bowl after batter is in pans, record. Weigh dip pan, pie pan and spatulas after batter is panned, record.

_____ Cake ___ Kramer

_____ Batch Size ___ Derby _____ Date

___ Boyd

Weight of unused bowl and beater: _____

Weight of unused dip pan, pie pan, and scrapers: _____

Weight of bowl and beater after batter is panned: _____

Weight of dip pan, pie pan and spatula after batter is panned: _____

Weight of batter:

Number of pans: _____ (each 8.0 lbs.)

Last pan: _____ lbs. (be accurate)

Note: Be sure to tare the pans.

Ingredient weight (for office use only): _____.

APPENDIX F

PROCEDURE FOR COLLECTING DATA

Size Batch	Kramer	Derby	Boyd
80 qt.	28 times (600/S)	28 times (600/S)	0
60 qt.	0	0	14 times (360/S)
30 qt.	0	0	14 times (180/S)

Seven cake recipes. Each done four times at Kramer and Derby, and two times at Boyd: White, Yellow, Spice, Banana, Applesauce, Brown Sugar, Devil's Food.

Ingredient Procedure:

All ingredients weighed.
Dry ingredients placed in individual containers and covered with plastic wrap or lids.
- Flour--20 lb. plastic bucket.
- Sugar--30 lb. plastic bucket.
- Salt--paper cup.
- Baking powder--paper cup.
- Dry milk--5 lb. plastic container.

Remaining ingredients covered with plastic wrap or lids.
- Shortening--stainless steel baker's bowl.
- Water #1--weighed by baker at time of preparation.
- Water #2--weighed by baker at time of preparation.
- Frozen whole eggs--stainless steel baker's bowl.
- Lemon extract--small glass jar.

Equipment Procedure:

(A) Beater and bowl weight recorded before they are used.
(B) Dip pan, pie pan and all scrapers weighed before they are used. (A pie pan is used to set the dip pan into.)
(C) Beater and bowl weight recorded after the cake is mixed and batter put into weighed pans.
(D) All utensils, scrapers, pie pans, etc., weighed after use.

Batter Weighing Procedure:

Tare each pan. Weigh batter directly into tared pans and record on form provided.

Scraping Procedure:

All ingredient containers to be scraped using a large rubber scraper. Used beater should be scraped with a large rubber spatula, and bowl with a baker's scraper.

APPENDIX G

RECIPES WITH CALCULATED HANDLING LOSS

WHITE CAKE

Portion Size: 1/60 (cut 6 x 10), 0.133 lb.
Suggested Serving Utensil: Spatula

Meal Pattern Allowance: 1 or 2 Portions

No. Portions: 180
Pan Size: 18 x 26 x 2¼

Percent	Ingredients	Weights and Measures	Procedure
22.94	Cake flour	5.56	1. Blend dry ingredients in mixer bowl on low speed (#1) 2 minutes.
29.83	Sugar	7.22	
2.29	Non fat dry milk	0.55	
1.15	Baking powder	0.28	
0.73	Salt	0.18	
10.33	Shortening, room temperature	2.50	2. Add. Blend 2 minutes on #1 speed.
9.18	Water #1	2.22	3. Add, mix 6 minutes on medium speed (#2). Scrape down bowl.
9.18	Water #2	2.22	4. Combine liquids.
13.77	Frozen egg whites, thawed	3.34	5. Add in two parts, mixing smooth after each addition. Scrape down bowl.
0.60	Vanilla	0.15	6. Mix on low speed (#1) 5 minutes after last liquid is added.
			7. Scale 8.0 lb. per pan.
			8. Bake 20 to 25 minutes at 375 degrees F.
			9. Cool. Frost.
			10. Cut 6 x 10.

Handling Loss: 0.805 % Volume: 24.22

PHILADELPHIA FUDGE CAKE

Portion Size: 1/60 (cut 6 x 10), 0.133 lb.
Suggested Serving Utensil: Spatula

Meal Pattern Allowance: 1 or 2 Portions

No. Portions: 180
Pan Size: 18 x 26 x 2¼

Percent	Ingredients	Weights and Measures	Procedure
25.22	Sugar	6.11	1. Blend dry ingredients in mixer bowl on #1 speed 2 to 3 minutes.
22.07	Cake flour	5.35	
3.94	Cocoa	0.95	
2.10	Chef Lac	0.51	
0.49	Soda	0.12	
0.41	Baking powder	0.10	
0.17	Salt	0.04	
9.46	Shortening, room temperature	2.29	2. Add. Blend on medium (#2) speed 4 minutes. Scrape down bowl.
8.41	Frozen whole eggs, thawed	2.04	3. Combine liquids. Add in 2 parts, mixing smooth after each addition. Scrape down bowl.
27.21	Water	6.59	
0.53	Vanilla	0.13	4. Mix on medium speed (#2) 5 minutes after last liquid is added.
			5. Scale 8.0 lb. per pan.
			6. Bake 20 to 25 minutes at 375 degrees F.
			7. Cool. Frost.
			8. Cut 6 x 10.

