STANDARDIZING SELECTED QUANTITY RICE RECIPES FOR USE IN THE PHILIPPINES

By

MILAGROS S. FLORENDO

Bachelor of Science

University of the Philippines

Quezon City, Philippines

1961

Submitted to the faculty of the Graduate College
of the Oklahoma State University
in partial fulfillment of the requirements
for the degree of
MASTER OF SCIENCE
May, 1966

STANDARDIZING SELECTED QUANTITY RICE

RECIPES FOR USE IN THE PHILIPPINES

Thesis Approved:

Mary E. Leidigh
Thesis Adviser

Helen F. Barbour

J. R. Boggs
Dean of the Graduate College

ACKNOWLEDGEMENTS

The writer wishes to express her gratitude and indebtedness to Miss Mary E. Leidigh, Associate Professor of Food, Nutrition and Institution Administration, for her invaluable assistance and advice, encouragement and understanding in the preparation of this thesis; to Dr. Helen F. Barbour, Head of the Food, Nutrition and Institution Administration Department for her help in conducting this study.

Thanks is extended to Mr. Henry Magalit for the statistical suggestions and analysis of the taste panel data.

Grateful acknowledgements are due to the professors and graduate students for their cooperation in the Tasting Panel.

The writer also wishes to express her deepest appreciation to her parents, and friends for their support, understanding and encouragement without which the study would have not been possible.

TABLE OF CONTENTS

Chapter		Page
I.	INTRODUCTION	1
II.	REVIEW OF LITERATURE	5
	Recipe Standardization	5
	Techniques Used in Rice Cookery	13
	Rice	16
	Milk	20
	Muffin	24
	Rice Custard	27
	Rice Pudding	28
	Taste Panel	29
III.	METHOD OF PROCEDURE	33
	Perfecting a Method for Rice Cookery	33
	Milk-Effect Study	35
	Materials	35
	Taste Panel Preparation	37
	Scoring System to be Used	40
	Statistical Analysis	40
	Standardization of Rice Recipes	42
IV.	RESULTS AND DISCUSSION	45
	Perfecting a Method of Rice Cookery	45
	Pretesting of the Rice Recipes	48
	Milk-Effect Study	49
	Selection of Dilution Ratio	51
	Standardization of Recipes	58
V.	SUMMARY AND CONCLUSIONS	77
BIBLIOGRAPHY		80
APPENDICES		84
	A. Letters	85
	B. Recipes	88
	C. Guides or Pointers for Taste Panel Scoring	93
	D. Milk-Effect Study	96
	E. Rating Scores	109

LIST OF TABLES

Table		Page
I.	Cooking Two Kinds of Rice With Varied Times and Ingredients	45
II.	Effect of Cooking Methods on Short Grain Rice	47
III.	Sum of Ranked Scores at 1:1 Dilution Ratio for Rice Custard	52
IV.	Sum of Ranked Scores at 1:1 Dilution Ratio for Rice Muffins	52
V.	Sum of Ranked Scores at 1:1 Dilution Ratio for Rice With Peanut Butter	53
VI.	Sum of Ranked Scores at 1:1 Dilution Ratio for Rice Pudding	54
VII.	Calculated X_r^2 to Show Effect of Dilutions and Kinds of Milk Used on Color	54
VIII.	Calculated X_r^2 to Show Effect of Dilutions and Kinds of Milk Used on Texture	55
IX.	Calculated X_r^2 to Show Effect of Dilutions and Kinds of Milk Used on Flavor	56
X.	Calculated X_r^2 to Show Effect of Dilutions and Kinds of Milk Used on Acceptability	57
XI.	A Summary of Recipes and Changes	61
XII.	Averages of Tasting Panel Scores for Rice Custard	64
XIII.	Averages of Tasting Panel Scores for Rice Pudding	68
XIV.	Averages of Tasting Panel Scores for Rice Muffins	74

LIST OF FIGURES

Figure		Page
1.	Taste Panel Preparation	38
2.	Taste Panel Sample Portion	38
3.	Taste Panel in Action	39
4.	Score Sheet for the Milk-Effect Study	41
5.	Score Sheet for the Rice Products	44

CHAPTER I

INTRODUCTION

Rice, the most commonly used grain product since ancient times is virtually the only food for millions of people in the Orient. Not only is it a versatile, appetizing, and adaptable item, but also inexpensive and economical. In addition, rice combines extremely well with any kind of food, and thus, it merits attention among menu items for food service. A good source of food energy, depending upon the processing, treatment, and cooking methods, rice provides calories, vitamins, and minerals. The bland texture, ivory color, and mild flavor of rice gives a touch of embellishment and variation. There is scarcely any fiber in white rice; therefore, all of the grain is completely available for nourishment.

In the Philippines where rice is a main staple product, it would appear to be of interest to select different methods of preparation by which rice can be utilized in acceptable food dishes. This paper is concerned with the acceptability of rice in the Philippines and some other Oriental rice-eating countries. An attempt will be made to standardize quantity rice recipes, using selected methods of preparation, which will assist the author in procedures for standardizing recipes. The material may be useful to food service administrators, dietitians, and dietetic interns in

formulating menus for school lunch rooms in the Philippines.

The use of standardized recipes is one of the most important and effective tools of management. It is a probable tool for obtaining a standard quality product. In addition, it is a means of determining the food budget, maintaining the quality and quantity food production and reducing food wastage which contributes to the high cost of food items. Experts and food service administrators agree on the importance of standardized recipes, because the use eliminates the dangers of including or omitting ingredients other than those specified, or using incorrect amounts.

In regard to standardized recipes, Kotschevar (37) has this to say:

> While the menu authorizes production and sets in motion activities which culminate in the production of foods, the standardized recipe controls production. No factory begins to manufacture a product until blueprint, purchase specifications, labor force, equipment use, materials, and methods of preparation are set forth in detail. The standardized recipe is to the food service what these are to manufacturers. It gives production control to management who must be responsible for it. The standardized recipe also assists in eliminating human failure and over a period of time, it will give greater standardization of quality, quantity, and cost.

However, the use of a standardized recipe is not a panacea for products made of inferior ingredients. From the purchase of the raw material to the actual serving of finished dish, the preparation of food may be a complex process. As a result, many opportunities may occur along the way for the food to decline in "quality" --the elusive "excellence or superiority" for which one constantly strives.

A comparison of two kinds of milk will be utilized in the recipes as the liquid media; these will be canned whole evaporated milk and evaporated "filled milk." The selection of these milks is made on the basis of the availability of supply at a minimum cost and its practicability for school lunch rooms in the Philippines. This emphasis on the incorporation of milk to dishes for school menus may increase the utilization and the consumption of milk, especially by the school children. Milk, an excellent source of calcium, phosphorous, and several vitamins and minerals, is one of the "bargain" protein foods in the Philippines. The increased use of milk in cooking is a possible solution to the health problems, such as protein and calcium deficiencies. To drink milk is to partake of a food that is frequently disliked or is seldom in some Filipino dishes. It is often regarded as a child's food. Thus, milk needs to be incorporated into an acceptable dish in order to mask it. The author believes undertaking this investigation is an opportunity to mask this undesirable attitude. The author has chosen the use of rice, one of the most useful and versatile food items, as a carrier for milk in milk combination dishes.

It is important that standardized recipes be used and that with the foods made of milk, a definitely stated amount of each food be served per person to be sure the equivalent of a half pint of milk is received. Chosen for standardization will be American-style rice recipes for use in school lunch programs in the Philippines. Proposed recipes will be rice pudding, rice custard, rice muffins and rice with peanut butter. Since these are new to the

author, a taste panel will be used to evaluate the recipes.

CHAPTER II

REVIEW OF LITERATURE

A great many factors, both known and unknown, may influence the quality of rice dishes being standardized. Materials to be covered are concerned with (1) emphasis on the use of a standardized recipe, (2) fundamental techniques of rice cookery and (3) evaluation of products by a taste panel.

Recipe Standardization

Within the scope of this review, the history of standardization may be conveniently set into three phases: (59) namely, the Ancient Dawn and Early Industrial phase which began with the dawn of the human race; the Modern Industrial phase at the turn of the nineteenth century; and the overlapping Organizational phase which is an extension of standards from the nineteenth century to the twentieth century.

According to Weidlein (59) since ancient times the panorama of standards' development has been impressive and vast. Standards, such as the system of weights and measures, have a rich history based on evidence or record. The history of other standards, for example that of recipe standardization, is comparatively limited. Standard measures are as old as man. They began at the time man found it necessary to estimate dimensions and distances for con-

struction and for food gathering and producing. Nature gave him his digits and limbs which he used. As refinements became necessary, other natural measures were brought into play.

Weidlein also states that the need to weigh came later than the need to measure. Historians say that the balance was used first to weigh precious metals for temple use. In the fourteenth or fifteenth century B. C., volume measurements sufficed in Egypt until the balance was first adopted. The earliest man-made weights of cylindrical stone which belong to the "beqa" system of Egypt date as early as 7000 B. C. This is the oldest standard material known in the world.

In the good old days, Weidlein says, our grandmothers used recipes calling for a cup of milk, butter the size of a walnut, a handful of this and a pinch of that. In this country, satisfactory standardization of the cup, the teaspoon and other kitchen utensils was completed in 1950.

The program of standardization, if truly functional, can be a sharp tool which "pays off" in consistent high quality food, customer satisfaction and predictable cost (56). The standardized recipe once mastered is a cook's best friend. The use of standardized recipes has proven to be reliable as a mechanical tool in obtaining a consistently acceptable product. This is just one of the phases of scientific management being followed among food service managers today in order to retain their clientele. Food service managers are aware of its importance because of the rising food costs and labor costs at the current period. The control of quality

and quantity in food service, especially in schools, hospitals, cafeterias and private institutions is facilitated by the use of standardized recipes.

A standardized recipe is a tailored recipe made to fit the specific needs of a particular food service operation. It produces a known quantity of a desired quality (48). The term "standardized recipe" is defined by West and Wood (60) as "one which has been tested a number of times and has been found consistently satisfactory in quantity, quality and yield." Shugart (54) defines a standardized recipe as one in which the amounts and proportion of ingredients and methods of procedure will consistently produce a high quality product. It is one that has been tailored to one's own food service as far as total yield, size of portions and cost is concerned.

The elusive "quality" one strives for in foods is "excellence or superiority." An authority (14) states the goal of a food service is the "maintenance of acceptable standards of food preparation that will result in a product of high quality, served in the best condition and manner possible." A similar definition is given by Goster (23) who defines a standard recipe in the following manner: "A standardized recipe is one which establishes a procedure that will make possible the production of high quality food." Kotschevar (37) believes, too, that a well-tested standardized recipe is a "must" for good quality control.

In the past, an exact technique for recipe development could not be stated because a trial and error procedure was involved.

More recently, definite procedures have been set up for recipe formulation by a number of people. The cooking practices of the past differ from the present due to various factors. The result of the impact of the modern technological age has brought about changes in the cooking methods, equipment and standards. More emphasis is placed on the preservation of nutrients, improving quality, simplification of method of preparation and reduction of food cost through the use of a standard recipe. Generally, the steps are: (14)

1. Plan with employees and supervisor the specific recipes to be standardized. Choose items which are satisfactory in eating quality.
2. Select an easy-to-read form for writing the recipe to be tested.
3. Record all essential information and important details as:
   a. exact amount of ingredients
   b. the order in which ingredients will be combined
   c. directions such as mixing time and speed
   d. time and temperature for baked products
   e. exact size of baking pans, the amount of batter or dough to be used.
4. Discuss instructions for serving standard portions, so that the actual yield may be checked against calculated yield.
5. Develop a check sheet or card for recording the information obtained in above.

Steps used as a guide in the pattern of standardizing recipes have been suggested also by McMahon (44). Given steps have been adapted as follows:

1. Choose a favorite recipe, perhaps a family size, and decide whether it would be practical for preparation by the instructions.
2. Prepare the recipe according to instructions. Score the resulting products for yield, characteristics of flavor, texture, and color. If the scoring indicates changes are necessary, repeat the recipe, varying the ingredients and rescoring each preparation of the recipe. The

recipe can be enlarged when a completely acceptable product has been made.
3. Enlarge the recipe to the size which will provide the number of servings required in the institution. Prepare and retest until the product is acceptable.
4. Record the approved recipe.
5. Recheck every four to six months.

Ericson (20) mentions starting off with a family size recipe. The recipe should be examined from the standpoint of ingredients, procedures, yield, cost and acceptability of product and further believes that the recipe needs to be obtained from a reliable source.

The use of standardized recipes is not a cure-all for products made of inferior ingredients. From the purchase of the raw materials to the actual serving of the finished dish, many opportunities may occur for the food to decline in quality. Quality insures acceptable products, thus making it possible to produce uniformly profitable meals served at all volume units. As indicated by Shugart (54), the factors important to the achievement of such goals are the selection of good wholesome ingredients and proper storage of the raw materials, as well as the food at different steps of preparation, and the use of good equipment.

Correct preparation methods also are essential. Errors in weighing or measuring, improper mixing, undercooking, poor timing, wrong temperatures or improper seasoning may damage both quality and cost. It is only by having a clear understanding of what standardization of a recipe means that one can be sure of achieving a standard product. All of these factors contribute to the production of high quality food and it would be difficult to say that any one

is more important than another.

As enumerated by Cranmore (12), the advantages of a food prepared from a standardized recipe are:

1. Management--establishes and maintains patron, accepted food, produced at known costs; controls portions, produced at known costs; eliminates dependence on individual employee and gains more personal freedom.
2. Employees--saves time and suffers less mental stress and fatigue. There is greater job satisfaction and security when quality food is consistently produced.
3. Patron---are assured of consistently good food in portions they like.

Goodenow (25) suggests that the recipe be tested at least seven times before it is accepted for the file. Three files of standardized recipes should be maintained: the master file in the manager's office, a file in the production supervisor's office and a file in the production area. To reduce soilage the recipes can be placed in plastic cases.

Many authors state that the use of a standardized recipe form is as important as the standardized recipe. The standardized recipe form includes much pertinent information. The form used to present the required information must be practical and simple. Although this varies with the needs of the operation, particularly, it includes: (12)

1. Exact weights and measurements of ingredients.
2. Cost facts which should include unit cost, raw food cost for the recipe, serving cost per portion, and the total cost.
3. Instructions, cooking time, temperature and equipment to be used.
4. Miscellaneous data, such as the name of the recipe, the number of servings, directions for serving, and total preparation time.

A recipe is composed of two major parts--a list of ingredients and detailed instructions for preparation. The following information should be included: (12)

1. Name of recipe,
2. Total quantity produced and number of portions of a stated size obtained,
3. Ingredients by weights and measure, sometimes by count,
4. Procedure and time for combining ingredients,
5. Cooking or baking temperatures,
6. Times for cooking or baking,
7. Panning information,
8. Cost information,
9. Standard of quality expected,
10. Total and production time.

Aldrich (1) states that the standardized recipe information should be clear in every detail. Included within the suggestions for a standardized recipe are a complete description of ingredients in the proper weights and measures with a minimum of abbreviations, a description of each step used in chronological order, an indication of the yield, size of utensils to be used and complete cooking instructions, including time and temperature. The advisability of using weighed quantities rather than measured quantities is mentioned.

Vital information is necessary for a recipe form to be useful to menu planners and cooks. Another way in which standardized recipes would be useful is as an aid in training new employees. As Miller (47) pointed out, the success of a standardization program, like almost anything else, depends upon the guidance and follow-up exercised by management. The standardization of recipes should not be just set up and the cooks left to do the job. Constant revision and checking on the recipe is required.

Several formats may be utilized for writing out the recipes.

One form which is used at Eastman Kodak Company is as follows:

Recipe_____ Kitchen File_____
Total Yield_____ Preparation Time___
Size/Serving_____ Labor Hours_____

Ingredients	Yield	Actual Yield	Method of Preparation

West and Wood (60) suggest this form for writing recipes:

X Cafeteria
Address

Recipe_____ Date_____
Source_____
Yield_____ Size Portion_____

Amount	Ingredients	Method	Unit Cost	Total Cost

A sample of a recipe format as advocated by Aldrich and Miller (46) is:

File No._____ Name of Recipe_____
Portion_____
Yield_____ Equipment_____

Ingredients	Yield	Procedure
1.		
2.		
Total Volume		
Total Weight		
No. of Portions		

After the recipe has been tested and considered acceptable, all the information obtained is assembled on cards, in notebooks or in a form convenient for handling and filing. "In no other way," says Eliason (58), "can we be assured that the product from the same standardized recipes in each operation will come up to the high

standards demanded." The program of recipe standardization is never finished. As people, equipment and ingredients change, the product may change and recipes must be restandardized. Recipe standardization is a means to an end and not an end in itself.

Techniques Used in Rice Cookery

Methods of cooking rice are of considerable importance because the means of preparing the rice affects its quality and nutritional value. Rice is chiefly used in plain boiled form. Many methods of cooking and preparing rice have been used, some of which are detrimental to its nutritional quality. Common practices in rice cooking are:

1. washing the raw rice before cooking. This serves to remove the fine starch that is readily soluble during cooking and thereby adds to stickiness.
2. much water is used in cooking and the excess is thrown away, carrying with it most of the starch which has become soluble.
3. immersing the rinsed raw rice in water in a quantity just sufficient to swell the grain properly. It is then cooked in a double boiler or over a slow fire until the water is completely absorbed.
4. rinsing cooked rice is often resorted to in order to remove further the films of soluble starch on the surface of the grains.
5. partly cooking rice, in some cases. After draining off the water, the half-cooked rice is steamed in an enclosed space over freely boiling water.

In the United States, rice is used in many ways but most of all as an accompaniment to a meat dish, similar to the use of potatoes. In the United States, open vessel cooking of rice with excess of water and double-boiler cooking of rice in a minimum of water are equally used. Many consumers wash the rice three times before cooking (18). Forty per cent of the rice eaters discard the

cooking water. Rinsing of the cooked rice takes place in thirty per cent of the cases (18). Because of these practices, little thiamine may be left in the white, milled rice finally used for human consumption in the United States.

It appears that in most parts of the Philippines, rice is washed thoroughly in three or four changes of water. Each time the rice is rubbed vigorously until all the cloudiness is removed from the rinsing water. Often, an inexperienced cook uses too much or too little water. If the water happens to be in excess, it is discarded; but if not sufficient, more water is added, thus causing a lack of uniformity in the finished product.

Kik (36) found that washing rice causes a great loss of minerals and thiamine. These authors believe that the occurrence of beriberi, in spite of the use of parboiled rice, is due to the practice of washing the rice prior to cooking. Rice is the only cereal which is washed in the course of preparation, thereby affecting the nutrient content. Therefore, the manner of washing and cooking can be of great nutritional importance.

The losses of thiamine, riboflavin and niacin caused by the washing of milled rice and brown rice are as follows (28):

1. 21.1% to 43% loss of thiamine,
2. 7.7% to 25.9% loss of riboflavin, and
3. 13% to 23% loss of niacin.