Handling Loss: 0.805%

Volume: 24.22

YELLOW CAKE

Portion Size: 1/60 (6 x 10), 0.133 lb.
Suggested Serving Utensil: Spatula

Meal Pattern Allowance: 1 or 2 Portions

No. Portions: 180
Pan Size: 18 x 26 x 2¼

Percent	Ingredients	Weights and Measures	Procedure
21.80	Cake flour	5.28	1. Blend dry ingredients on low speed (#1) 2 minutes.
26.50	Sugar	6.42	
0.30	Salt	0.07	
1.40	Baking powder	0.34	
2.56	Non fat dry milk	0.62	
10.83	Shortening	2.62	2. Add. Blend 2 minutes on #1 speed.
13.26	Water #1	3.21	3. Add. Mix 6 minutes on medium speed (#2). Scrape down bowl.
16.57	Frozen whole eggs, thawed	4.01	4. Combine. Add in three parts mixing smooth after each addition.
6.38	Water #2	1.55	5. Scrape down bowl after each addition.
0.40	Lemon extract	0.10	6. Mix on medium speed (#2) 6 minutes.
			7. Scale 8.0 lb. per pan.
			8. Bake 35 minutes at 375 degrees F.
			9. Cool. Frost.
			10. Cut 6 x 10.

Handling Loss: 0.805% Volume: 24.22

PHILADELPHIA FUDGE CAKE

Portion Size: 1/60 (cut 6 x 10), 0.133 lb. Meal Pattern Allowance: 1 or 2 Portions
Suggested Serving Utensil: Spatula

Percent	Ingredients	No. Portions: 600 Pan Size: 18 x 26 x 2¼ Weights and Measures	360 18 x 26 x 2¼	Procedure
25.22	Sugar	20.36	12.21	1. Blend dry ingredients in mixer bowl on #1 speed 2 to 3 minutes.
22.07	Cake flour	17.81	10.69	
3.94	Cocoa	3.18	1.91	
2.10	Chef Lac	1.70	1.02	
0.49	Soda	0.40	0.24	
0.41	Baking powder	0.33	0.20	
0.17	Salt	0.14	0.08	
9.46	Shortening, room temperature	7.64	4.58	2. Add. Blend on medium (#2) speed 4 minutes. Scrape down bowl.
8.41	Frozen whole eggs, thawed	6.79	4.07	3. Combine liquids. Add in 2 parts, mixing smooth after each addition. Scrape down bowl.
27.21	Water	21.96	13.18	
0.53	Vanilla	0.43	0.26	4. Mix on medium speed (#2) 5 minutes after last liquid is added.
				5. Scale 8.0 lb. per pan.
				6. Bake 20 to 25 minutes at 375 degrees F.
				7. Cool. Frost.
				8. Cut 6 x 10.
Handling Loss: 0.895%.	Volume:	80.72	48.43	

YELLOW CAKE

Portion Size: 1/60 (cut 6 x 10), 0.133 lb.
Suggested Serving Utensil: Spatula

Meal Pattern Allowance: 1 or 2 Portions

Percent	Ingredients	No. Portions: 600 Pan Size: 18 x 26 x 2¼ Weights and Measures	360 18 x 26 x 2¼	Procedure
21.80	Cake flour	17.60	10.56	1. Blend dry ingredients on low speed (#1) 2 minutes.
26.50	Sugar	21.39	12.83	
0.30	Salt	0.24	0.15	
1.40	Baking powder	1.13	0.68	
2.56	Non fat dry milk	2.07	1.24	
10.83	Shortening	8.74	5.24	2. Add. Blend 2 minutes on #1 speed.
13.26	Water #1	10.70	6.42	3. Add. Mix 6 minutes on medium speed (#2). Scrape down bowl.
16.57	Frozen whole eggs, thawed	13.38	8.02	4. Combine. Add in three parts mixing smooth after each addition.
6.38	Water #2	5.15	3.09	5. Scrape down bowl after each addition.
0.40	Lemon extract	0.32	0.19	6. Mix on medium speed (#2) 6 minutes.
				7. Scale 8.0 lb. per pan.
				8. Bake 35 minutes at 375 degrees F.
				9. Cool. Frost.
				10. Cut 6 x 10.
Handling Loss: 0.895%.	Volume:	80.72	48.43	