Aykroyd (36) reports that the average loss of thiamine is from 40 to 50%, while Swamminathan (36) found that raw rice samples lose an average of 60% niacin on first washings; the second and third washings do not remove much more. The losses caused by cooking depend

on whether the cooking water is discarded or not. Therefore, the use of too much water and the discarding of the surplus water are the most common causes of loss of nutrients. Cooking in an open vessel leads to greater loss of thiamine, riboflavin and niacin than cooking in a double boiler. Also there is an appreciable loss of protein and phosphorous when rice is cooked in an open pan. Limited washings and suitable cooking will substantially prevent losses (36).

An objective in the preparation of rice is the avoidance of stickiness in the cooked grain. Although different cultural groups may prefer various kinds of texture, there is a rather widespread preference for rice that is tender but not mushy or sticky when cooked. Matz (46) believes that the different varieties of rice have a typical cooking quality which does not vary much from lot to lot. Most of the long grain varieties tend to cook to a dry and fluffy state and the kernels do not split or stick together as much as the other types. This stickiness is a function of the gel characteristics of the starch component of the grain.

Amylose proportion and gelatinization temperature are factors affecting stickiness. Rao (52) found a correlation between amylose content and the swelling number of rice. The gelatinization suspension of ground starch is measured by the use of Brahendes Amylograph and Viscograph which is useful to evaluate rice properties. Short grain varieties tend to gelatinize in the lower temperature range. There appears to be a negative correlation of temperature with stickiness. Therefore, it seems to be of little

doubt that the major determinant of rice structure is the starch. However, cell cohesiveness also plays a role.

Desikachar and Subrahmanyan (18) state that newly harvested rice tends to leach out into the cooking water more than does rice stored for some time. Hence, fresh rice tends to cook to a pasty mass enclosing a viscous, sticky gruel. These differences are attributed to a qualitative difference between the cell wall of new and old rice. However, the authors made no conclusion on the possibility that the cell contents undergo changes from longer storage periods. This is brought about by inhibition of the diffusion from the cell when the membrane of the wall is damaged by cooking. Such changes could result in the formation of insoluble materials.

The variety of the rice used has some influence upon its cooking quality. For example, long grained varieties are less sticky than the short grained rice when cooked (20). The short grained varieties are soft and chalky. These varieties are slightly sticky and are favored as a good choice for croquettes, puddings or rice rings. The long grained varieties are hard and translucent, fluffy and separate when cooked. The choice of rice to be served with stews, curries or meat is the long grained variety.

Rice

Rice is one of the most important and unique cereals in Asia. The Rice Council for Market Development gave the following account of the composition of rice, (p. 8), in the pamphlet Rice in the United States.

	Raw White, Milled 100gm. (½ cup)	Cooked White, Milled 100 gm.(2/3C.)
Calories	362	119
Protein-gms.	8	3
Fat-gms.	trace	trace
Total CHO	79	26
Water-gms.	.2	.1
Calcium-mg.	12	71
Phosphorous-mg.	24	8
Iron-mg.	136	45
Thiamine-mg	.8	.3
Riboflavin-mg.	.07	.01
Niacin-mg.	1.6	.4

The cooking of rice results essentially in the gelatinization and swelling of the starch granules with an absorption of water. The physical structure of the rice granules contains both the starch and the non-starch constituents.

According to Hughes (27) one problem in rice cookery is retaining the form of the rice kernel, while cooking until tender. Rice may be steamed using just enough water for complete absorption by the grain. It can be cooked also in a large quantity of rapidly boiling water so that kernels remain separate and distinct. Mention is made that packaged rice need not be washed. But if washing is done, the rice will be less sticky if hot water is used. Rice needs no more than two and one quarter times its volume of water and usually increases to about three times its volume during

cooking.

Experimental studies have reported new methods of evaluating the cooking qualities of rice. Formerly the oldest method used in research was known as the "constant cooking method" or testing for taste and flavor after preparation by prolonged cooking. In such tests, the increase in volume, the water absorption capacity and the stability in cooking were investigated (17). However, the data from the cooked portion, showed approximate resistance to disintegration of the rice kernels rather than the condition of the swollen rice kernels. The judgment on the consistency of the kernels, that is, rice ready to be eaten, is subjective and not expressed in figures (17).

Rao (32) has made important contributions to the method of rice cooking by determining the increase in volume when using a small quantity of rice. With this in mind, new methods have been evolved to find the degree of swelling of rice kernels. On the other hand, the assessment on the cooking qualities of small quantities of rice under different cooking conditions from the pastiness of the starch have been reported.

Some important new methods of cooking rice which have been published can be grouped as follows (15):

a) amylogramm or viscogramm--records the swelling properties of rice starch or viscosity in a temperature range of 20-94° C. over different periods of time.

b) alkali test--rice treated with potassium hydroxide solution swells, since the alkali induces hydration of the starch

kernels at room temperature.

c) starch-iodine blue test--rice kernels are allowed to swell at a temperature of 77° C. After iodine is used to color the starch that has been dissolved in water, the color is measured by colorometric-waves.

d) amylopectin and amylose ratio--measure of content in rice starch.

e) shaking test-- a test for the brittleness of swollen kernels. This is designed to contrast the sticky nature of cooked short kernel rice with the dry state of long kernel rice.

f) oryzogram--test showing the consistency of the rice kernels as well as the quantity of water and cooking time to obtain an optimum kernel consistency. This method is suitable to judge the quality of rice from the standpoint of palatability.

In general, rice varieties differ in their cooking characteristics. At the same time, there has been no uniformity in methods for evaluating differences in cooking and eating quality. Batcher (4) supports this idea and has reported a study done on the cooking quality of rice. Long grain varieties required more water for cooking than the medium and short-grained varieties and according to panel evaluations were less cohesive. Off-flavor and color also differed within varieties.

Wilmot (61) states that if water absorption of rice was measured at a temperature below boiling (70° or 80° C), the water absorption of short and medium grain varieties was greater than that of long grain varieties. Rice with high water uptake ratios

tended to yield larger volumes of cooked rice. It was observed in this study that the residual liquids from long grain rice types generally have higher starch contents and lower pH values than the other types.

Juliano, et al.(33) made a study on the relationship between the cooking quality of rice and the physiochemical properties of some rice varieties. Samples of both Japonica and Indica rice were the materials. It was found out that Indica rice varied more in physiochemical properties than Japonica rice.

Milk

In food preparation milk may be used in different ways and mixed with a variety of foods. Use of milk with cereal is a common way. Milk may be a base for pudding, dessert and cereal combinations, as in custards, cakes and all types of breads. Milk is a highly nutritional, valuable substance in which over 100 separate chemical components have been identified (42).

Several factors affecting the content of the constituents of milk to a greater or lesser extent are (42):

1. Different species of animals: Different species give a wide variation in the fat content of milk. The highest fat content (5%) is from Jersey and Guernsey breeds, whereas Holsteins have the lowest (3.5%) and that of Ayrshires and Shorthorns is between these. There is a tendency for the protein content of this milk to parallel the fat content.
2. The stage of lactation: Colostrom is rich in globulin content compared to normal milk.
3. Age and individual variations: With the advancing age of the cow, the average fat content of milk is increased. Differences in composition of milk are derived from individual cows.
4. Length of time and variations in milking:

> Generally the feed has a slight effect upon the concentration of the various milk constituents. The flavor of the milk is affected by the feed.

It is recommended that all adults drink daily two cups of fresh fluid milk or its equivalent in evaporated or dry milk. The allowance is increased to 3-4 cups for children and 6 cups for pregnant and nursing mothers (51).

Both evaporated milk and evaporated filled milk are available and produced in the Philippines. These two milks have the following compositions:

Philippines Specifications

	Evaporated Milk	Filled Milk	U. S. Specifications
Fat Approx.	7.84	6.00%	7.90%
Protein	6.80	7.25%	----
CHO	----	11.00%	----
Mineral Salt	1.60	1.75%	----
Solids not less than	26.10	26.00	25.90

In filled milk, the milk fat has been replaced by vegetable fats in the ratio of 94% coconut oil and 6% corn oil, whereas in standard evaporated milk the whole fat is milk fat.

Special care must be exercised in cooking milk to prevent a number of changes. One of these is the formation of coagulated caseinate as a result of prolonged heating. Sweetman (57) holds the opinion that heated milk forms a precipitate that tends to cause scorching, particularly when milk is in a deep layer or in

contact with direct heat (rather than in hot water). Because of this tendency, the use of the double boiler for milk cookery is recommended. Sweetman maintains that direct heat can be used in cooking milk products when care is taken to maintain a low heat. Lowe (42) has suggested stirring several times during the baking process. The use of a covered pan is another idea to eliminate the formation of scum. Proudfit (51) also advocates the use of low temperatures indicating that custards especially should be baked longer and at slightly lower temperatures. The use of a double boiler for successful custards is not necessary with the present heat-controlled modern ranges according to Proudfit. In the absence of temperature controls, an asbestos mat or a flame speader may be used to lower the temperature of the surface unit.

Another important point considered by Peckham (50) is that milk cooked over direct heat requires a type of utensil that is made of stainless steel or other substantial materials. Light weight utensils should be avoided, since not enough protection is provided and scorching of milk might take place.

One of the most important chemical changes produced in milk during processing and storage consists of the formation of a group of flavorful lactones (29). Generally, these lactones form the basis of flavor for fresh food materials. Depending upon processing and storage conditions, the unstable and the flavorless precursors rearrange in different degrees to yield the lactones. Time and temperature in both processing and storage are the factors implied for this yield. Dynamically there is spontaneous flavor

change when the product is in the fresh state. The olfactory quality of the lactones is coconut-like, which is typical and evident in evaporated milk and filled milk.

Irving (29) cites some origins of off-flavor in processed milk, which are not exclusive but may have a bearing on evaporated and filled milks. These are the characteristic "caramel" flavor, the development of which is independent of the product's oxygen level. Related to this is a defect arising from the fat phase of the product, a characteristic in the changing flavor of milk fat. Therefore, the introduction of ultra-high temperature and short time processing, coupled with aseptic canning raises hopes that the strong caramelized flavor of evaporated milk can be overcome and that an acceptable milk product can be developed.

Keeney and Doan (29) demonstrated that the compound(s) associated with the coconut-like defect has the property of lactone. Patton, et al. (29) postulated that the flavor and odor properties of delta decalactone are identical with the coconut-like taste and conclusively identified this in evaporated milk. Recent chemical work in gas chromatography has shed light on the presence of lactones in stored dairy products containing milk fat. This concept is further enriched by an understanding of the mechanism in the off-flavor development. Complete hydrogenation of fresh milk fat does not destroy its capacity to generate lactones. The role of antioxidants, and the development of oxidized flavor are unrelated to the development of lactones and coconut-like flavor defect (29).

There are at least two possible approaches, according to Patton (29), done to this lactone. One involves steam stripping of milk fat to be used in stored forms of beverage milk. This will remove the lactones and ketones from the fat. The other involves development of milk fats that have a low potential of producing ketones and lactones.

Boldingh and Taylor (29) point out that milk fat and the precursor compounds are of biological origin. The particular lactones and ketones that have been identified and the nature of their precursors have implications in the biosynthesis of milk fat.

Griswold (24) stated that the cooked flavor characteristic of evaporated milk was not usually detected in cooked foods or, if detected, was not objectionable, when investigating with fluid and evaporated milk for institutional cookery.

Muffins

Muffins are considered a drop of batter and popularly belong in the category of quick breads. The ingredients used and the baking affect the quality of the finished product. The way in which the ingredients are mixed and combined is a distinguishing factor in making muffins.

All purpose flour is usually chosen for muffins, although it is possible to make good muffins with other kinds of flour. Whole wheat, cooked rice or corn meal may be substituted for part of the flour in a recipe. Whole wheat flour may be used entirely or combined with white flour.

The type of baking powder used influences the optimal time for

mixing. Less mixing is desirable when quick-acting powder is used. Salt is used to give a desirable flavor.

Sugar is not an essential ingredient in muffins, but is frequently used for flavor and to improve texture and color. Since sugar inhibits gluten formation, sweet muffins are more apt to be fine in grain and free from tunnels (6).

Eggs are not used in all muffins. However, they are usually considered desirable because they contribute to nutritional value as well as to flavor and color. Eggless muffins are more likely to be free from tunnels than those made with eggs. The cell walls of the muffins are thick and heavy if the egg is not beaten thoroughly and mixed well with the fat and liquid.

Fat helps to make muffins tender and shortens the strands of gluten. Any flavorless fat of low melting point may be used or oil may be substituted. The use of an oil seems sensible since most recipes indicate melting the fat before adding to the mixture. Milk is the usual liquid (61).

Muffin variations are legion. Novelty flours can be used, various flavorings can be added, sweet or savory ingredients can be included and the muffins can be changed in countless interesting ways.

There are three different mixing methods for muffins. The choice depends upon the procedure preferred and the results liked best. The "muffin" method calls for combining all the dry ingredients and adding the combined liquid ingredients all at once. Blair (7) has reported a new method which consists of cutting the

shortening into the dry ingredients, then adding the liquid ingredients all at once and mixing quickly. The third method of making muffins is the conventional cake method in which the shortening is creamed and the sugar and egg are added. Then the flour is added alternately with the liquid. This makes a delicate, cake-like muffin.

In making muffins, the dry ingredients must just be dampened. The combination of dry and liquid ingredients must be even. The batter is lumpy rather than smooth. Overmixing muffins is a common fault; developing the gluten in the flour makes tough muffins with elongated holes inside and peaks or knobs on top.

Plain muffins have a sweet, pleasant flavor. A good muffin, according to Griswold (24), is very light with a coarse but even texture. The crust is golden brown and has a "pebbly" surface. It should be evenly browned in color and tender. A well-baked muffin has a coarse even grain. The air cells are approximately the same size and evenly distributed. An overmixed muffin batter is shiny and flows in a long smooth stream from the spoon. Usually the products have peaked tops and "tunnels." These are formed by the expansion of gas along the pathways in the muffin made by elongated strands of gluten. Other causes of tunnel development in muffins are: a baking pan with shallow cups and too hot an oven.

To produce a good muffin, the batter must not be beaten beyond the stage of slight lumpiness. Sweetman (57) states: "The difference between success and failure is a matter of a few strokes of the stirring spoon." Halliday and Noble suggested timing of the

stirring operation in an effort to correlate stirring time with the appearance of the batter and the standard product.

The baking temperature for muffins varies. An oven temperature of 400°F (204°C) to 425°F (218°C) is satisfactory for most muffins (42). The bottoms of the pans in which muffins are baked are usually oiled. This is so the batter will cling to the sides of the pan as the muffins rise. The pans are filled two-thirds full with batter.

Rice Custard

Baked custard is a type of pudding identified as a custard pudding. Custard may be defined as a cooked mixture of egg, milk, sugar and flavoring (20). Rice custard is made by adding cooked rice to a custard mixture before baking. A commonly used method for making custard is to scald the milk before combining with the ingredients. Scalding the milk shortens the time and may improve the product. In addition, scalding the milk may lead also to detecting slight sourness which might otherwise go unnoticed (51). The egg is beaten until completely mixed. (Too much beating makes porous custard.) Then the flavorings are added. The hot milk is gradually stirred into the egg mixture to give even distribution of the hot liquid in the concentrated protein. Like other pudding varieties custard is spiced with nutmeg, cinnamon or a mixture of both. Flavoring custards may be with brown sugar, caramel, coffee and grated lemon or orange rind, as well as light or dark raisins and sliced peaches or dates (6).

Rice pudding needs to be baked at moderate temperatures using

a water bath (6). To prevent syneresis it is suggested not to stir rice pudding after the first third of the baking period. Neither should the pudding be cut until thoroughly cold (6).

A review of the principles involved in custard cookery by Justin, et al., is as follows (34):

> The baked custard is cooked in an oiled dish set in a pan of hot water. The oven temperature should be moderate (177°C or 350°F), low enough that the water surrounding the dish does not boil. The custard mixture provides the heat-coagulable milk-protein furnished by the egg. As the mixture is heated gelation forms a solid mass. Custard heated beyond the gelation point shows syneresis. Egg syneresis is a usual characteristic of custard when the temperature of the mixture is held for a long time or at too high a level. The custard is considered done when the tip of a small pointed knife carefully inserted comes out clean. This type of custard should be removed from the heat as soon as done, or it might curdle from overcooking.

Rice Pudding

Many things can be said for a simple pudding when attention centers on desserts. In most instances, puddings are inexpensive, and easy to make. Puddings with the classic favorites, like bread, apple, tapioca and rice are quite familiar. Specifically, puddings are commended because of the capacity for variety. Flavor can be varied and appearance can be altered and made attractive (34).

The old-fashioned rice pudding is made from raw rice, which calls for long, slow oven cooking in milk with occasional stirring until a brown skim forms on top (6). The traditionalists insist that nutmeg is the only proper flavoring (6). Those less bound by tradition, suggest using vanilla, nutmeg or grated rind of lemon as flavoring and the addition of raisins, with bits of citron, cut-up

dates or figs as variables. Using brown rice rather than white rice is another idea.

Not all types of rice puddings call for cooking in the oven. There is, for example, the type referred to as creamy rice pudding which is made in a sauce pan, double boiler or steam jacket kettle. These are flavored with spices or lemon, chocolate, coffee or maple. Raisins, pineapple, apricots and other fruits are welcome additions. Other suggestions are sliced peaches, nutmeg-flavored whipped cream, coffee pudding made with dates topped with almond meringue or perhaps a vanilla version with a branded black cherry sauce.(20)

Some rice puddings can be made as cooked rice combinations. "Glorified rice" combines rice, marshmallows, whipped cream, pineapple and sometimes slivered almonds or additional fruit (53). Another kind of simple pudding combines cooked rice, crushed pineapple and a rich velvety custard sauce.

The Bavarian type of rice pudding is made with gelatin and whipped cream (53). These puddings are easily varied with sauces such as sliced, fresh or frozen peaches, strawberries or red raspberries, with whipped cream topped with apricot puree or a splash of "creme de menthe" (53).

Taste-Panels

A technique employed in laboratory research for the evaluation of a product is the use of a test panel. The technique is also known as using a sensory tasting panel. Sensory tasting panel techniques consist of the following: determining the size of the

taste panel, selecting panel members, training of panel members, choosing the tests, tasting and analyzing results. A test panel may determine whether an individual recipe or cooking technique will provide a satisfactory product.

Persons comprising taste panels should be sensitive to the different physiological tastes, such as salty, sour, bitter and sweet. Krumm (39) says that both sexes may be used, with ages ranging between 20 and 50. Tasters must be in good health and free from fatigue and worries. To perform their jobs properly, the food tasters must be free from colds, headaches, diarrhea and allergies. Abstinence from smoking and drinking should be practiced.

The desire to do well may predispose taste panel members to success. Interest and motivation are important determinants in the selection and success of the judges as panel members. Gerardote, et. al. (22), states that the panel member is usually required to deal analytically with a series of complex situations. Simple factors such as sensitivity to the basic taste or odor will partially determine a person's value as a panel member.

Peryam (50) says that the level of performance in a complex situation depends on factors such as rate of adaption, memory, recovery to flavor properties, adjustment to the test situation and skill in handling flavor perception. In the selection stages some possible taste panel members may be eliminated due to lack of sensitivity to the flavor involved and to poor flavor memory. Included, too, is the prospective panel member's failure to understand the

test. Gerardot and Peryam (22) believe that the procedure in providing efficient panels involves two stages: first, testing of ability to make simple discriminations of differences between samples; and second, testing of the ability to reproduce qualitative judgments.

One other aspect of taste tasting is concerned with the reliability of results. A sufficient number of judgments are needed to assure statistically the important differences. This can be shown through the correct responses as given by the degress of discrimination of the judges. The number of judgments can be increased either by using more people or getting more judgments per person. Generally, panels of less than five members are not used, (45). However, decisions have been based on fewer than sixteen judgments and are not based on more than thirty judgments.

Excellent methods of determining flavor evaluation, food acceptance and sensory analysis are available (41). These basic tools that have been developed are paired comparison, duo trio, triangle flavor, scoring and scaling tests. The different tools can provide precise and reliable facts and information. Although variations of these test methods are encountered from time to time, these are of minor importance. Understanding and comparison of these methods may be facilitated by noting the variations.

Other approaches to the problem of evaluating food are the ranking test and scoring test (11). The ranking test is a relatively simple method that can be employed in evaluating food. The judges (5-15 in number) are asked to rank by increasing or decreasing

numbers a series of samples. Such factors as taste, odor, color and texture may be ranked. The numerical scores are averaged to obtain the results. Score cards are used and these include a series of descriptive phrases to guide the taste panel judges in grading each characteristic item. The terms should be truly descriptive in order to indicate the judge's opinion of the product (11).

In judging the quality of a food that has been prepared, Jones (31) states that certain points should be considered. Adequate score cards, careful selection of the judges and accurate sampling of the product are important. The judges should possess experience, have a sense of discrimination, have good food standards and be free from food prejudices.

A rating scale devised for use by the judges shows there is no guarantee that all the members of the panel will utilize the scale in the same manner. Samples presented to the taste panel can require the use of statistical analyses specifically adapted to them. One method used as presented by Siegel (55) is the Friedman two-way analysis of variance. A particular decision can be made when a particular hypothesis, as operationally defined, is to be rejected or accepted in terms of the information yielded by the study.

CHAPTER III

METHOD OF PROCEDURE

A. Perfecting a Method for Rice Cookery

It appears that in almost all parts of the Philippines rice is washed with vigorous rubbing to remove the starch and foreign matter before cooking. Much of the cooking is done without measuring the water, therefore errors in using more or less water are committed. If the water happens to be in excess, it is discarded, but if not sufficient, some more is added. Thus, there is a lack of uniformity in the finished product. An interest in the cooking of rice in any form requires standard techniques and formulae. Preliminary study for perfecting the method of cooking rice to be utilized in standardizing the rice recipes will be made. The purpose will be to determine the correct proportions of raw rice and water and the length of cooking time needed.

A method for cooking rice, developed by the Rice Council for Market Development, Houston, Texas, is known as the "Magic 1-2-1" in which 1 cup rice, 2 cups water and 1 tsp. salt are used. All ingredients are placed in a 2½ quart pan over high heat until the water boils. The mixture is stirred once and covered with a tight-fitting lid. The heat is turned low and the rice is cooked below boiling until the water is absorbed. The rice is allowed to dry for ten minutes over low flame. According to the Rice Council,

regular rice yields 3 cups cooked rice by this method.

In this work, salt will be omitted from the recipes since sugar will be the seasoning called for in the recipes to be tested. The rice will be washed and drained thoroughly to suit the cooking practices commonly followed in Filipino cookery.

Two kinds of rice types will be tested: short grain rice (SGR) and long grain (LGR) rice. Each kind will be cooked in a saucepan on top of a gas-fired range. The steps to be followed in the preparation of both long and short grain rice will be:

1. Measure and weigh 1 cup of rice into 2½ quart pan.
2. The rice will be washed once to remove dust and foreign matter.
3. Drain rice thoroughly for a few minutes in a sieve.
4. Measure the amount of water needed.
5. Cook using the Magic 1-2-1 method.

The 2½ quart cooking vessel will be large enough to prevent the water from boiling over and to allow for the swelling of the rice. Each saucepan to be used will be fitted with a close-fitting lid. High heat will be used until the water boils. The mixutre of rice and water will be stirred once, covered, the flame lowered to low heat and the product simmered. ("Simmering" is the period when the rice absorbs water.) The rice will be allowed to dry, covered for ten minutes over low flame.

Experiments will be set up as follows:

No. 1 - SGR-1 1 cup rice short grain and 1½ cups water.

No. 2 - SGR-2 1 cup rice short grain and 2 cups water.

No. 3 - LGR-1 1 cup rice long grain and 1½ cups water.

No. 4 - LGR-2 1 cup rice long grain and 2 cups water.

The samples of cooked rice will be cooled and casually evaluated by five Home Economics students present in the research laboratory.

B. Milk-Effect Study

The purposes of this study are as follows:

1. To determine whether an untrained taste panel can detect differences when a standard evaporated milk is used in a recipe and when a standard evaporated filled milk is used.
2. To compare the two kinds of milk used when different dilution ratios of the milks are used in preparing four rice recipes.
3. To find the best dilution ratio of the milks for use in the four rice recipes.

Materials

Four rice recipes will be tried and retested in this preliminary study using two kinds of milk. The milks selected for this study are standard evaporated milk (Carnation) and standard filled milk (Milnot). Both of these milks are readily available in the Philippines. The milks used will be purchased from a large local supermarket in Stillwater at the time of the study. The required amounts of ingredients will be determined and purchased in bulk. For example rice, sugar, flour and so on. In order to preserve the quality of some fresh produce items like eggs and butter, a weekly

market order will be made. All cooking of the recipes will be done by the writer. The original size recipes were selected from different cookbooks. Prior tryouts of the original size recipes will be made.

The cans of milk will be cleaned and opened at each preparation time. The milks will be diluted and measured as accurately as possible with standard measuring utensils, ie., cups or quart measures. The different dilutions of milk will be incorporated in the rice recipes and each rice recipe will be organoleptically evaluated by a taste panel. Rice recipes will be prepared for six portions. Accurate weights of each ingredient using a dietetic scale will be recorded.

In this milk-effect study the recipe for six portions will be coded as follows:

1. Code A - Follow the pretested rice recipe exactly using undiluted evaporated milk.
2. Code B - Follow the pretested rice recipe using a 1:1 dilution of evaporated milk.
3. Code C - Follow the rice recipe using a 1:2 dilution of evaporated milk.
4. Code X - Follow the rice recipe using undiluted filled milk.
5. Cody Y - Follow the rice recipe using 1:1 dilution of filled milk.
6. Code Z - Follow the rice recipe using 1:2 dilution of filled milk.

Panel members will be selected to judge the products on the basis of qualitative factors such as flavor, color, texture, and acceptability. The evaluations of the judges will be determined statistically.

Taste Panel Preparation

Twelve persons, faculty and graduate students at Oklahoma State University, whose ages are twenty-three and above, will be asked to serve on the taste panel. A letter will be sent to them for their willingness to serve on the panel. The tasting will be conducted at the Food Research Laboratory of the Home Economics West. The room is quiet with comfortable room temperature, well lighted and equipped with clean partitioned booths for each judge, figure 1. Each booth will be provided with a chair, scoresheet and a tray containing a glass of water, napkin, fork, spoon and pencil, figure 2. The panel of food tasters will carry out their jobs free from the judgment of the other members and any distractions that may be posed by noise, vibrations and odors, figure 3. The tests will be conducted in the afternoons four times a week for three consecutive weeks with preparation of samples in the morning preceding each tasting session.

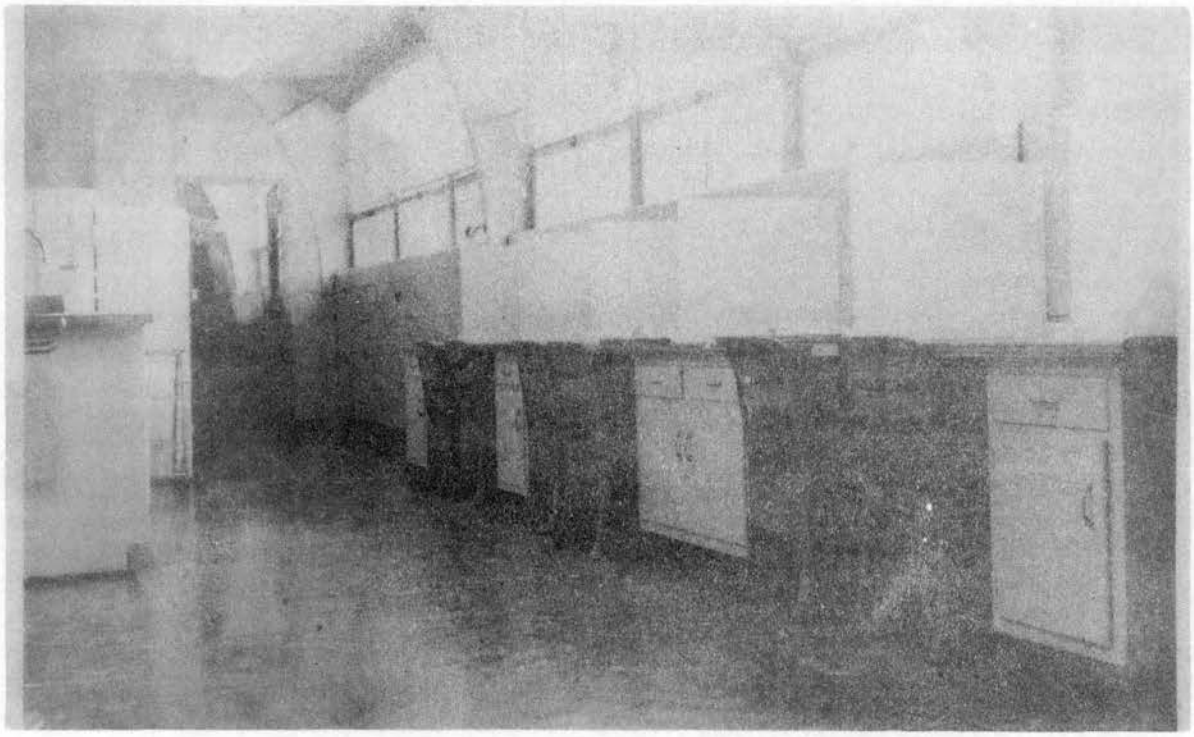

Figure 1. Taste Panel Preparation

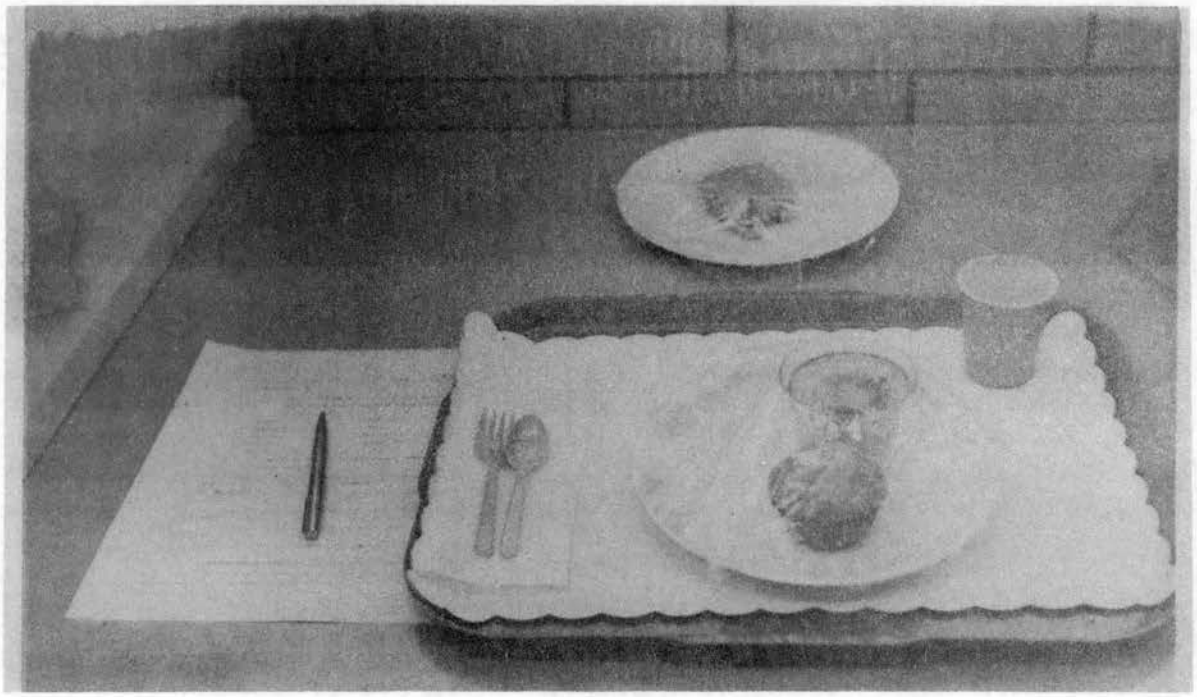

Figure 2. Taste Panel Sample Portion

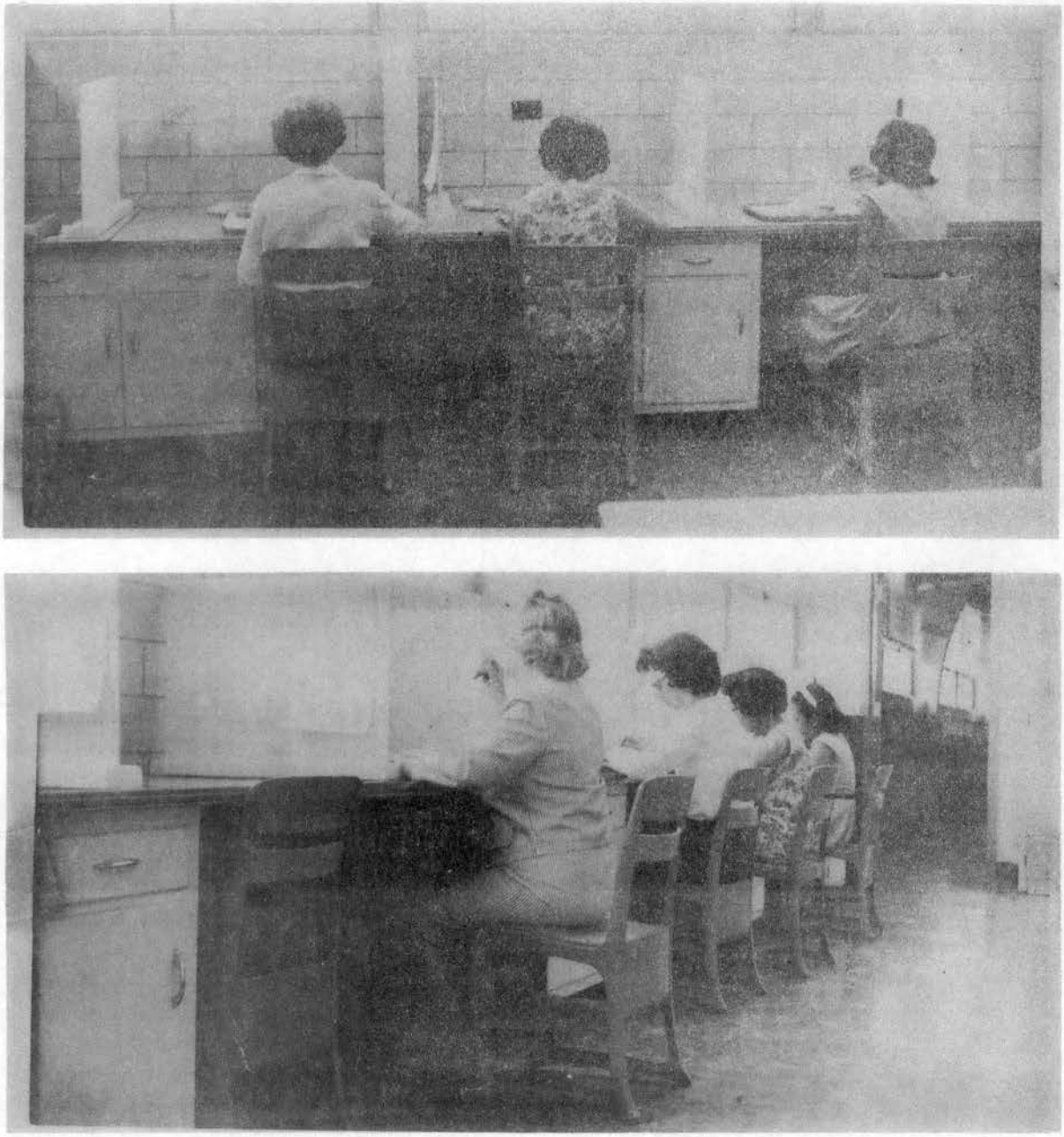

Figure 3. Taste Panel in Action

Scoring System To Be Used

As stated, the panel will be composed of Americans and Filipinos who are willing to participate in the study. Each panel participant will be provided with a scoring sheet to evaluate the recipes. Data will be gathered from the studies on the kinds of milk media to be used and the selection of a suitable milk dilution ratio to be utilized in the rice dishes. Using the different treatments, a statistical evaluation of the four rice recipes will be made. In order to assure an attractive, palatable and acceptable product a detailed score sheet will be devised. A sample scoresheet is adapted from the Hedonic Scale of the Quartermaster Research and Development Command, Quartermaster Corps, U.S. Armed Forces. This scale was designed for use by subjects without experience in food tasting.

In the evaluation of results, nine numerical scales of preference will be used with a score of nine (9), the highest preference and a score of one (1), the lowest preference. Further blank lines will be provided for suggestions and comments.

The results of the milk-effect study will be tabulated and summarized. The results will help determine the use of one milk and one dilution in the rice recipes to be standardized.

Statistical Analysis

Separate and individual statistical analysis of the panel's score sheets for each recipe will be made. The scores given by members of the panel will be ranked and the procedure outlined by Siegel, using the Friedman two way analysis of variance will be

Product_____ Date_____

Trial Number_____

Name_____

Directions: Before you are samples of a rice dish which is being tested. Please examine, taste, and score the samples carefully using the following scale:

Extremely Poor - 1
Very Poor - 2
Poor - 3
Below Fair - 4
Fair - 5
Below Good - 6
Good - 7
Very Good - 8
Excellent - 9

Quality Characteristics in Question	Samples						Comments
	A	B	C	X	Y	Z	
Color							
Texture							
Flavor							
Acceptability							
Suggestions for Improvement: _____							

Figure 4. Score Sheet for the Milk Effect Study

used to test the data for significance.