WHITE CAKE

Portion Size: 1/60 (cut 6 x 10), 0.133 lb. Meal Pattern Allowance: 1 or 2 Portions
Suggested Serving Utensil: Spatula

Percent	Ingredients	No. Portions: 600 Pan Size: 18 x 26 x 2¼ Weights and Measures	360 18 x 26 x 2¼	Procedure
22.94	Cake flour	18.52	11.11	1. Blend dry ingredients in mixer bowl on low speed (#1) 2 minutes.
29.83	Sugar	24.08	14.45	
2.29	Non fat dry milk	1.85	1.11	
1.15	Baking powder	0.93	0.56	
0.73	Salt	0.59	0.35	
10.33	Shortening, room temperature	8.34	5.00	2. Add. Blend 2 minutes on #1 speed.
9.18	Water #1	7.41	4.45	3. Add. Mix 6 minutes on medium speed (#2). Scrape down bowl.
9.18	Water #2	7.41	4.45	4. Combine liquids.
13.77	Frozen egg whites, thawed	11.12	6.67	5. Add in two parts, mixing smooth after each addition. Scrape down bowl.
0.60	Vanilla	0.48	0.29	6. Mix on low speed (#1) 5 minutes after last liquid is added.
				7. Scale 8.0 lb. per pan.
				8. Bake 20 to 25 minutes at 375 degrees F.
				9. Cool. Frost.
				10. Cut 6 x 10.
Handling Loss: 0.895%.		Volume: 80.72	48.43	

APPENDIX H

SCHEDULE FOR DATA COLLECTION

Date	Derby		Date	Kramer		Date	Boyd	
Jan. 17	Applesauce	600/S	Jan. 17	Applesauce	600/S	Jan. 17	Applesauce	360/S
Feb. 14	Applesauce	600/S	Feb. 14	Applesauce	600/S	Feb. 14	Applesauce	180/S
Dec. 14	Applesauce	600/S	Dec. 14	Applesauce	600/S	Dec. 14	Applesauce	360/S
Feb. 4	Applesauce	600/S	Feb. 4	Applesauce	600/S	Feb. 4	Applesauce	180/S
Jan. 25	Banana Spice	600/S	Jan. 25	Banana Spice	600/S	Jan. 25	Banana Spice	360/S
Mar. 7	Banana Spice	600/S	Mar. 7	Banana Spice	600/S	Mar. 7	Banana Spice	180/S
Feb. 16	Banana Spice	600/S	Feb. 16	Banana Spice	600/S	Feb. 16	Banana Spice	360/S
Mar. 2	Banana Spice	600/S	Mar. 2	Banana Spice	600/S	Mar. 2	Banana Spice	180/S
Jan. 19	Brown Sugar	600/S	Jan. 19	Brown Sugar	600/S	Jan. 19	Brown Sugar	360/S
Feb. 21	Brown Sugar	600/S	Feb. 21	Brown Sugar	600/S	Feb. 21	Brown Sugar	180/S
Feb. 28	Brown Sugar	600/S	Feb. 28	Brown Sugar	600/S	Feb. 28	Brown Sugar	360/S
Jan. 21	Brown Sugar	600/S	Jan. 21	Brown Sugar	600/S	Jan. 21	Brown Sugar	180/S
Dec. 1	Devil's Food	600/S	Dec. 1	Devil's Food	600/S	Dec. 1	Devil's Food	360/S
Jan. 27	Devil's Food	600/S	Jan. 27	Devil's Food	600/S	Jan. 27	Devil's Food	180/S
Feb. 8	Devil's Food	600/S	Feb. 8	Devil's Food	600/S	Feb. 8	Devil's Food	360/S
Feb. 23	Devil's Food	600/S	Feb. 23	Devil's Food	600/S	Feb. 23	Devil's Food	180/S
Feb. 3	Spice	600/S	Feb. 3	Spice	600/S	Feb. 3	Spice	360/S
Feb. 10	Spice	600/S	Feb. 10	Spice	600/S	Feb. 10	Spice	180/S
Dec. 3	Spice	600/S	Dec. 3	Spice	600/S	Dec. 3	Spice	360/S
Jan. 28	Spice	600/S	Jan. 28	Spice	600/S	Jan. 28	Spice	180/S
Nov. 22	White	600/S	Nov. 22	White	600/S	Nov. 22	White	360/S
Nov. 29	White	600/S	Nov. 29	White	600/S	Nov. 29	White	180/S
Dec. 6	White	600/S	Dec. 6	White	600/S	Dec. 6	White	360/S
Dec. 10	White	600/S	Dec. 10	White	600/S	Dec. 10	White	180/S
Jan. 31	Yellow	600/S	Jan. 31	Yellow	600/S	Jan. 31	Yellow	360/S
Feb. 18	Yellow	600/S	Feb. 18	Yellow	600/S	Feb. 18	Yellow	180/S
Mar. 4	Yellow	600/S	Mar. 4	Yellow	600/S	Mar. 4	Yellow	360/S
Mar. 9	Yellow	600/S	Mar. 9	Yellow	600/S	Mar. 9	Yellow	180/S