C. Standardization of Recipes

Selection of the original recipes was based on the following considerations - the flexibility of the recipe and adaptability of the recipe in terms of availability of ingredients and equipment in countries like the Philippines. See Appendix, page 89 for the original recipes selected. Standardizing the preparation of a product aims to avoid guesswork and gives a desirable form of an acceptable product. The prime concern of this study is the standardization of recipes for rice custard, rice muffins, rice with peanut butter and rice pudding. It is hoped to increase and standardize these four recipes to produce yields of 12, 25 and 50 portions. The actual research work will be centered on these recipes for institutional use, their revisions to improve the quality of the product and to simplify cooking procedures. The criteria for acceptability and product quality will be based on taste panel judging and scoring. Standard evaporated milk at a dilution selected in the milk effect study will be used. The method of cooking which will be decided will be utilized. Revisions and modifications will be made as needed for the succeeding testing. Records will be made of each yield and quality. Other factors, such as time, temperature and size of serving portions will be clearly recorded, making the changes after each trial. Each recipe will be tested at least three times or until judged acceptable.

A letter (see Appendix, page 87) will be sent out advising the former members of the milk effect taste panel of the continuation

of the research into recipe standardization. The tasting panel will be scheduled to judge on Monday, Wednesdays, and Fridays. The score sheet shown in Figure 5 will be used for the judging of the rice products. The rice dishes will be presented to members of the panel and will be scored using the adapted Hedonic Scale. There will be an evaluation of four qualities, namely color, flavor, texture and acceptability. In order to have a better evaluation of the products, space is provided for the taste panel member's comments and suggestions for improvements.

It is hoped that products from standardized recipes for 12, 25 and 50 portions may be successfully produced.

Product: Rice Recipes Date_____

Trial Number: _____

Directions: Before you are samples of a rice dish which is being tested. Please examine, taste, and score the samples carefully using the following scale:

Extremely Poor - 1
Very Poor - 2
Poor - 3
Below Fair - 4
Fair - 5
Below Good - 6
Good - 7
Very Good - 8
Excellent - 9

Evaluate the product on the basis of color, texture, flavor, and acceptability.

Name of Product	Score A	Comments
Rice Muffin		
Rice Pudding		
Rice Custard		
Suggestions for Improvement_____		

Figure 5. Score Sheet for the Rice Products

CHAPTER IV

RESULTS AND DISCUSSION

A. Perfecting a Method of Rice Cookery

Two kinds of rice types were tested: short grain rice (SGR) and long grain rice (LGR). Each kind was cooked in a saucepan on top of a gas-fired range. The process of cooking rice by the Magic 1-2-1 method was tried two times to determine an average simmering time at Stillwater, Oklahoma. (Note: the simmering time varies not only with the altitude, but also upon factors such as humidity and atmospheric pressure.) The simmering time was fixed at fourteen minutes. Table I shows the results of these trials. Also in

TABLE I

COOKING TWO KINDS OF RICE WITH

VARIED TIMES AND INGREDIENTS

Type of Rice	Ingredients		Time (minutes)	
	Rice 1 C (wt.gm)	Water (cups)	Simmering	Setting
Trial I				
Short Grain Rice				
SGR 1	204 gms	1½ c	20 min	10 min
SGR 2	200 gms	2 c	14 min	10 min
Trial II				
Short Grain Rice				
SGR 1	195 gms	1½ c	14 min	10 min
SGR 2	202 gms	2 c	14 min	10 min

TABLE I (Continued)

Type of Rice	Ingredients: Rice 1 c (wt.gm)	Ingredients: Water (cups)	Time (minutes): Simmering	Time (minutes): Setting
Trial I				
Long Grain Rice				
LGR 1	195 gms	1½ c	14 min	10 min
LGR 2	200 gms	2 c	14 min	10 min
Trial II				
Long Grain Rice				
LGR 1	193 gms	1½ c	14 min	10 min
LGR 2	193 gms	2 c	14 min	10 min

Table I is shown varied lengths of cooking time. From the time the samples of rice were put over the flame to the time the samples were considered cooked, the cooking time varied. The temporary taste panel of five selected the best among the four samples of rice presented.

After the product was cooked, the long grain rice gave a soft, tender product and mushy look or pasty characteristic. The short grain rice, however, was firm with tender grains, dry, flaky and had grains separate from each other. Generally, all the grains of the short grain sample were whole and distinct from each other. The majority of the five judges agreed that the long grain rice was best in appearance. When it came to the taste, most of the judges agreed on the flavor of short grain rice. Generally, all the grains of the short grain rice samples were whole and distinct from each other. Three out of the five judges preferred SGR-1, which had the characteristics of a good boiled rice. The product was not too soft and not too hard. The writer therefore, selected

the short grain rice to be used in the study and will use the proportion of one cup to one and one half cups of water.

Table II shows the results of the length of cooking times on the selected short grain rice. From the three trials an average length of cooking time for the short grain rice was determined to be 28 minutes. This length of cooking time will serve as a guide in cooking rice for the recipes to be standardized. "Simmering" time was considered to be from the time the rice was covered and the flame lowered until all water was absorbed. The "setting" period was from the end of "simmering" time until a dry product was obtained.

TABLE II

EFFECT OF COOKING METHODS ON SHORT GRAIN RICE

Type of Rice	Ingredients Rice 2C (wt.gms)	Water	Time (minutes) Boiling	Simmering	Setting	Total Cooking Time Minutes
Short Grain						
SGR 1-2 C	394 gms	3 c	6 min	13 min	10 min	29 min
SGR 2-2 C	392 gms	3 c	4 min	10 min	10 min	24 min
SGR 3-2 C	398 gms	3 c	7 min	14 min	10 min	31 min
Average Time Cooking of Rice	395 gms		6 min	10 min	10 min	28 min

A method of cooking rice was adapted for use throughout the standardizing of the rice recipes. This method is patterned after the Magic 1-2-1 method. The method for cooking the rice was as follows:

1. Measure and weigh two cups of short grain rice (395

grams) into a 2½ quart saucepan.

2. Wash rice grains once to remove dust and foreign matter.
3. Drain thoroughly until all the water is removed.
4. Measure three cups of water in pan with rice.
5. Set on the gas-fired stove on a high heat and bring to a boil (about six minutes).
6. Stir once. Cover and turn heat to low.
7. Simmer for 14 minutes until the water is absorbed.
8. Dry for another 10 minutes.

Generally it took about 30 minutes to cook the rice. Yield-3 cups.

B. Pre-testing of the Rice Recipes

The perfected method of cooking rice was utilized in standardizing the four rice recipes. Two of the rice recipes called for the use of raw rice. The writer tried the use of cooked rice in all of the proposed rice recipes. In these trials it was necessary to adapt a basic procedure to be followed throughout. The preliminary study resulted in rice recipes in which the amounts of ingredients were altered, the procedure was changed and the temperature adjusted in the original size recipes.

The panel members who served in judging these tentative recipes were five home economics students available at the time of product preparation. These temporary judges gave their critical opinions regarding the products as to texture, color and flavor. To have a more accurate study a formal tasting panel was utilized at the start of the milk-effect study and the standardizing of the rice

recipes for six portions.

The changes which were made were:

1. In the recipe for rice with peanut butter, the use of the double boiler for cooking rice was eliminated. Cooking rice in a double boiler is rarely practiced in the Philippines and this method was thought also to be tedious and difficult for institutional cooking.
2. In the recipe for rice custard, cooking by the double boiler method also was eliminated. Instead, a very low flame was used.
3. In the recipe for rice custard the folded egg whites were eliminated, since Philippine acceptance of the custard would be better without the spongy texture.
4. The baking temperatures for rice custard and rice muffins were determined to be 350°F and 375°F respectively.
5. Vanilla was used as a flavoring for rice custard, instead of lemon or almond extract.
6. In the recipe rice with peanut butter, peanut butter was increased from ½ cup to one cup. Onion flakes were omitted. Sugar was used.

C. Milk Effect Study:

To determine the best kind of milk and the level of dilution best suited for the four rice recipes, a milk effect study was made. The four rice recipes were prepared in six portion sizes with the following as variables: a) two kinds of milk, b) three levels of dilution. Each recipe was prepared six ways; each coded separately

as A, B, C, X, Y, and Z. The standard evaporated milk groups consisted of A = undiluted portion; B = 1:1 dilution ratio and C = 1:2 dilution ratio. The standard filled milk group consisted of X = undiluted portion; B = 1:1 dilution ratio and C = 1:2 dilution ratio.

Tables III, IV, V and VI show the scores given by the taste panel on all six samples of each rice recipe for trials 1, 2 and 3. Each sample was evaluated with respect to four quality characteristics: a) color, b) texture, c) flavor and d) acceptability. To test the statistical significance of the data presented, the Friedman 2-way analysis of variance was used. Samples A, B, C, X, Y and Z were designated as treatment and the twelve panel members as groups. The data of one panel member was eliminated, eventually, after she was absent several times. The scores were ranked as follows; the highest score was given a rank of 1, the next highest score, the rank of 2 and so on. Equal scores were given the average of tied ranks. The tables in the Appendix show the ranked data from the judges. Calculations, as outlined in Siegel, were made to determine whether the rank totals (R_j) for a given treatment differed significantly. The treatment with the smallest rank total indicated the best condition (kind of milk and level of dilution) under which the rice recipes were to be prepared and were proven to be statistically significant. A X_r^2 value was computed from the formula:

$$X_r^2 = \frac{12}{NK(K+1)} \sum_{Y=1}^{K} (R_j)^2 - 3N(K+1)$$

where N = number of rows
K = number of columns
Rj = sum of ranks in the jth column

The computed X_r^2 was compared with the tabulated X_r^2 associated with five degrees of freedom and at two significant levels of α = .05 and .10. Tables VII, VIII, IX and X show the calculated X_r^2 for the four rice recipes with respect to color, texture, flavor and acceptability respectively. A single asterisk indicates statistical significance at α = .05 and a double asterisk statistical significance at α = 0.10.

Selection of Dilution Ratio

The rank totals (R_j) for the samples A, B, C, X, Y and Z with respect to the quality characteristics of each rice recipe (see Appendix) were examined. Lower values were observed for samples B and Y in all of the four recipes and three trials. This indicated a panel preference for a dilution ratio of 1:1 in all four rice recipes. With a dilution ratio of 1:1 a comparison of scores received for the two kinds of milk was made.

The results in Table III show the score for standard evaporated milk to be generally lower than the score for standard filled milk in Trials I and II. This indicated a preference for standard evaporated milk for rice custard on the part of the judges. However, Trial III shows a preference for standard filled milk. The average score was found to be 34.0 and 29.0 respectively in terms of color, texture, flavor and acceptability. This reversal of scores in Trial III shows inconsistency and contrary results for the different trials. It seems either kind of milk, standard evaporated or standard filled, might be used to give an acceptable rice custard. There was no explanation for the reversal in Trial III.

TABLE III

SUM OF RANKED SCORES AT 1:1 DILUTION

RATIO FOR RICE CUSTARD

Quality Characteristics	Trial I		Trial II		Trial III	
	Std. Evap. Milk	Std. Filled Milk	Std. Evap. Milk	Std. Filled Milk	Std. Evap. Milk	Std. Filled Milk
Color	26	39	33	47.5	39	34
Texture	30.5	38	39	42	34.5	30
Flavor	27	33	33.5	40.5	36.5	34
Acceptability	27	31.5	32	44	34	29

The data in Table IV show that the lowest scores were found with the use of standard evaporated milk for the rice muffin. With one exception, consistent preference for standard evaporated milk was recorded for all three trials.

TABLE IV

SUM OF RANKED SCORES AT 1:1 DILUTION

RATIO FOR RICE MUFFIN

Quality Characteristics	Trial I		Trial II		Trial III	
	Std. Evap. Milk	Std. Filled Milk	Std. Evap. Milk	Std. Filled Milk	Std. Evap. Milk	Std. Filled Milk
Color	40.5	40	33.5	41	21	31.5
Texture	29	37	27.5	37	25	34
Flavor	29.5	39	31	37	25.5	31.5
Acceptability	31	42	29.5	36	22.5	29

Of the four rice recipes tasted at 1:1 dilution, higher ranked scores were given for rice with peanut butter. This was felt to indicate a less acceptable product. Again the sum of ranked scores

for products using standard evaporated milk was lower in all trials except III in comparison to the sum of scores for products using standard filled milk.

TABLE V

SUM OF RANKED SCORES AT 1:1 DILUTION RATIO FOR RICE WITH PEANUT BUTTER

Quality Characteristics	Trial I		Trial II		Trial III	
	Std. Evap. Milk	Std. Filled Milk	Std. Evap. Milk	Std. Filled Milk	Std. Evap. Milk	Std. Filled Milk
Color	39	45.5	30.5	36	22	27
Texture	31.5	46.5	35	31.5	25.5	30.5
Flavor	28	45	33	40	30.5	29
Acceptability	31.5	46	32.5	38	27.5	25.5

Table VI presents the sum of ranked scores for rice pudding when the panelists judged the over-all characteristics at 1:1 dilution of standard evaporated milk and standard filled milk. For the rice pudding, the lower ranked scores were found within the standard evaporated milk in Trial III, but were found in two cases in standard filled milk for Trials I and II. In terms of acceptability, all three trials indicate preference for standard evaporated milk.

To show the statistical significance of the data gathered, calculated X_r^2 are tabulated in Tables VII, VIII, IX and X.

In Table VII, the calculated X_r^2 indicates statistical significance for the effect of dilution and kinds of milk on color as shown in Trial III of rice custard. Trials I and III for rice

pudding and Trial I for rice with peanut butter. The kind of milk at a certain dilution ratio may indicate statistical significance on color for rice pudding. No statistical significance for rice custard and rice with peanut butter can be determined with significance in only one trial.

TABLE VI

SUM OF RANKED SCORES AT 1:1 DILUTION RATIO FOR RICE PUDDING

Quality Characteristic	Trial III		Trial II		Trial I	
	Std. Evap. Milk	Std. Filled Milk	Std. Evap. Milk	Std. Filled Milk	Std. Evap. Milk	Std. Filled Milk
Color	15.5	23	35	26	38.5	37.5
Texture	21.5	22.5	30.5	36.5	34	31
Flavor	22.0	22	40	32.5	33	39.5
Acceptability	19	26	30.5	34.5	32.5	39

TABLE VII

CALCULATED X_r^2 TO SHOW EFFECT OF DILUTIONS AND KINDS OF MILK USED ON COLOR

Rice Product	Trial I	Trial II	Trial III
Rice Custard	8.421	4.417	10.280*
Rice Muffin	1.8885	2.2005	5.235
Rice with Peanut Butter	11.060*	8.98	2.629
Rice Pudding	15.636**	6.887	98.053*

* = significant at 0.05

** = significant at 0.10

Any differences of the sum of ranked scores given to samples A, B, C, X, Y and Z of rice muffins with respect to color were probably due to chance or, as a whole, the panel was not able to detect any effect of the kinds of milk and dilutions on color.

The kinds of milk and levels of dilution were, however, significant factors that influenced the panel with respect to the color of rice pudding.

Only the data for Trial I of rice with peanut butter and Trial III of rice pudding were significant at $\alpha = .05$. No definite conclusion can be made about the effect of the kinds of milk and levels of dilution on rice custard and rice muffins with respect to texture. This seems inconsistent with the known fact that the amount of liquid has a marked influence on the texture of custards and muffins. Therefore, doubt may be cast on the use of an untrained panel for the particular kind of experiment conducted.

TABLE VIII

CALCULATED X_r^2 TO SHOW EFFECT OF DILUTIONS AND KINDS OF MILK USED ON TEXTURE

Rice Product	Trial I	Trial II	Trial III
Rice Custard	5.866	5.795	2.649
Rice Muffin	1.805	4.768	3.129
Rice with Peanut Butter	9.864*	3.858	0
Rice Pudding	1.355	8.278	6.61*

* = significant at 0.05

** = significant at 0.10

The panel was able to detect significant differences with respect to flavor (Table IX) among the six samples used for rice custard at Trial I, rice muffins at Trial II and rice pudding at Trial III and are indicative of a statistically significant preference for the kinds of milk and levels of dilution used in the particular recipes. Differences detected for rice with peanut butter were apparently due to chance and have no statistical meaning. No conclusion on the kind of milk used at a certain dilution can be made from only one significant trial.

TABLE IX

CALCULATED X_r^2 TO SHOW EFFECT OF DILUTIONS AND KINDS OF MILK USED ON FLAVOR

Rice Product	Trial I	Trial II	Trial III
Rice Custard	10.5010*	3.104	0.790
Rice Muffin	3.3368	9.658*	0.213
Rice with Peanut Butter	6.471	6.835	1.1727
Rice Pudding	9.7665**	4.001	8.79

* = significant at 0.05

** = significant at 0.10

Table X shows significant differences among samples with respect to acceptability detected at two trials for rice custard, none for rice muffins, one trial for rice with peanut butter, and none for rice pudding. Therefore, no conclusions can be made about the effect of kinds of milk and levels of dilution in the acceptabilities of rice muffins, rice with peanut butter and rice pudding. There

seemed to be a statistical significance on the effect of the kinds of milk at a dilution ratio of 1:1 for rice custard. Lowest sum of ranked scores was within the dilution level of 1:1 with the use of standard evaporated and standard filled milk.

TABLE X

CALCULATED X_r^2 TO SHOW EFFECT OF DILUTIONS AND KINDS OF MILK USED ON ACCEPTABILITY

Rice Product	Trial I	Trial II	Trial III
Rice Custard	11.541*	6.601	10.460*
Rice Muffin	5.004	3.741	1.77
Rice with Peanut Butter	8.9215	0	10.5675*
Rice Pudding	5.249	3.715	.3545

* = significant at 0.05

** = significant at 0.10

In general, some conclusions that may be made about the milk effect study are the following:

1. Rice with peanut butter gave the highest sum of ranked scores with respect to color, texture, flavor and acceptability. This indicated that there was generally a low preference for rice with peanut butter.
2. Samples B and Y (both of the 1:1 dilution ratio) gave the lowest sum of ranked scores of all six samples for all four rice recipes.
3. Inconsistency in the choice by the panel of either standard filled milk or standard evaporated milk was

observed for rice custard, while preference for the standard evaporated milk was indicated for rice muffins, rice with peanut butter and rice pudding.

4. Statistically the data gathered is not significant at the significance levels of .05 and 0.10. Values significant at the levels of .05 and 0.10 are found in only one trial and not duplicated in further trials, except for rice with peanut butter in Table VII and rice custard in Table X. Even data that showed significance seem to have been arrived at by chance or the panel was not consistent in judgment in all three trials for a given recipe. As a whole the panel was unable to detect differences among the six samples for judging presented of each recipe.
5. Based on the lower values of ranked scores, the author selected the use of standard evaporated milk at a 1:1 dilution ratio for all four rice recipes.

C. Standardization of Recipes

Six Americans and six Filipinos agreed to serve on the panel to evaluate the rice products presented at each testing. Each member of the panel used the score sheet devised. (See Figure 5, p. 44) Prime consideration was given to the quality characteristics, namely, color, texture, flavor and acceptability. A desirable goal for an acceptable product was a score of 7.0-(good) and 8.0-(very good) according to the numerical scale used. Scores obtained from each judge for each rice dish were summarized and tabulated. Average

ratings of the judges' scores were made for each recipe sampling.

Re-tested recipes (see Appendix, page 88) were standardized for 12, 25 and 50 portions. Standardization of the six portions of each rice recipe was simultaneously made during the milk-effect study. Then these recipes were mathematically increased to quantity portions by a factor yield of 2.0, 4.17 and 8.33, respectively, and computed by Aldrich's method of adjusting the recipe yield. The taste panel's choice of standard evaporated milk at 1:1 milk dilution ratio set the desired formulas for incorporating milk into the rice recipes as well as helping standardizing procedures and training the panel.

Successive changes were made as suggested in the evaluation of the product by the panelists. Modifications of the recipes for 25 and 50 portions of rice custard, rice muffins and rice pudding were made until the product was found satisfactory. These will be discussed in detail later.

Preparation and cooking of the rice samples was done the morning of each tasting session. Each judge was served one portion of each of the three recipes tested on a paper plate properly labeled. A plate containing a sample of each rice product was set aside for viewing by the panel. This could show surface, color and so on that the individual samples might not show. Serving portions of each rice recipe for 25, remaining after the panel judging were evaluated by women residents in Thatcher Hall. Samples placed on trays were given at random for evaluation. These college women were given the same score sheet devised for the panel but only the

scores of the regular panel members were recorded and tabulated. (See Appendix page 96). Since most of the "informal panel" did not have tasting experience, their comments merely served as a guide for the researcher. Scores were inspected and the comments and suggestions were taken into consideration where personal observation by the writer was made. Higher scores were given for the products by the college girls than the regular panel. The comments and suggestions of the regular panelists were found to be helpful in the development and testing of the rice recipes.

The ingredients were changed one at a time in each trial. The recipes were retested again for evaluation. This procedure was repeated four times or as often as necessary to obtain a satisfactory product. In each trial, the writer followed the standardized procedure taking accurate weights of each ingredient, following the steps in cooking, timing accurately and setting the oven temperature correctly. These items were also recorded: total yield of the final product, number of servings and size of each serving. The recipes for portions for rice custard, rice muffin and rice pudding are shown in Table XI. Changes made in each trial are shown.

Rice Custard

The 12 portion recipe for Rice Custard was evaluated three times. The recipe as calculated (factor of 2.0) was followed in the first trial. In the second trial the amount of egg was increased from four to eight per recipe in an attempt to increase coagulability and thus shorten preparation and baking time. The rice

TABLE XI

A SUMMARY OF RECIPES AND CHANGES

Rice Custard	6 Portions	12 Portions I	12 Portions II	12 Portions III	12 Portions IV	25 Portions I	25 Portions II	25 Portions III	25 Portions IV	25 Portions V	50 Portions I	50 Portions II
Milk	2 C	4 C	4 C	4 C		8½C	8½C				17 C	17 C
Rice	1 C	2 C	2 C	2 C		4½C	4½C				8½C	8½C
Egg Yolk	2	4	8	8		17	17				34	34
Sugar	½ C	1 C	1 C	1 C		2 1/8C	2 1/8C				4½C	4½C
Salt	¼ t	½ t	½ t	½ t		1 t	1 t				2 1/8t	2 1/8t
Vanilla	½ t	1 t	1 t	1 t		4 t	4 t				8 t	8 t
Nutmeg		--	--	--		Nutmeg	Nutmeg				Nutmeg	Nutmeg

Rice Pudding	6 Portions	12 Portions I	12 Portions II	12 Portions III	12 Portions IV	25 Portions I	25 Portions II	25 Portions III	25 Portions IV	25 Portions V	50 Portions I	50 Portions II
Rice	1½ C	1½C	1½C	2 C	2 C	6 C	6 C	6 C	6 C	6 C	12 C	12 C
Milk	2 C	3 C	2½C	2 C	2 C	8 C	8 C	8 C	8 C	8 C	16 C	16 C
Sugar	½ C	1 C	1 C	1 C	1 C	2 C	2 C	2 C	2 C	2 C	4 C	4 C
Salt	½ t	1 t	1 t	1 t	1 t	2 t	2 t	2 t	2 t	2 t	2 t	2 t
Lemon Peel	1 t	2 t	2 t	2 t	2 t	4 t	3 t.	3 t	coconut chocolate mocha	3t & Lemon Sauce	6 t	6 t
Nutmeg	¼ t	½ t	½ t	½ t	½ t	1 t	1 t	1 t	1 t	1 t	2 t	2 t
Raisin	½ C	1 C	1 C	2/3 C	2/3 C	1 1/3 C	1 1/3C	omit	1 1/3C	1 1/3C	2 2/3C	2 2/3C
Margarine	--	--	--	--	--	½ C	½ C	¼ C	¼ C	¼ C	½ C	½ C
Temperature:		350°F 2½ h	350°F. 2 h	350°F 1½ h	350°F 1½ h	350°F 1½ h	350°F 1½ h	350°F 1½ h	350°F 1½ h	350°F 1½ h	350°F 1½ h	350°F 1½ h

TABLE XI (Continued)

Rice Muffins 6 Portions		12 Portions				25 Portions					50 Portions	
		I	II	III	IV	I	II	III	IV	V	I	II
Flour, cake	2¼ C	2¼C	1 3/4C	1 3/4C	1½C	6¼C	6¼C	6¼C	6¼C		12½C	12½C
Rice	3/4C	1½C	1½ C	1½ C	1½C	3 C	2 C	2 C	2 C		4 C	4 C
Baking Powder	3½ t	3½t	3½ t	3½ t	14t	14 t	14t	14t	14t		8 T	8 T
Egg	2	4	4	4	4	5	5	5	5		10	10
Milk	1 C	2 /3C	2/3 C	2/3 C	½ C	1 C	1 C	1 C	1 C		2 C	2 C
Margarine	2 T	2 T	2 T	3 T	4 T	3/4C	½ C	½ C	1 C		1 3/4C	1 3/4C
									Crisco			
Salt	½ t	½ t	½ t	½ t	½ t	2 t	2 t	2 t	2 t		4 t	4 t
Sugar	3 T	3 T	3 T	3 T	3 T	1 1/3C	1 1/3C	1 1/3C	1 1/3C		2 2/3C	2 2/3C
Mixing Strokes		18	18	18	18	25	22	18	15		12	12

custard baked at 350°F for two and one half hours at the first trial and was decreased to two hours of baking at the second trial. In Trial II the product showed an increased structure of the rice custard. The same amount of egg was used and the mixture was baked again at 350°F in the third trial to determine if the same results would be yielded. Baking time was one and one half hours. Changes in the preparation time may be attributed to the changes in the writer's technique. Average scores given for Trials I, II, and III were 7.0, 7.16 and 7.90 respectively, with 7 (good) and 8 (very good). Consistent scores indicating continued improvement suggested the rice recipe was ready to be increased to 25 portions.

Five trials were made at the 25 portion stage. In the first trial, nutmeg was sprinkled on top to improve color and the appearance. This was done before baking time. Results of the average scores of Table XII showed the judges considered this an improvement of the rice custard. Improvement was due also to the increased amount of vanilla. Vanilla was increased to 1 tsp per six portion recipe. Most comments were favorable and higher scores resulted. The second trial was run again for the panel's evaluation. The judging panelists gave favorable evaluations of the product (average scores of 8.0 - very good - were given), except when some judges noted that the rice settled to the bottom of the custard dish. The writer stirred the mixture in the next trial. The milk-rice mixture was stirred before the addition of nutmeg prior to baking in the first trial at making 50 portions of rice custard. This was done also in the second trial. There was little improvement. The

product showed a semi-layer of rice custard mixture. Among the three recipes rice custard was well liked and accepted as shown by the consistent scores.

Comments of the panelists for rice custard were:

> nice on top, mild sweet flavor, excellent flavor, tender, smooth or fine texture, highly acceptable slight caramel flavor is pleasing and rice seems to keep its texture well.

Some suggestions in regard to the portion period were made on the use of salt in water when the rice was cooked. The need to increase the amount of sugar was evidenced among comments from the Filipino panel members. One reason may be due to the familiarity of the Filipinos with a sweeter type of custard. Sweetness was just right for the American panelists.

Table XII gives the calculated average scores of the three portions for the rice custard in each series of evaluations. Rice custard showed higher scores when the recipe for 25 and 50 portions were retested and re-evaluated, indicating adjustments made proved successful.

TABLE XII

AVERAGES OF TASTING PANEL SCORES FOR RICE CUSTARD

Treatment Number	12 Portions	25 Portions	50 Portions
Trial I	7.00	8.125	8.25
Trial II	7.16	8.50	8.50
Trial III	7.90		

Average scores of 7.0, 7.16 and 7.90 were given by the panelists

in the three trials of the 12 portion recipe. These scores indicate a good product. Consistent scores were obtained for the 25 and 50 portion recipes. The two trials showed average scores of 8.025 to 8.5, which may mean a satisfactory product was obtained. A score of 8.0 indicates a very good product. Since the product was found satisfactory and accurate in production it was decided not to standardize it further. The standardized recipe for 50 portions is as follows:

RICE CUSTARD

Ingredients	Weights	Measure
Milk	1½ gal	4¼ qts
Rice	1,400 gms	8½ c
Eggs	2 2/3 c	34
Sugar	720 gms	4¼ c
Salt	10 gms	2 1/8 tsp
Vanilla	2 2/3 Tbsp	8 tsp

Procedure:

1. Heat milk and cooked rice together for 15 minutes.
2. Beat in a bowl until smooth sugar, eggs and salt.
3. Add milk and rice slowly into egg mixture.
4. Cook until thick for one hour over a very low flame stirring often while cooking.
5. Cool slightly and add vanilla.
6. Place individual cups in an open flat pan withwater half-way up the cups.

7. Measure and spoon ½ cup of mixture into the individual cups.
8. Sprinkle with nutmeg.
9. Bake at 350°F for 1 hour. Test for doneness by inserting a knife.

Rice Pudding

Among the rice recipes being standardized rice pudding was less acceptable than the rice custard and the rice muffin according to the judges scores and comments. The panelists described the product as dull-looking in appearance and mushy and dry on top in Trial I of the 12 portion presentation. Although rice pudding was rated low in the 12 portions recipe, marked improvements were made by the final trials of this study. Taste evaluations were divided among the taste panelists. Some judges accepted the product highly with favorable comments. Other panelists preferred other products more than rice pudding. Rating scores were generally lower than for the products of other recipes.

Changes made to improve the rice pudding included the following items.

Selection of cooked rice and amount of milk was tried in Trials I, II, III and IV of the 12 portions of rice pudding recipe. This was done to try to shorten the baking time from two and one half hours to an hour or so. In trial I for 12 portions, 3 cups of milk were used with 1½ cups of cooked rice. Baking time still was found to be two and a half hours, so it was decided to use different levels of cooked rice and milk for Trials II and III. 1½ cups of rice and 2½ cups of milk were used at Trial II. At Trial III, 2

cups of rice and 2 cups of milk were used. See Table XI for the changes made. Scores obtained for the four trials were 6.33, 6.83, 7.0 and 7.50 respectively. Scores of 6.33 and 6.83 in Trials I and II indicate a product below the goal set so it was necessary to improve the product.

Raisins were decreased by one half cup in the 12 portions recipe. This was suggested by several panelists since a dominant raisin flavor was imparted. In the third trial for 25 portions, raisins were omitted as suggested by the comments of the panel members. The panel, however, preferred rice pudding with raisins and so these were replaced in Trial IV of the 25 portion recipe.

Margarine was added to improve the flavor at the start of the 25 portions recipe. This was done on Trials I and II of the 25 portions recipe. On Trial III the amount of margarine was decreased by ¼ cup since it was noted by the panelists that the product was greasy; ¼ cup of margarine was used in all the trials until the standardized recipe was obtained.

Several variations were tried, such as the use of lemon sauce in the fifth trial of the 25 portions and chocolate topping in the fourth trial of 25 portions; the use of different flavors of mocha, chocolate or coconut were tried in Trial IV of the 25 portion recipe. The panelists preferred rice pudding without the use of these flavorings. The diversion was aimed to improve the appearance of the product. In Trial II of the 12 portion recipe the lemon peel used was decreased by one teaspoon since a strong lemon flavor was detected by the panelists.

Aluminum foil was used to cover the pudding to prevent the loss of moisture at the 50 portion recipe in Trial I. This might also prevent the forming of scum on top of the product before the end of baking time. Foil was used from the start of baking until the end of baking time.

Comments for the rice pudding by the panelists were:

> pudding has more pronounced caramel flavor, rice seems softer, texture good, raisin dominates the flavor, taste excellent, good flavor, not too sweet, color could be improved, appearance wasn't too good, gummy or sticky, golden color well blended, soft and tender, moist yet firm, highly flavored, lemon sauce is a good addition and has improved the flavor, juice should be decreased.

Table XIV shows the average scores obtained for the rice pudding. The product rice pudding was accepted by the members of the panel although it was scored fairly at the different treatment numbers. Thus, the product was considered acceptable and standardized since consistent results were obtained.

TABLE XIII

AVERAGES OF TASTING PANEL SCORES FOR RICE PUDDING

Treatment Number	12 Portions	25 Portions	50 Portions
Trial I	6.33	7.83	7.33
Trial II	6.83	7.25	7.08
Trial III	7.0	7.42	----
Trial IV	4.50	7.50	----
Trail V	----	7.58	----

The following is the final recipe for Rice Pudding for 50 portions:

RICE PUDDING

Ingredients	Weights	Measure
Rice, cooked	1920 gms.	12 cups
Milk, diluted	1 gallon	4 qts.
Sugar	714 gms.	4 cups
Salt	16 gms.	4 tsp.
Lemon Peel	16 gms.	2 Tbsp.
Nutmeg	4 gms.	2 tsp.
Raisin	260 gms.	2 2/3 cups
Margarine	113 gms.	½ cup

Procedure:

1. Combine thoroughly all the ingredients.
2. Pour into two 11½ x 17½" pans. Mix evenly.
3. Cover with aluminum foil.
4. Bake at 350°F for 1½ hours.
5. Remove foil cover and continue to bake to brown top for 10 minutes.

TOTAL YIELD: 2 pans 6,912 gms.
25 servings per pan

SIZE PER SERVING: A portion 3½" x 21/3" x 1½" or ½ cup

Rice Muffins

The rice muffin recipe was developed and tasted four times in the 12 and 25 portion levels. Two levels of cake flour used at the 12 portion stage were 1 3/4 cups and 1 1/2 cups. These changes in

the amount of flour were made in an attempt to improve the crusty, cracked top surface and the uneven textured cell walls of the products. In the first trial of 12 portions, the original amount of 2 ¼ cups of flour was used. (See changes made in Table XI) The count of mixing strokes was decreased at the start of the 25 portions; the decrease was to try to produce a lighter and better textured product compared to the heavy compact product of the six and twelve portion recipe. The amount of strokes was decreased in the 25 portion recipes from 25 strokes in the first trial, to 22 in the second trial, to 18 strokes in the third and 15 strokes in the fourth trials. Finally, the number of strokes was decreased to 12 strokes in the 50 portion recipe. This number of strokes was used in the two trials for 50 portions. These changes were made since rice muffins in the 12 portions recipe continued to have a cracked, crusty top surface. The products were acceptable to the panelists although scores given were not as high as the scores obtained by the rice custard product. The scores were within the 7.0 (good) goal set. The average scores given in Trials I, II, III and IV were 7.50, 7.08, 7.09 and 8.09 respectively for 12 portion recipes. Similar scores can be seen during the first three trials with improvement at the fourth trial, see Table XIV.

In the first trial for 12 portions, the author decreased the amount of liquid from 1 cup to 2/3 cups of milk. In the second trial for 12 portions the amount of flour was changed from 2¼ cups to 1 3/4 cups. This was used to see if any change on the texture and the crusty surface would result. Since the judge's comments

indicated grainy parts of rice and specks of white in the six portion muffins, the rice incorporated in Trial I of the 12 portion recipe was well mashed by a fork. Well mashed rice was added at Trial II and in succeeding trials.

In the third trial, no changes were made in the proportion of ingredients, except with the amount of margarine. The amount of margarine was increased to three tablespoons to improve the tenderness of the product.

Since the texture of the product was still poor, it was decided that Trial IV of the 12 portion recipe would use 1½ cups of flour, ½ cup of milk, ½ cup of rice and 4 tablespoons of margarine. The judge's scores increased to 8.09 for the resulting product. Generally, the increase in score was associated with increased tenderness and acceptability of the baked product. The rice muffin was considered to be a fairly good product at this point.

The rice muffin recipe was increased to 25 portions using the 4.17 factor. The evaluations for the first trial of the 25 portion recipe were relatively similar to those for Trials I, II, III and IV of the 12 portion recipes. Average scores given for the four trials of the 25 portions recipes were: 7.42, 7.58, 7.67, 7.96 and 7.0, respectively. Scores showed improvement at each trial except for Trial IV when solid shortening (Crisco) was used. The resulting product was heavy and compact with thick uneven cell walls as well as a crusty top. For the second trial the rice was forced through a sieve to prevent the hard, grainy rice particles. The amount of rice was decreased to two cups, the amount of egg was changed to 1

instead of 2 and milk and margarine were each decreased by ½ cup (see Table XI). The author was encouraged to decrease the number of mixing strokes from 25 to 22. This would help prevent the forming of tunnels and the yielding of a heavy product. The scores obtained showed a slight increase from the first trial. A third trial was made to see if similar results could be obtained. In the third trial the same ingredient formula was followed. The number of mixing strokes was the only variable. The number of strokes was decreased again to 18. Scores (see page 62) obtained on this trial showed a slight increase indicating some scant improvement in the rice muffins. The resulting product, however, was viewed to be dry with large, uneven cell walls and with little improvement in the crust portion. Consistent scores of 7.0 to 7.96 were given to the rice muffins. Such scores indicated an acceptable product but more room for improvement of the product could be obtained.

In the next Trial, no. IV of 25 portions, solid shortening (Crisco) was used in place of margarine. This was tried to determine if a better product would be obtained with the use of shortening instead of margarine. The resulting product was described as crumbly, bland in flavor, of poor color with a high degree of volume. The texture was drier than the previous samples. The scores showed a slight decrease from the previous trials from 7.96 to 7.0, respectively. Because of the judge's reactions it was decided to continue to use margarine in the recipe.

The recipe was increased to produce 50 portions by the factor of 8.33. Two trials were made and the scores obtained were 7.33

and 8.08, respectively. Prior to Trial I of the 50 portions, it was decided that the formation of a hard crust might be prevented by cooking the rice to a longer and softer state. The cooked rice was prepared by adding 4 cups of water to the rice in the recipe for 50 portions. The rice was cooked until soupy. This rice mixture was then sieved similarly to the method used in the other trials. A homogeneous rice paste was obtained. The mixture was weighed and incorporated into the rice muffin recipe.