APPENDIX I

HALL/CAKE INTERACTION, SIGNIFICANT

MEAN WASTE

TABLE IX

LEAST SIGNIFICANT DIFFERENCES OF DECIMAL FRACTION WASTE
FOR HALL/CAKE SIGNIFICANT MEAN DIFFERENCES

Within or Between B180 and B360	Between Either B_i and D600 or K600	Within or Between D600 and K600
lsd .01 = 0.0125	lsd .01 = 0.0108	lsd .01 = 0.00883
lsd .05 = 0.00937	lsd .05 = 0.00811	lsd .05 = 0.00663
lsd .10 - 0.00784	lsd .10 = 0.00677	lsd .10 = 0.00553

TABLE X

SUMMARY OF HALL/CAKE SIGNIFICANT MEAN DIFFERENCES IN PERCENT BATCH WASTE

Hall/Cake	vs Hall/Cake	Sig.	Sign	Hall/Cake	vs Hall/Cake	Sig.	Sign
D/C	K/B	+	+	K/C	K/W	*	-
D/W	K/B	+	+	K/W	K/A	*	+
D/S	K/W	*	-	K/W	K/B	**	+
D/A	K/W	*	-	K/BS	K/B	+	+
D/C	B2/C	+	+	K/W	B1/C	+	+
D/C	B2/A	*	-	K/W	B1/S	*	+
D/C	B2/B	**	-	K/W	B1/BS	+	+
D/W	B2/Y	+	+	K/W	B1/A	*	+
D/W	B2/A	*	-	K/B	B1/W	+	-
D/W	B2/B	**	-	K/Y	B2/A	**	-
D/S	B2/A	**	-	K/Y	B2/B	**	-
D/S	B2/B	**	-	K/C	B2/A	**	-
D/BS	B2/A	**	-	K/C	B2/B	**	-
D/BS	B2/B	**	-	K/W	B2/Y	**	+
D/A	B2/A	**	-	K/W	B2/C	*	+
D/A	B2/B	**	-	K/W	B2/S	+	+
				K/W	B2/BS	*	+
K/W	B2/B	+	-	K/B	B2/A	**	-
K/S	B2/A	**	-	K/B	B2/B	**	-
K/S	B2/B	**	-	B1/Y	B2/A	**	-
K/BS	B2/A	*	-	B1/Y	B2/B	**	-
K/BS	B2/B	**	-	B1/C	B2/A	**	-
K/A	B2/A	**	-	B1/C	B2/B	**	-
K/A	B2/B	**	-	B1/W	B2/Y	+	+
B2/Y	B2/A	**	-	B1/W	B2/C	+	+
B2/Y	B2/B	**	-	B1/W	B2/A	+	-
B2/C	B2/A	**	-	B1/W	B2/B	*	-
B2/C	B2/B	**	-	B1/S	B2/A	**	-
B2/W	B2/A	+	-	B1/S	B2/B	**	-
B2/W	B2/B	*	-	B1/BS	B2/A	**	-
B2/S	B2/A	**	-	B1/BS	B2/B	**	-
B2/S	B2/B	**	-	B1/A	B2/A	**	-
B2/BS	B2/A	**	-	B1/A	B2/B	**	-
B2/BS	B2/B	**	-	B1/B	B2/A	*	-

Note:

1. All possible pairwise differences were statistically analyzed and the above summary table was composed using the print-out of pairs and the least significant differences.

2. B1 = 180-size batch at B Hall, B2 = 360-size batch at B Hall.

3. +, *, and ** indicate significance at the 10, 5, and 1% levels, respectively.

4. A plus sign (+) in the last column means that the hall/cake combination on the left has the greater percent pan waste, and vice versa if a negative sign (-) is in the last column.

5. BS = brown sugar cake, W = white cake, Y = yellow cake, A = applesauce cake, C = chocolate cake, S = spice cake, B = banana cake.

6. The most wasteful combinations of hall and cake were: B2/A, B2/B, and K/W.

VITA[2]

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