Predominance of baking powder was tasted by some of the panelists, so in the first trial of the 50 portion, baking powder was decreased by two teaspoons. The amount of margarine was decreased from 2 cups to 1 3/4 cups. These changes might give a lighter product. The number of mixing strokes was cut to 12. It was noted by the judges that a better product resulted. Scores given were 7.33 and 8.08 respectively for the two trials . The rice muffin seemed to be lighter than at the first evaluation of the recipe. A second trial was made following the same recipe. At Trial II an average score of 8.08 (very good) was obtained from the evaluation of the product. Since time was a limiting factor, the study was concluded. Further improvement of the quality of rice muffins undoubtedly may be obtained.

Judge's comments for the rice muffins included:

> greasy, a little heavy, rather rubbery,
> slightly large cell walls and tunnels
> are forming.

The greasiness of the rice muffins often observed by the panelists may have resulted from the amount of melted margarine brushed on

the tops after each baking period.

At the conclusion of the study favorable comments on rice muffins were given by the judges.

Results of the rice muffin evaluations determined from the taste panel responses were tabulated. After each judging, the scores were totalled (these are shown in Appendix E, p. 109) and average scores were calculated. The average of the judge's scores for rice muffins in all the series of evaluations are shown in Table XIV.

TABLE XIV

AVERAGES OF TASTING PANEL SCORES FOR RICE MUFFINS

	12 Portions	25 Portions	50 Portions
Trial I	7.50	7.42	7.33
Trial II	7.08	7.58	8.08
Trial III	7.09	7.67	----
Trial IV	8.09	7.96	----

The products in most trials were rated as "good" as shown from Table XIV. The judge's scores from Trial I showed a slight increase and were within the 7.0 (good) goal set.

The standardized recipe for Rice Muffins is as follows:

RICE MUFFINS

Ingredients	Weights	Measures
Flour, cake	1180 gms	12½ c
Rice, cooked	612 gms	4 c
Baking Powder	72 gms	8 Tbsp

Ingredients	Weights	Measures
Sugar	594 gms	2 2/3 c
Salt	16 gms	4 tsp
Eggs	2/3 c	10
Milk	1 pint	2 c
Margarine, melted	3/4 lbs	1 3/4 c

Procedure:

1. Preheat oven to 375° F.
2. Sift together the flour, sugar and salt.
3. Pass the cooked rice through sieve until soft and paste-like.
4. Blend the cooked rice with the dry ingredients.
5. Beat eggs until thick and fluffy.
6. Combine well beaten egg, slightly cooled melted shortening and milk together.
7. Make a well in the dry ingredients and stir in the liquid mixture. Use 12 strokes. (Do not overmix)
8. Fill muffin pans lined with paper baking cups with 1/3 cup batter.
9. Bake at 375°F for 25 minutes.
10. Brush tops with melted margarine while hot.

TOTAL YIELD: 50 portions 3,729 gms.

SIZE PER SERVING: 1 medium size muffin.

Rice with Peanut Butter

The product Rice with Peanut Butter was not developed past the

six portion size, since results from the milk-effect study gave unfavorably low scores. The scores of the product as evaluated by the eleven members of the panel may be reviewed in Appendix D, page 96.

CHAPTER V

SUMMARY AND CONCLUSIONS

Three selected rice recipes for Philippine use were developed and tested by a taste panel comprised of six Americans, two were American professors, and six Filipino graduate students acquainted with the problems of experimental research. A technique of cooking rice was perfected, and an effect study on two kinds of milk using various dilutions was evaluated by a taste panel. The responses of the members of the taste panel were subjected to statistical analyses to detect the significance of the kinds of milk and milk-dilution ratios used. The panel as a whole was unable to detect differences and the kinds of milk were not statistically significant at a level of .05 and .10, except in terms of color and acceptability, for rice pudding and rice custard, respectively. Evaporated milk at a ratio of 1:1 was chosen. The three selected rice recipes were then standardized into quantity sizes of 12, 25 and 50 portions.

The standardization of the rice recipes will permit their use in menus so a consistent quality of an acceptable Filipino food will be produced. The original recipes chosen were adjusted repeatedly and scored by the taste panel. The final recipes were accepted by the panel of judges after a number of trials resulted in a satisfactory product.

In summary, the following conclusions can be made:

1. The best proportions of rice and water were found to be one cup of rice to one and one-half cups of water.
2. Rice increases its volume approximately three times when cooked. An allowance for the size of the cooking vessel should be about three or four times the volume of the rice to be cooked.
3. Proper dilution of milk for cooking is necessary. A 1:1 dilution ratio of milk was judged desirable for cooking the selected recipes.
4. A known quantity of highly acceptable food is assured through the use of a tested recipe, quality ingredients and proper preparation techniques.

The selected rice recipes were Rice Custard, Rice Muffin, Rice Pudding and Rice with Peanut Butter. Among these rice recipes, Rice Custard was found most acceptable to the taste panel, as indicated by the scores and consistent yields of acceptable products. The recipe-Rice with Peanut Butter was not developed since it was consistently given low scores by the panel in the first judgings. The Rice Muffin and Rice Pudding recipes could achieve better quality but were well accepted by the taste panel at the conclusion of this research.

Since time was a limiting factor, it is possible further improvements in the quality of the products could have been obtained. It is hoped a similar study can be undertaken in the future to investigate the use of rice flour in these recipes. It is possible

that homogeneity of the mixtures for these rice recipes would be better through the use of rice flour.

SELECTED BIBLIOGRAPHY

1. Aldrich, Pearl J. Quality food means more than recipes. Journal of American Dietetic Association. 29:1089, 1953.

2. Aldrich, Pearl J. Tailor made recipes for modern food services. Journal of American Dietetic Association. 31:898, 1955.

3. Baker, Robert. Taste panel. Cornell University Hotel and Restaurant Administration Quarterly. 2:24, 1961.

4. Batcher, O. M. Cooking rice for school lunches. Journal of Home Economics. 48:36, 1956.

5. Bennett, A., B.M. Spoker, and M. Dodd. The value of training a sensory test panel. Food Technology. 10:225, 1956.

6. Blair, Eulalia. The simple puddings. Volume Feeding Management. 17:32, 1963.

7. Blair, Eulalia. The quick breads. Volume Feeding Management. 17:68, 1963.

8. Boggs, M. M. and H. L. Hanson. Analysis of foods by sensory difference tests. Advances in Food Research. 2:219, 1949.

9. Brandt, D. A. and E. P. Hutchison. Retention of taste sensitivity. Food Technology. 10:419, 1956.

10. Callahan, James and Pearl Aldrich. New methods of yield recipes. Journal of American Dietetic Association. 35:45, 1959.

11. Carlin, A. F., O. Kempthorne, and J. Gordon. Some aspects of numerical scorings in subjective evaluation of foods. Food Research. 21:273, 1956.

12. Cranmore, M. K. Mechanics of standardizing quantity recipes. Institutions. 33:166, 1953.

13. Cranmore, M. K. Willing hands aid recipe standardization. Institutions. 34:84, 1953.

14. Corbitt, Helen. Success with standardized recipes. Food Service. 21:58, 1959.

15. Dawson, E. H. Cooking quality of rice. Rice Journal. 2:16, 1960.

16. DeJesus, Pascuala. Rice - It's Nutritive Values and Culinary Uses. 2nd edition. Philippines: Carla Publication, 1960.

17. Desikachar, R. Changes leading to improved culinary properties of rice on storage. Advances in Food Research. 39:325, 1956.

18. Desikachar, H. S. and V. Subrahmanyan. Enrichment of rice with riboflavin. Food Technology. 16:146, 1962.

19. Dickens, Dorothy, Alexander Fanelli, and Virginia Ferguson. Attractive menu items. Journal of American Dietetic Association. 30:881, 1954.

20. Ericson, Myrtle H. Recipe standardization. Cornell University Hotel and Restaurant Administration Quarterly. 1:55, 1960.

21. Forty ways to prepare rice. Restaurant Management. 90:68, 1962.

22. Gerardot, N. F., D. R. Peryam, R. Shapiro. Selection of sensory testing panels. Food Technology. 6:140, 1952.

23. Goster, A. Approach to the panel studies of foods and the need for standardization. Food Technology. 8:304, 1954.

24. Griswold, Ruth M. The Experimental Study of Foods. Boston: Houghton Mifflin Company, 1962.

25. Hardworking recipe system. Volume Feeding Management. 13:61, 1959.

26. Harrison, and L. W. Elder. Some applications of statistics to laboratory taste testing. Food Technology. 4:434, 1950.

27. Hughes, O. Introductory Foods. 4th edition. New York: MacMillan Company, 1962.

28. Influence of processing on nutritive value of milled rice. Journal of Agricultural and Food Chemistry. 3:600, 1955.

29. Irving, George, et al. Food quality. American Association for the Advancement of Science. Washington: Donnelley and Sons Company, 1965.

30. Jansen, Pearl. Recipe constructions. Journal of American Dietetic Association. 29:125, 1953.

31. Jones, F. Prerequisite for Test Environment. Flavor Research

and Food Acceptance. New York: Arthur Little, Inc., Reinhold Publication Corporation, 1958.

32. Jordan, R., E. S. Wegner, and H. A. Hollender. Non-homogenized vs. homogenized milk in baked custards. Journal of the American Dietetic Association. 30:1126, 1954.

33. Juliano, Bienvenido. Studies on the physical chemical properties of rice. Journal of Agricultural and Food Chemistry. 12:134, 1964.

34. Justin, Margaret M., Lucille Rust, and Gladys Vail. Foods. 3rd edition. Boston: Houghton Mifflin Company, 1948.

35. Kavanaugh, Mary. Planning meals and testing recipes for school lunch. Practical Home Economics. 30:175, 1952.

36. Kik, et al. Cereals in nutritive value of rice germ. Journal of Agricultural and Food Chemistry. 2:1179, 1954.

37. Kotschevar, Lendal. Standards, Principles and Techniques in Quantity Food Production. Ann Arbor, Michigan: Edwards Bros., Incorporated, 1964.

38. Kramer, A. Glossary of some terms used in the panel evaluation of foods and beverages. Food Technology. 13:733, 1959.

39. Krumm, Jack. Truest evaluation in sensory panel tasting. Food Engineering. 27:74, 1955.

40. Lawton, R. D. Standardization leads to lower cost. Journal of American Dietetic Association. 33:106, 1957.

41. Little, A. D. Flavor Research and Food Acceptance. New York: Reinhold Publishing Corporation, 1958.

42. Lowe, Belle. Experimental Cookery. 4th edition. New York: John Wiley and Sons, Incorporated, 1958.

43. McFarlane, Alberta. Standardized recipe system works. Institutions. 44:23, 1959.

44. McMahon, Grace. A service for small institutions. Journal of American Dietetic Association. 26:884, 1950.

45. A method of choosing judges for sensory experiments. Food Research. 20:492, 1955.

46. Matz, Samuel. Food Texture. Connecticut: Avi Publishing Company, 1962.

47. Miller, Grace. Product standardization for quality and cost control. Journal of American Dietetic Association. 33:39, 1962.

48. Miller, Grace and Pearl Aldrich. Standardizing recipes for institutional use. Michigan State University Agricultural Expt. Station. Bulletin No. 233, 1963.

49. Moore, A. How standardized recipe files are built. Hospital Management. 75:85, 1953.

50. Peakham, Gladys. Foundations of Food Preparation. New York: MacMillan Company, 1964.

51. Proudfit, Fairfax. Normal and Therapeutic Nutrition. 12th edition. New York: MacMillan Company, 1958.

52. Rao, B. S. Vasudra Murthy. The amylose and amylopectin contents of rice and their influence on the cooking quality. Indian Academy of Science. 36:70, 1952.

53. Rice in food service. Volume Feeding Management. 18:28, 1962.

54. Shugart, Grace. Standardized recipes. School Lunch Journal.

55. Siegel, Sidney. Nonparametric Statistics for the Behavioral Sciences. New York: McGraw Hill Book Compahy, Inc., 1956.

56. Spearman, Rosa. How recipe standardization pays dividends. School and College Cafeteria. 4:18, 1941.

57. Sweetman, Marion and Ingeborg MacKellar. Food Selection and Preparation. 4th edition. New York: John Wiley and Sons, Inc., 1957.

58. The standardized recipe menu system works. Volume Feeding Management. 13:46, 1959.

59. Weidlin, A. S. National Standards in a Modern Economy. New York: Harper and Brothers Publishers, 1962.

60. West, Bessie and La VelleWood. Food Service in Institutions. New York: John Wiley and Sons, Inc., 1955.

61. Wilmot, Jennie. Food for the Family. 5th edition. Chicago: J. B. Lippincott Company, 1960.

A P P E N D I C E S

APPENDIX A

LETTERS

Food, Nutrition and Inst. Adm. Dept.
Oklahoma State University
Stillwater, Oklahoma
December 9, 1965

Dear _____,

A research study is to be conducted this semester on the standardization of quantity rice recipes for Philippine use.

Your cooperation and participation as a taste panel member will be greatly appreciated, since you are familiar with the experimental problems of research.

There will be an evaluation of four rice dishes during the preliminary testing. Testing of the recipes will be done in the Home Economics West--Room 403. Please check the following to indicate whether you can participate in the study and suggest the time convenient for you, preferably in the afternoon on Tuesdays, Wednesdays, Fridays and Saturday mornings.

Yes, I will participate_____

No, I cannot participate_____

Time convenient for me_____

Please send your reply to Foods, Nutrition and Inst. Administration Department, Room 103 East Home Economics Building.

Thank you,

Milagros S. Florendo
Graduate Student

Miss Mary E. Leidigh
Assoc. Professor

Food, Nutrition & Inst. Adm. Dept.
Oklahoma State University
Stillwater, Oklahoma
February 21, 1966

Dear_____,

Thank you very much for serving as a member of the panel. Your cooperation is greatly appreciated.

There will be a continuation of standardizing the methods of the rice recipes. If you are willing to continue to serve as a member of the panel, do respond. Definite days for the testing of the recipes have been set. They are Mondays, Wednesdays, and Fridays starting February 25, Friday. The samples will be ready from 1:00-5:00 pm at your convenience. Testing will be held at the same place, Research laboratory, Home Economics West Building, 403.

Please indicate in the enclosed envelope and mail your reply to Room 108, Home Economics East Building before Friday.

Sincerely yours,

Milagros S. Florendo
Graduate Student

APPENDIX B

RECIPES

ORIGINAL SIZE RICE RECIPES

RICE CUSTARD

Ingredients:

Rice, cooked	1 cup
Milk	2 cups
Egg yolks	2
Sugar	½ cup
Salt	¼ teaspoon

Heat in double boiler the cooked rice and milk. Beat until smooth the egg yolks, sugar and salt. Add the milk and rice slowly. Pour back into the double boiler and cook until thick. Fold in two egg whites stiffly beaten. Add ½ teaspoon vanilla or lemon peice to taste. Approximate no. servings (4 to 6).

Reference: Wilma Perkins, The Fannie Merritt Farmer - Boston Cooking School Cookbook (Boston: Little, Brown and Co., 1959), p. 352.

ORIGINAL SIZE RICE RECIPES

OLD TIME RICE PUDDING

Ingredients:

Rice, raw	½ cup
Milk	4 cups
Sugar	½ cup
Salt	½ teaspoon
Lemon Peel	1 teaspoon
Nutmeg	½ teaspoon
Raisins (seeded)	½ cup

Combine rice, milk, sugar and salt. Pour into greased 1½ quart baking dish. Bake in slow oven, 300°F; 1 hour, stirring several times. Add lemon peel, nutmeg and raisins. Continue baking 2 to 2½ hours. 2/3 cups sugar may be used in place of granulated sugar.

Approximate no. servings (6).

Reference: Better Homes and Garden New Cookbook (Meredith Publ. Co., 1953), p. 199.

ORIGINAL SIZE RICE RECIPES

RICE MUFFINS

Ingredients:

Flour, bread	2¼ cups
Rice, cooked	3/4 cups
Baking Powder	3½ teaspoon
Egg	1
Sugar	3 teaspoons
Milk	1 cup
Butter or substitute	2 teaspoons
Salt	½ teaspoon

Sift together the flour, salt and baking powder. Add the sugar and the rice. Mix them in thoroughly. Then moisten with the well beaten egg, melted shortening and milk. Beat thoroughly and bake in well oiled muffin pan. Approximate no. servings (6).

Reference: Wilma Perkins, The Fannie Merritt Farmer--Boston Cooking School Cookbook (Boston: Little, Brown and Co., 1959), p. 352.

ORIGINAL SIZE RICE RECIPES

RICE WITH PEANUT BUTTER

Ingredients:

Rice, raw	1/3 cup
Water	1 cup
Peanut Butter	½ cup
Milk	1 cup
Onion, chopped or flaked	1 teaspoon
Salt	1 teaspoon

Wash rice and add 1 cup boiling water with salt. Boil 5 minutes and cook in a double boiler until water is absorbed. Mix the peanut butter until smooth with a portion of 1 cup of milk. Add to rice with remaining milk and the flaked onion. Cook 30 minutes until rice is tender. Approximate no. servings (6).

Reference: Alice Bradley Menu Cookbook (New York: MacMillan Company, 1922), p. 183.

RICE CUSTARD
(To Be Standardized)

Ingredients	6 Portions	12 Portions	25 Portions	50 Portions
Rice, cooked	1 c	2 c	4 1/8 c	8½ c
Milk	2 c	4 c	8¼ c	16 2/3 c
Egg yolks	2	4	8	17
Sugar	½ c	1 c	2 1/8 c	4 1/8 c
Salt	¼ t	½ t	2 1/8 t	2 t
Vanilla	½ t	1 t	2 1/8 t	4 1/8 t

Procedure:

1. Heat in a double boiler milk and cooked rice.
2. Beat until smooth the egg yolks, sugar and salt.
3. Add the milk and rice slowly.
4. Pour back into saucepan and cook until thick for one hour.
5. Cool and add vanilla.
6. Spoon ½ cup mixture into individual custard cups.
7. Bake at 350°F for 1 hour at steam bath.

RICE WITH PEANUT BUTTER
(To Be Standardized)

Ingredients	6 Portions
Rice, cooked	1 c
Peanut Butter	1 c
Milk	1½ c
Onion, flaked	omit
Sugar	½ c
Salt	¼ t

Procedure:

1. Combine all ingredients.
2. Pour into greased 1½ quart baking pan.
3. Bake at 350°F. for 1½ hours.

RICE PUDDING
(To Be Standardized)

Ingredients	6 Portions	12 Portions	25 Portions	50 Portions
Rice, cooked	1½ c	3 c	6¼ c	12½ c
Milk, diluted	3½ c	7 c	14 3/4 c	29½ c
Sugar	½ c	1 c	2¼ c	4 1/8 c
Salt	½ t	1 t	2 1/8 t	4 1/8 t
Lemon Peel	1 t	2 t	4 1/8 t	8 1/3 t
Nutmeg	¼ t	½ t	1 1/8 t	2 1/3 t
Raisins, seeded	½ c	1 c	2 1/8 c	4 1/8 t

Procedure:

1. Combine rice, milk, sugar and salt.
2. Pour into 1½ quart baking dish.
3. Add lemon peel, nutmeg and raisins.
4. Pour into 1½ quart baking dish.
5. Bake for 2 - 2½ hours at 350°F.

RICE MUFFIN
(To Be Standardized)

Ingredients	6 Portions	12 Portions	25 Portions	50 Portions
Flour, Cake	2¼ c	4½ c	9¼ c	18 3/4 c
Rice, cooled	3/4 c	1½ c	3 1/8 c	6¼ c
Baking Powder	3½ t	7 t	3 t	8 t
Egg	2	4	8	16
Sugar	3 T	6 T	13½ T	2c+1T
Milk, diluted	1 c	2 c	4 1/8 c	8 1/3 c
Margarine, melted	2 T	4 T	9 T	1c+2T
Salt	½ t	1 t	2 1/8 t	4 1/8 t

Procedure:

1. Sift together the flour, sugar, salt and baking powder.
2. Make a well and mix in the liquid mixture.
3. Combine the well-beaten egg, milk and melted shortening.
4. Stir slightly. Count 15-18 strokes.
5. Measure 1/3 cup batter and spoon into the muffin tins.
6. Bake in paper lined muffin pans at 375°F for 25-30min. Preheat oven.

APPENDIX C

GUIDES OR POINTERS FOR TASTE PANEL SCORING

GUIDES OR POINTERS FOR TASTE PANEL SCORING

1. The scorer is seated. The scorer will examine the food as carefully as possible using the teaspoon or fork.
2. Aroma of sample may be tested.
3. Tasting:
   a. The tempo of tasting should be slow and a long time may be required.
   b. Before tasting next sample-wait for two minutes. Scorer must rinse mouth or drink water before a second sample is tested.
4. Please do not talk about the samples with other members of the taste panel who may be present.
5. Some pointers which may help you with your comments, opinions, and suggestions for improvement are:

Description of Factors

Color

eye appeal

attractiveness

Texture

overcooked, undercooked, cooked just right

dry, tough, or watery

mushy, grainy, or gritty

tender, smooth or firm

Flavor

tasty, appetizing, or well-blended flavor

uneven distribution of ingredients

sweet, too sweet, or too flat

increase the ingredient (name it)

decrease the ingredient (name it)

Acceptability

acceptable, just right, enjoyed, like very much

not acceptable, poor, disliked

APPENDIX D

MILK-EFFECT STUDY

Rice and Peanut Butter Trial 1

Panel Member	Color						Texture						Flavor						Acceptability					
	A	X	B	Y	C	Z	A	X	B	Y	C	Z	A	X	B	Y	C	Z	A	X	B	Y	C	Z
1.	1.5	3	4.5	4.5	6	1.5	3.5	3.5	3.5	3.5	3.5	3.5	5.5	5.5	3	3	1	3	6	4.5	4.5	6.5	1	2.5
2.	3.5	3.5	3.5	3.5	3.5	3.5	6	4	4	1.5	1.5	4	6	3	3	3	1	5	4.5	4.5	2.5	2.5	1	6
3.	3.5	3.5	3.5	3.5	3.5	3.5	4	1.5	1.5	4	6	4	6	4.5	2	3	1	4.5	6	3	5	3	1	3
4.	1.5	1.5	3.5	5.5	5.5	3.5	4	4	2	6	1	4	1	4.5	2	4.5	4.5	4.5	1	2.5	2.5	4.5	6	4.5
5.	2.5	6	5	2.5	2.5	2.5	1	2.5	2.5	4.5	6	4.5	5	6	3.5	3.5	1.5	1.5	5	5	2.5	5	1	2.5
6.	1	2.5	2.5	5	5	5	3	3	3	6	3	3	2	2	2	5	5	5	1.5	3	1.5	5	5	5
7.	1.5	1.5	3	4.5	6	4.5	2.5	2.5	1	5	5	5	1	3.5	3.5	3.5	6	3.5	1	2	4	4	6	4
8.	1.5	1.5	4.5	4.5	4.5	4.5	2	2	4	5.5	5.5	2	1.5	4.5	1.5	4.5	4.5	4.5	2	2	2	4.5	6	4.5
9.	1.5	5	1.5	3	5	5	1.5	1.5	4	4	4	6	2	3.5	1	5.5	5.5	3.5	1	3.5	2	5.5	5.5	3.5
10.	4	1.5	6	4	1.5	4	1.5	3	1.5	4.5	6	4.5	5	2	2	5	2	5	3	3	3	5.5	1	5.5
11.	1.5	3	1.5	5	5	5	2	2	4.5	2	4.5	6	1	4.5	4.5	4.5	2	4.5	1	4	2	4	6	4
Total	23.5	32.5	39.0	45.5	48.0	42.5	31.0	29.5	31.5	46.5	46	46.5	36.0	43.5	28	45	34.0	44.5	32	37	31.5	46	39.5	45.0

SS^2 = 9,310 | 9,264 | 9,133.50 | 9,086.50

X_r^2 = .026(9,310)-231 | .026(9,264)-231 | .026(9,133.50)-231 | .026(9,086.50)

= 11.060* | = 9.864* | = 6.471 | = 5.249

Rice and Peanut Butter Trial 2

Panel Member	Color						Texture						Flavor						Acceptability					
	A	X	B	Y	C	Z	A	X	B	Y	C	Z	A	X	B	Y	C	Z	A	X	B	Y	C	Z
1.	5	2	2	5	5	2	3.5	3.5	3.5	3.5	3.5	3.5	2.5	5	2.5	5	1	5	2.5	5	2.5	5	1	5
2.	5.5	2.5	2.5	2.5	5.5	2.5	2.5	5	2.5	2.5	2.5	6	2.5	5	2.5	5	1	5	3	5	1.5	5	1.5	5
3.	3	3	3	3	6	3	4.5	4.5	2	2	6	2	5	3.5	3.5	1.5	6	1.5	4.5	4.5	2.5	1	6	2.5
4.	2.5	5.5	2.5	2.5	2.5	5.5	2	5	2	5	2	5	2.5	5	2.5	5	1	5	4	4	4	4	1	4
5.	1.5	5.5	3.5	3.5	1.5	5.5	4.5	4.5	1.5	1.5	4.5	4.5	4	4	1.5	1.5	6	4	2	5	2	2	5	5
6.	1.5	1.5	3	4.5	4.5	6	1.5	1.5	4	4	6	4	3	1.5	1.5	5.5	5.5	4	3	1.5	1.5	5	5	5
7.	4.5	4.5	4.5	1.5	4.5	1.5	5	2.5	2.5	2.5	6	2.5	4.5	4.5	4.5	4.5	1.5	1.5	4	1	4	4	4	4
8.	5.5	2	2	4	5.5	2	6	3.5	3.5	3.5	1	3.5	4.5	4.5	4.5	2	1	4.5	6	3.5	3.5	3.5	1	3.5
9.	1	3.5	3.5	3.5	6	3.5	1.5	3.5	5	1.5	3.5	6	3	5.5	3	3	1	5.5	1	5	5	2.5	2.5	5
10.	5.5	1.5	1.5	3.5	5.5	3.5	3.0	3.0	6.0	3.0	3.0	3.0	4.5	4.5	4.5	4.5	1.5	1.5	4.5	4.5	4.5	4.5	1.5	1.5
11.	2.5	5.5	2.5	2.5	5.5	2.5	2.5	2.5	2.5	2.5	5.5	5.5	5.5	5.5	2.5	2.5	2.5	2.5	4.5	4.5	1.5	1.5	4.5	4.5
Total	38	37	30.5	36.0	52	37.5	36.5	39.0	35.0	31.5	43.5	45.5	41.5	48.5	33	40	28	40	39	43.5	32.5	38	33.0	45

$SS^2 = 9,149.50$

$X_r^2 = .026(9,149.50) - 231$

$= \underline{6.887}$

$.026(9,033.00) - 231$

$= \underline{3.858}$

$.026(9,147.50) - 231$

$= \underline{6.835}$

$.026(9,027.50) - 231$

$= \underline{3.715}$

Rice with Peanut Butter Trial 3

Panel Member	Color						Texture						Flavor						Acceptability					
	A	X	B	Y	C	Z	A	X	B	Y	C	Z	A	X	B	Y	C	Z	A	X	B	Y	C	Z
1.			2.5	2.5	2.5	2.5			4	2.5	2.5	1			4	2.5	2.5	1			4	2	2	2
2.			1.0	4	2.5	2.5			4	3	1.5	1.5			4	1.5	1.5	3			4	1.5	1.5	3
3.			2.5	2.5	2.5	2.5			3	1	3	3			3	3	1	3			3.5	1.5	1.5	3.5
4.			2	4	2	2			1.5	3.5	3.5	1.5			2	4	2	2			2	4	2	2
5.			3.5	1.5	1.5	3.5			3	1.5	4	1.5			2	4	2	2			3	3	3	1
6.			1	3	3	3			3	3	1	3			2	2	2	4			1.5	3.5	1.5	3.5
7.			1	4	3	2			1	3.5	3.5	2			1	3	3	3			1	3.5	3.5	2
8.			1.5	1.5	3.5	3.5			1	3	3	3			3	3	3	1			1	2.5	4	2.5
9.			1.5	1.5	3.5	3.5			1	3.5	2	3.5			3	3	3	1			1.5	1.5	3.5	3.5
10.			3.5	1.5	3.5	1.5			2	2	2	4			3.5	1.5	1.5	3.5			3.5	1.5	1.5	3.5
11.			2	1	3	4			2	4	2	2			3	1.5	4	1.5			2.5	1	4	2.5
Total			22	27	30.5	30.5			25.5	30.5	28	26			30.5	29	25.5	25			27.5	25.5	28	29

$X_r^2 = .054(3,104.25) - 165$ $\quad .054(3,040.50) - 165$ $\quad .054(3,046.50) - 165$ $\quad .054(3,031.50) - 165$

$X_r^2 = \underline{2.6295}$ $\quad = \underline{0}$ $\quad = \underline{1.1727}$ $\quad = \underline{.3545}$

Rice Custard Trial 1

Panel Member	Color						Texture						Flavor						Acceptability					
	A	X	B	Y	C	Z	A	X	B	Y	C	Z	A	X	B	Y	C	Z	A	X	B	Y	C	Z
1.	3	3	1	5.5	3	5.5	4.5	2.5	4.5	1	2.5	6	4	2	2	2	5.5	5.5	4	1.5	4	1.5	4	6
2.	4	2	2	5.5	2	5.5	2	3.5	1.0	5.5	3.5	5.5	3.5	2	1	5	3.5	6	3.5	2	1	5	3.5	6
3.	1	6	3.5	3.5	3.5	3.5	4.5*	1.5	4	4	4	6	5.5	2	2	2	4	5.5	4	1.5	1.5	4	4	6
4.	4.5	4.5	1	2	3	6	2.5	1	2.5	4.5	6	4.5	2	1	4	4	6	4	2	2	4.5	2	6	4.5
5.	2.5	1	2.5	4	6	5	2.5	1	2.5	4.5	6	4.5	2	1	4	4	6	4	2	2	4.5	2	6	4.5
6.	4	2.5	1	5.5	2.5	5.5	2.5	2.5	1	4	6	5	5.5	4	2	2	2	5.5	5.5	2	1	3	4	5.5
7.	2.5	2.5	2.5	2.5	6	5	3	6	3	3	3	3	6	3.5	1.5	1.5	3.5	5	6	3.5	1.5	1.5	3.5	5
8.	2	5	2	2	5	5	3.5	6	1	3.5	3.5	3.5	4	4	1	4	4	4	4	4	1	4	4	4
9.	3.5	1.5	3.5	5.5	1.5	5.5	6	4.5	2.5	4.5	2.5	1	5.5	5.5	3.5	3.5	2	1	5.5	5.5	3	4	1.5	1.5
10.	5.5	3.5	3.5	1.5	5.5	1.5	4.5	4.5	4.5	1.5	4.5	1.5	5.5	3.5	1	3.5	2	5.5	5	3.5	1.5	3.5	1.5	6
11.	5.5	3.5	3.5	1.5	5.5	1.5	5	3	5	2	5	1	1.5	5	5	1.5	3	5	3.5	5.5	3.5	1	5.5	2
Total	38	35	26	39	43.5	49.5	37.5	36	30.5	38	46.5	41.5	45	33.5	27	33	41.5	51	45	33	27	31.5	43.5	51

$$X_r^2 = \frac{12}{NK(K+1)} \Sigma j = (Rj)^2 - 3N(K+1)$$

$$X_r^2 = \frac{12}{11(6)(6+1)} \left[(38)^2 + (26)^2 + (43.5)^2 \text{---}\right] - 3(11)(6+1)$$

$$X_r^2 = \frac{12}{462}(9{,}208.50) - 231 \qquad (9{,}111.00) \qquad (9{,}288.50) \qquad (9{,}328.50)$$

$$X_r^2 = .026(9{,}208.50) - 231 = \underline{8.4210} \qquad = \underline{5.866} \qquad = \underline{10.5010}^* \qquad = \underline{11.5410}^*$$

Rice Custard Trial 2

Panel Member	Color						Texture						Flavor						Acceptability					
	A	X	B	Y	C	Z	A	X	B	Y	C	Z	A	X	B	Y	C	Z	A	X	B	Y	C	Z
1.	2.5	4.5	1	6	4.5	2.5	1.5	5.5	1.5	3.5	3.5	5.5	1	5.5	2.5	4	2.5	5.5	1	4.5	2	4.5	4.5	4.5
2.	4.5	4.5	1	2	3	6	3	1	3	3	5.5	5.5	3.5	1.5	3.5	1.5	5.5	5.5	4	2.5	2.5	1	5.5	5.5
3.	3.5	3.5	5.5	1.5	5.5	1.5	2	2	5	5	5	2	2.5	5	2.5	6	2.5	2.5	2	5	2	5	5	2
4.	2.5	2.5	1	5	5	5	1	2.5	5	5	2.5	5	1	3.5	3.5	6	3.5	3.5	1	3.5	3.5	3.5	3.5	6
5.	2	1	4	6	4	4	2	1	5.5	3.5	3.5	5.5	1.5	1.5	4.5	4.5	3	6	1.5	1.5	4.5	4.5	3	6
6.	2.5	2.5	5	2.5	6	2.5	2.5	6	2.5	4.5	4.5	1	6	3.5	5	3.5	1.5	1.5	4.5	4.5	4.5	4.5	1.5	1.5
7.	1	4.5	2	4.5	4.5	4.5	4	6	1.5	4	4	1.5	3	6	1	3	5	3	2.5	6	1	4.5	4.5	2.5
8.	2	5.5	3	5.5	1	4	1.5	5.5	3.5	5.5	3.5	1.5	4	5.5	2	5.5	2	2	2.5	5	2.5	6	2.5	2.5
9.	4	4	4	4	1	4	3.5	3.5	5.5	1.5	5.5	1.5	6	5	2	2	4	2	5.5	5.5	4	2	2	2
10.	5.5	3.5	1.5	5.5	1.5	3.5	5	5	1	5	2.5	2.5	4	6	1.5	1.5	4	4	4	6	1	4	2	4
11.	2	2	5	5	5	2	2	5	5	2	5	2	1	3	5.5	3	5.5	3	1.5	4.5	4.5	4.5	4.5	1.5
Total	32	38	33	47.5	41	39.5	28	43	39	42	45	33.5	33.5	46	33.5	40.5	39	38.5	30	40.5	32	44	31.5	38

$X_r^2 = \frac{12}{462}(9,054.50)-231$ $\quad \frac{r}{462}(9,107.50)-231$ $\quad \frac{12}{462}(9,004.2)-231$ $\quad \frac{12}{462}(9,138.50)-231$

$X_r^2 = .026(9,054.50)-231 = \underline{4.4170}$ $\quad = \underline{5.795}$ $\quad = \underline{3.104}$ $\quad = \underline{6.6010}$

Rice Custard Trial 3

Panel Member	Color						Texture						Flavor						Acceptability					
	A	X	B	Y	C	Z	A	X	B	Y	C	Z	A	X	B	Y	C	Z	A	X	B	Y	C	Z
1.	2.5	1	5	5	5	2.5	3	1.5	5	5	5	1.5	3	1	5.5	5.5	3	3	2.5	1	5	5	5	2.5
2.	6	2.5	2.5	2.5	2.5	5	6	4	1.5	1.5	4	4	5.5	5.5	2.5	2.5	2.5	2.5		3.5	3.5	1	3.5	3.5
3.	5.5	2.5	2.5	2.5	2.5	5.5	4.5	4.5	1.5	1.5	4.5	4.5	4.5	4.5	4.5	1.5	4.5	1.5	4	4	4	1	4	4
4.	4.5	1.5	4.5	1.5	4.5	4.5	3.5	1	3.5	3.5	6	3.5	5.5	1	5.5	3	3	3	5.5**	1	2.5		5.5	2.5*
5.	1.5	1.5	5.5	3.5	3.5	5.5	3	1	5	3	3	6	1.5	1.5	3.5	5	3.5	6	1.5	1.5	3.5	5.5	3.5	5.5
6.	2	4.5	2	4.5	2	6	6	3	4.5	2	4.5	1	5	2.5	4	2.5	6	1	6	3	5	2	4	1
7.	6	2.5	5	2.5	2.5	2.5	5	3.5	1.5	1.5	3.5	6	5	2.5	1	2.5	5	5	5.5	3	1	3	3	5.5
8.	4	4	4	4	1	4	5.5	5.5	2.5	2.5	2.5	2.5	5	5	2	2	5	2	5.5	5.5	2.5	2.5	2.5	2.5
9.	5.5	1.5	3.5	1.5	3.5	5.5	6	4	4	1.5	4	1.5	4	6	4	1.5	4	1.5	4.5	4.5	4.5	1.5	4.5	1.5
10.	5.5	5.5	3	3	1	3	3	6	3	3	3	3	5.5	5.5	2	2	2	4	4.5	6	2	2	2	4.5
11.	5.5	3.5	1.5	3.5	1.5	5.5	5	5	2.5	5	1	2.5	4	5	2	6	2	2	5.5	3	3	5.5	1	3
Total	48	30.5	39	34	29.5	49.5	50.5	37	34.5	30	41.0	36	48.5	40	36.5	34	38.5	31.5	45.5	35	34	29	33	33.5

$$X_r^2 = \frac{12}{11(6)(7)} (9,280) - 231$$

$X_r^2 = .026(9,280.00) - 231$ $= \underline{10.280}^*$

$X_r^2 = .026(8,986.50) - 231$ $X_r^2 = \underline{2.649}$

$X_r^2 = .026(8,915.00) - 231$ $= \underline{0.790}$

$X_r^2 = .0285(7,735.50) - 210$ $= \underline{10.460}^*$

Rice Muffin Trial 1

Panel Member	Color						Texture						Flavor						Acceptability					
	A	X	B	Y	C	Z	A	X	B	Y	C	Z	A	X	B	Y	C	Z	A	X	B	Y	C	Z
1.	1	4	2.5	5	1.5	4.5	1.5	4.5	6	3	1.5	4.5	1	5.5	3.5	5.5	2	3.5	1.5	4	4	6	1.5	4
2.	1	3.5	3.5	3.5	2	6	2	6	2	4.5	4.5	2	2	5	2	5	2	5	1	6	3.5	3.5	3.5	3.5
3.	2	5	5	5	3.5	5.5	3.5	5.5	1.5	3.5	1.5	5.5	2.5	5	1	5	2.5	5	2	5	2	5	2	5
4.	2.5	5.5	2.5	2.5	5	2	*(5	2	2		4	2	5	3.5	1.5		3.5	1.5	4	4	1.5		4	1.5)
5.	1.5	3	5	5	6	2	6	2	3.5	3.5	1	5	4	2	4	6	1	4	3.5	2	3.5	6	1	5
6.	2	4.5	2	4.5	5.5	2.5	5.5	2.5	1	4	2.5	5.5	5.5	4	1	2.5	2.5	5.5	5.5	2	1	4	3	5.5
7.	3.5	3.5	3.5	3.5	6	5	6	5	2	4	2	2	6	3.5	3.5	3.5	3.5	1	5.5	5.5	3	3	3	1
8.	2	4.5	4.5	2	5	1	5	1	2.5	5	5	2.5	4	4	4	1	4	4	3.5	3.5	3.5	3.5	3.5	3.5
9.	5	2	5	2	1	4	1	4	2	5	3	6	3.5	3.5	3.5	3.5	3.5	3.5	2	5	2	5	2	5
10.	3.5	3.5	3.5	3.5	3	5	3	5	5	1.5	5	1.5	5.5	2.5	5.5	2.5	2.5	2.5	4	4	6	1.5	4	1.5
11.	3.5	3.5	3.5	3.5	3.5	6	3.5	6	3.5	3.5	3.5	1	1.5	6	1.5	4.5	4.5	3	2.5	6	2.5	4.5	4.5	1
Total	27.5	42.5	40.5	40	31.5	46.5	37	41.5	29	37	29.5	35.5	35.5	41	29.5	39	28	37	31	43	31	42	28	35

$$X_r^2 = \frac{12}{10(6)(7)}(8,957.25)-231 \qquad .0285(7,431.75)-210 \qquad (7,485.50) \qquad .0285(7,544.00)-210$$

$$.026(8,957.25)-231 \qquad = \underline{1.805} \qquad = \underline{3.3368} \qquad = \underline{5.004}$$

$$= \underline{1.8885}$$

Rice Muffin Trial 2

Panel Member	Color						Texture						Flavor						Acceptability					
	A	X	B	Y	C	Z	A	X	B	Y	C	Z	A	X	B	Y	C	Z	A	X	B	Y	C	Z
1.	4.5	1	6	2.5	4.5	2.5	5	2	2	5	2	5	5	1	2.5	5	2.5	5	5	1	2.5	5	2.5	5
2.	1	4.5	2.5	4.5	2.5	6	1	4	2.5	5.5	2.5	5.5	2	2	2	5	5	5	1.5	3.5	1.5	5.5	3.5	5.5
3.	5.5	5.5	3.5	3.5	1.5	1.5	4.5	4.5	1.5	1.5	4.5	4.5	4	6	1.5	4	1.5	4	4	6	1.5	4	1.5	4
4.	5.5	3.5	1	5.5	3.5	2	1.5	5.5	1.5	3.5	3.5	5.5	5.5	3.5	1.5	1.5	5.5	3.5	3.5	3.5	1	3.5	6	3.5
5.	3.5	5.5	3.5	1.5	3.5	5.5	6	4.5	2.5	1	4.5	2.5	5	5	1	2.5	5	2.5	4.5	6	1.5	1.5	4.5	3
6.	3.5*	3.5	1.5	5	1.5	3.5	4	4	1	4	6	2	6	4.5	4.5	1	2.5	2.5	6	3.5	5	1	3.5	2
7.	1.5	3.5	6	3.5	3.5	3.5	3.5	1.5	5.5	3.5	5.5	1.5	5.5	1	3	3	3	5.5	3.5	1	3.5	3.5	3.5	6
8.	3.5	1.5	4	6	4	4	2	4	5.5	2	5.5	2	2.5	2.5	5.5	2.5	5.5	2.5	2.5	2.5	5.5	2.5	5.5	2.5
9.	1.5	3	3	3	3	6	4	2	2	5.5	2	5.5	6	4.5	4.5	4.5	1	4.5	3.5	3.5	3.5	3.5	3.5	3.5
10.	3	2.5	1	2.5	4.5	4.5	6	2.5	2.5	2.5	2.5	5	6	1	5	3	3	3	6	3	3	3	3	3
11.	6	5.5	1.5	3.5	1.5	5.5	3	5.5	1	3	3	5.5	2	5	2	5	2	5	3	5.5	1	3	3	5.5
Total	39	39.5	33.5	41	33.5	44.5	40.5	40	27.5	37	41.5	44.5	49.5	36	31	37	36.5	43	43	39	29.5	36	40	43.5

X_r^2 = .026(8,969.225)-231 = 2.2005

.026(9,068.50)-231 = 4.768

.026(9,257.50)-231 = 9.695*

.026(9,028.50)-231 = 3.741

Rice Muffin Trial 3

Panel Member	Color						Texture						Flavor						Acceptability					
	A	X	B	Y	C	Z	A	X	B	Y	C	Z	A	X	B	Y	C	Z	A	X	B	Y	C	Z
1.			1.5	1.5	3.5	3.5			2.5	4	1	2.5			2	3.5	1	3.5			2.5	2.5	1	4
2.			2	4	2	2			4	2.5	2.5	1			4	2	2	2			3.5	3.5	2	1
3.			2.5	2.5	2.5	2.5			3	3	1	3			3.5	3.5	1.5	1.5			2.5	2.5	2.5	2.5
4.			1.5	3.5	1.5	3.5			2.5	2.5	2.5	2.5			1.5	1.5	3.5	3.5			1		2.5	2.5
5.			2.5	2.5	1	4			1	3	3	3			1	3	3	3			1.5	3.5	3.5	1.5
6.			1.5	3.5	1.5	3.5			1	2.5	4	2.5			3.5	1.5	1.5	3.5			4	1.5	1.5	3
7.			2.5	2.5	2.5	2.5			2	4	2	2			3	4	1.5	1.5			1.5	4	3	1.5
8.			1.5	3	1.5	4			1.5	3.5	1.5	3.5			1	2.5	4	2.5			1	3	3	3
9.			1.5	3.5	1.5	3.5			1.5	3.5	1.5	3.5			2.5	2.5	2.5	2.5			2.5	2.5	2.5	2.5
10.			3	1	3	3			3.5	1.5	1.5	3.5			1.5	3.5	1.5	3.5			2	2	2	4
11.			1	4	2.5	2.5			2.5	4	1	2.5			2	4	2	2			1.5	4	1.5	3
Total			21	31.5	23	34.5			25	34	21.5	29.5			25.5	31.5	24	29			22.5	29	22.5	26

X_r^2 = .054(3,152.50)-165 = 5.235

.054(3,113.50)-165 = 3.129

.054(3,059.50)-165 = 0.213

.06(2,529.50)-150 = 1.77

Rice Pudding Trial 1

Panel Member	Color						Texture						Flavor						Acceptability					
	A	X	B	Y	C	Z	A	X	B	Y	C	Z	A	X	B	Y	C	Z	A	X	B	Y	C	Z
1.	1	2	5	3	4	6	1.5	1.5	4.5	4.5	3	6	2	2	4	5	2	6	1	2	3.5	5	3.5	6
2.	2	2	2	5	5	5	1	2.5	4	2.5	6	5	1	3	3	3	5	6	1	3.5	2	3.5	5.5	5.5
3.	2	5	5	2	2	5	4.5	6	4.5	1.5	1.5	3	4	6	4	1.5	1.5	4	4	4	4	1.5	1.5	6
4.	1	6	4.5	4.5	4.5	4.5	2.5	6	2.5	2.5	2.5	5	1.5	4	1.5	6	4	4	1.5	6	1.5	4	4	4
5.	2	5	3.5	3.5	1	6	1.5	5	6	3.5	1.5	3.5	2	5.5	5.5	3.5	1	3.5	2	6	4.5	2	2	4.5
6.	2	5	4	2	2	6	2	4.5	4.5	2	6	2	4.5	2.5	2.5	1	4.5	6	5	3.5	3.5	1	2	6
7.	1.5	1.5	4	4	4	6	1.5	6	3	1.5	4	5.0	1.5	3.5	2	5.5	3.5	5.5	1	2	3.5	5	3.5	6
8.	1	2.5	5	2.5	5	5	2.5	6	2.5	2.5	5	2.5	1	4	4	4	4	4	1	4	4	4	4	4
9.	5.5	5.5	2	4	1	3	6	4.5	1.5	4.5	3	1.5	5	6	3.5	1	3.5	2	5.5	5.5	3.5	3.5	1	2
10.	5	5	1.5	5	3	1.5	6	5	2	4.0	2	2	2.5	5	1	5	2.5	5	5	5	1	5	2.5	2.5
11.	5.5	5.5	2	2	4	2	4.5	6	2.0	2.0	4.5	2.0	2	5.5	2	4	5.5	2	3	6	1.5	4.5	4.5	1.5
Total	28.5	45	38.5	37.5	35.5	50	33.5	53	34	31	38	37.5	27	47	33	39.5	37	48	30	47.5	32.5	49	34.5	48

$X_r^2 = .026(9,486.00)-231$

$X_r^2 = \underline{15.636}^*$

$.026(8,566.50)-231$

$X_r^2 = \underline{1.355}$

$X_r^2 = .026(9,260.25)-231$

$X_r^2 = \underline{9.7665}^*$

$X_r^2 = .026(9,227.75)-231$

$= \underline{8.9215}$

Rice Pudding Trial 2

Panel Member	Color						Texture						Flavor						Acceptability					
	A	X	B	Y	C	Z	A	X	B	Y	C	Z	A	X	B	Y	C	Z	A	X	B	Y	C	Z
1.	1	2	3.5	3.5	5.5	5.5	4	1.5	1.5	4	4	6	2.5	1	2.5	4.5	4.5	6	2.5	1	2.5	5	5	5
2.	1.5	1.5	3	4.5	4.5	6	1	5.5	3	3	3	5.5	2	5	2	5	5	2	1	4.5	2	4.5	4.5	4.5
3.	2.5	5	5	1	2.5	5	3	4	4	4	3	3	2	5	5	5	2	2	2	5	5	5	2	2
4.	5.5	2.5	1	2.5	4	5.5	6	5	1.5	1.5	3.5	3.5	5	5	1.5	1.5	3	5	5	5	1	2	3	5
5.	1.5	1.5	3.5	3.5	5	6	2.5	4.5	1	2.5	6	4.5	2	5.5	3.5	1	5.5	3.5	1.5	5	1.5	3	5	5
6.	3	4.5	2	1	6	4.5	5.5	5.5	3	3	1	3	1.5	6	4.5	1.5	3	4.5	1.5	6	3.5	5	1.5	3.5
7.	1.5	5.5	3.5	1.5	3.5	5.5	3.5	3.5	6	3.5	1	3.5	3.5	1	5.5	3.5	2	5.5	2.5	4.5	6	2.5	1	4.5
8.	4.5	4.5	1.5	1.5	4.5	4.5	5	6	2.5	2.5	2.5	2.5	2.5	2.5	5.5	2.5	5.5	2.5	5	5	2	2	2	5
9.	5.5	5.5	4	2	2	2	6	3	3	5	1	3	3	6	5	3	1	3	5.5	5.5	4	2.5	1	2.5
10.	4.5	4.5	4.5	1.5	1.5	4.5	2.5	6	2.5	5	2.5	2.5	5.5	5.5	2	2	2	4	2.5*	5	4		1	2.5*
11.	5.5	5.5	3.5	3.5	1.5	1.5	5.5	5.5	2.5	2.5	2.5	2.5	5.5	5.5	3	3	3	1	3	3	3	3	3	3
Total	36.5	42.5	35	26	40.5	50.5	44.5	50	30.5	36.5	30	39.5	35	48	40	32.5	36.5	39	29.5	44.5	30.5	34.5	28	40

$X_r^2 = .026(9,230.00)-231$

$X_r^2 = \underline{8.98}$

$X_r^2 = .026(9,203.00)-231$

$X_r^2 = \underline{8.278}$

$X_r^2 = .026(9,038.50)-231$

$X_r^2 = \underline{4.001}$

$X_r^2 = .0285(7,355.00)-210$

$= \underline{0}$

Rice Pudding Trial 3

Panel Member	Color						Texture						Flavor						Acceptability					
	A	X	B	Y	C	Z	A	X	B	Y	C	Z	A	X	B	Y	C	Z	A	X	B	Y	C	Z
1.			1	2	4	3			1	2	3.5	3.5			1	2	4	3			1	2	4	3
2.			1.5	1.5	4	3			1	2	3.5	3.5			2.5	2.5	2.5	2.5			1	2	3.5	3.5
3.			1	3.5	3.5	2			1	2.5	4	2.5			2	2	4	2			1.5	3.5	3.5	1.5
4.			1.5	3	4	1.5			2	2	4	2			1.5	1.5	3.5	3.5			2	2	4	2
5.			1	2.5	4	2.5			1	2	4	3			1	2	1.5	3.5			1	2	3	4
6.			1	2.5	4	2.5			2	1	3	4			2.5	1	2.5	4			2	1	3	4
7.			1	1	4	1			2.5	2.5	2.5	2.5			2.5	1	4	2.5			2	2	4	2
8.			1.5	1.5	3.5	3.5			1	2.5	2.5	4			1	3.5	3.5	2			1	3.5	3.5	2
9.			4	1.5	3	1.5			3	3	3	1			3	2	4	1			4	2.5	2.5	1
10.			1	1	4	1			3.5	1.5	1.5	3.5			1	2.5	4	2.5			2	2	2	4
11.			1	3	2	4			3.5	1.5	1.5	3.5			4	2	2	2			1.5	3.5	1.5	5
Total			15.5	23	40	25.5			21.5	22.5	33	33			22	22	37.5	28.5			19	26	34.5	32

$X_r^2 = .054(3,019.50) - 165$

$X_r^2 = \underline{98.053}^*$

$X_r^2 = .054(3,146.50)$

$X_r^2 = \underline{6.61}^*$

$X_r^2 = .054(3,186.50)$

$X_r^2 = \underline{8.79}$

$X_r^2 = .054(3,251.25) - 165$

$= \underline{10.5675}^*$

APPENDIX E

RATING SCORES

Rating Scores for Rice Custard

12 Portions				25 Portions			50 Portions		
Panel Members	Trial Number 1	2	3	Panel Members	Trial Number 1	2	Panel Members	Trial Number 1	2
1.	7	7	7	1.	8	9	1.	8	8
2.	6	6	8	2.	9	8	2.	8	8
3.	7	6	9	3.	8	8	3.	8	9
4.	7	7	8	4.	8	8	4.	9	8
5.	5	7	7	5.	7	9	5.	9	9
6.	5	8	8	6.	8.5	8	6.	8	9
7.	8	7	8	7.	8	9	7.	8	8
8.	9	6	7	8.	9	9	8.	8	8
9.	9	8	8	9.	8	8	9.	8	9
10.	7	6	9	10.	7	9	10.	9	8
11.	8	8	8	11.	9	8	11.	8	9
12.	8	8	---	12.	8	9	12.	---	9
Average Ratings	7.16	7.00	7.90		8.125	8.5		8.25	8.5

Rating Scores for Rice Muffin

12 Portions					25 Portions						50 Portions				
Panel Members	Trial Number 1	2	3	4	Panel Members	Trial Number 1	2	3	4	5	Panel Members	Trial Number 1	2	3	4
1.	6	7	9	8	1.	8	7	9	8	9	1.	8	7	6	7
2.	6	7	8	9	2.	7	7	7	9	6	2.	8	7	8	9
3.	4	7	7	8.5	3.	6	7	8	8.5	7	3.	9	9	8	8
4.	7	7	7	9	4.	8	8	8	9	8	4.	8	8	7	8
5.	5	6	8	8	5.	8	8	7	8	5	5.	8	9	7	8
6.	6	4	6	6	6.	6	7	7	6	7	6.	8	9	8	7
7.	9	7	8	8	7.	9	9	8	8	7	7.	9	8	9	9
8.	7	8	8	6	8.	6	7	7	6	8	8.	7	9	8	7
9.	8	9	8	9	9.	9	7	9	9	5	9.	8	9	8	8
10.	7	8	9	7	10.	7	9	6	7	8	10.	6	8	7	7
11.	8	7	9	8	11.	8	6	7	8	6	11.	8	7	8	8
12.	7	8	---	9	12.	7	9	9	9	8	12.	7	7	7	8
Average Ratings	7.5	7.08	7.09	8.09		7.42	7.58	7.67	7.96	7.00		7.33	8.08	7.06	7.08

Rating Scores for Rice Pudding

12 Portions					25 Portions						50 Portions		
Panel Members	Trial Number 1	2	3	4	Panel Members	Trial Number 1	2	3	4	5	Panel Members	Trial Number 1	2
1.	5	8	6	8	1.	7	5	8	8	7	1.	7	8
2.	7	7	7	9	2.	8	7	7	9	7	2.	8	7
3.	4	5	6	9	3.	8	7	8	9	8	3.	9	8
4.	5	4	6	8	4.	9	5	9	8	7	4.	8	8
5.	7	8	7	7	5.	6	8	9	7	7	5.	8	8
6.	3	4	7	6	6.	8	8	6	6	8	6.	5	9
7.	8	6	8	8	7.	8	7	9	8	8	7.	9	7
8.	8	8	6	7	8.	7	7	8	7	7	8.	7	8
9.	7	9	7	8	9.	9	7	8	8	8	9.	6	8
10.	8	8	9	7	10.	7	9	7	7	9	10.	7	8
11.	6	7	8	5	11.	9	8	8	5	7	11.	7	7
12.	8	8	---	8	12.	8	9	8	8	8	12.	---	8
Average Ratings	6.33	6.83	7.00	7.50		7.83	7.25	7.42	7.5	7.58		7.33	7.08

VITA

Milagros S. Florendo

Candidate for the Degree of

Master of Science

Thesis: STANDARDIZING SELECTED QUANTITY RICE RECIPES FOR USE IN THE PHILIPPINES

Major Field: Food, Nutrition and Institution Administration

Biographical:

Personal Data: Born at Manila, Philippines, July 6, 1941, the daughter of Arsenio R. and Pilar L. Florendo.

Education: Graduated in High School from St. Theresa's College in 1957, received the Bachelor of Science degree from the University of the Philippines in 1961, with a major in Nutrition and Dietetics.

Experiences: Faculty member of the Far Eastern University, Philippines, 1962; served Dietetic Internship at the Far Eastern University Hospital, Philippines 1961-62; passed the Civil Service Exams for Dietitians given by the Philippine Government 1962.

Date of Final Examination: May, 1966