IMPROVEMENT OF BREAD CONTAINING FRUIT JUICE

BY WITTHAWAT KASAYAPANANT

A special project submitted to the Faculty of Biotechnology, Assumption University in part fulfillment of the requirement of the degree of Bachelor of Science in Biotechnology

2008

IMPROVEMENT OF BREAD CONTAINING FRUIT JUICE

BY WITTHAWAT KASAYAPANANT

A special project submitted to the Faculty of Biotechnology, Assumption University in part fulfillment of the requirement of the degree of Bachelor of Science in Biotechnology

2008

Improvement of Bread Containing Fruit Juice

Name: Witthawat Kasayapanant

Project advisor: A. Nootrudee Siriboon

Academic year: 2008

Title:

N. Sint

(Ms. Nootrudee Siriboon) Advisor

All rights reserved by Faculty of Biotechnology Assumption University

Abstract

Bread containing strawberry fruit juice was improved by product development method. The main scope of this study was to develop strawberry bread product by improving quality attributes and approving the final product by sensory evaluation method. Sweet bun yeast was selected to use in bread by higher fermentation power in sweet formula. Varying the amount of strawberry juice, addition of strawberry flavor and incorporation of strawberry jam were operated to improve the product preference. Significant differences in the product preference level were observed. The analytical and sensory data showed that the final product was approved by consumer test (p < 0.05).



Acknowledgement

Respectively, I would like to express my gratitude to my lovely project advisor, A. Nootrudee Siriboon who helped, stimulated the suggestions and encouraged me in all the time of research form the beginning to writing of this special project.

Furthermore, I have to thank for my faculty members, my study advisor, APornpen P., Biotechnology friends, senior friends, junior friends and all those who gave me the possibility to complete this project

Especially, I would like to give my special thanks to my parents, my brother and my sister, the sweet family who patiently love and enable me to complete this work.



THE ASSUMPTION UNIVERSITY LIBRARY

List of Content

	Page
Abstract	i
Acknowledgement	ii
List of Content	iii
List of Table	iv
List of Figure	v
Introduction	1
Objectives	2
Literature review	3
Material and Method	9
Result and Discussion	15
Conclusion	27
Recommendation	28
References	29
Appendix A: Preliminary experiment	30
Appendix B: Product development	32
Appendix C: Consumer acceptance	46

List of Table

Table		Page					
1	Basic formula of bread with fruit juice	9					
2	Basic formula of sweet bun	10					
3	Adjusted formula of strawberry bread						
4	Strawberry bread formula varying the amount of strawberry juice	12					
5	Strawberry bread formula varying the strawberry flavor	12					
6	Strawberry bread formula with addition of strawberry jam	13					
7	Job description timeline	14					
8	Product Development Time Line in 2008						
9	Bread quality average score and standard deviation from scoring						
	test on two different breads made from the different types of yeast						
10	Scoring of Bread Quality	20					
11	Just-about-right test of the sweet bun formula by substituting water						
	with strawberry juice						
12	Hedonic score of breads varying the amount of strawberry juice	22					
13	Hedonic score of breads varying the amount of strawberry flavor 2						
14	Hedonic score of strawberry breads not contained jam and 2						
	strawberry bread with rolled-in-jam						
15	Average scores and standard deviation of the final product based	26					
	on hedonic test by 100 consumers						

List of figure

Figure		Page
1	Graph for increased dough volume from 0-60 minute's fermentation	15
2	Volumes of 0 minute fermented dough making from different types of yeast	16
3	Volumes of 30minute fermented dough made from different types of yeast	16
4	Volumes of 40minute fermented dough made from different types of yeast	17
5	Volumes of 60minute fermented dough made from different types of yeast	17
6	Photographic comparison between bread made from regular yeast (left) and sweet bun yeast (right)	19
7	Strawberry bread without strawberry jam (left) and strawberry bread incorporate with strawberry jam	24

Introduction

Nowadays, bread becomes one of the staple foods consumed around the world. Bread is commonly made at home in foreign countries or sold in many bakery shops around the world. In Thailand, consumers are widely accustomed to bread and its flavor characteristics.

Previously mentioned bread is a valuable natural product made from wheat flour that provides an excellent unique characteristics and nutritional benefits. Thus, it is very important to increase the product value by addition other ingredients in the common bread to create new innovative product.

According to the recommendation of Thitima (2007), the development of bread containing fruit juice, based on the fact of the consumer desire and satisfaction, the quality of bread made from fruit juice could be improved by changing the type of yeast suitable for sweet bread in order to increase the rate of fermentation. Other than that, to approve the product, the improvement following the product development method is very important to study the consumer preference on the new variety of bread in terms of appearance and sensory evaluation.

The improvement of strawberry bread from previous study of Thitima's (2007) and approved the combination between bread and strawberry juice is the main purpose of the project.

Objectives

- 1. To improve strawberry bread developed by Thitima (2007) by changing the type of yeast used in fermentation of the dough.
- 2. To formulate new strawberry bread,
- 3. To determine consumer acceptance of the product.



Literature Review

This innovative product is made from bakery production that requires the specific ingredient and process. Also, this research is analyzed by sensory evaluation to approve the consumer acceptance.

Bread

Bread is a staple food that forms the basis of a traditional diet made from flour or meal mixed with other dry and liquid ingredients, usually combined with a leavening agent, and kneaded, shaped into loaves, and prepared by baking dough. It may be leavened or unleavened. Salt, fat and a leavening agent such as yeast are common ingredients, though breads may contain a range of other ingredients: milk, egg, sugar, spice, fruit (such as raisins), vegetables (such as onion), nuts (such as walnuts) or seeds (such as poppy seeds).

Bread Formulation

The amount of water and flour are the most significant measurements in a bread recipe, as they affect texture and crumb the most. Professional bakers use a system of percentages known as Bakers' Percentage in their recipe formulations, and measure ingredients by weight instead of by volume. Measurement by weight is much more accurate and consistent than measurement by volume, especially for the dry ingredients.

Flour is always 100%, and the rest of the ingredients are a percent of that amount by weight. Common table bread in the U.S. uses approximately 50% water, resulting in finely-textured, light, bread. Most artisan bread formulas contain anywhere from 60 to 75% water. In yeast breads, the higher water percentages result in more CO_2 bubbles, and a coarser bread crumb. One pound (500 g) of flour will yield a standard loaf of bread, or two French loaves.

Sweet bread ingredient

Flour

Flour is a product made from grain that has been ground into a powder. It provides the primary structure to the final baked bread and provides the starch and protein necessary for the production of bread.

Wheat flour

Wheat flour in addition to its starch contains three water-soluble protein groups, albumin, globulin, proteoses, and two non-water soluble protein groups, glutenin and gliadin. When flour is mixed with water the water-soluble proteins dissolve, leaving the glutenin and gliadin to form the structure of the resulting dough. When worked by kneading, the glutenin forms strands of long thin chainlike molecules while the shorter gliadin forms bridges between the strands of glutenin.

The resulting network of strands produced by these two proteins is known as gluten. Gluten development improves if the dough is allowed to autolysis.

All purpose flour

All-purpose or plain flour is blended wheat flour with an intermediate gluten level which is marketed as an acceptable compromise for most household baking needs. In general, flour made from harder wheat (like bread flour) is higher in protein and gluten, making it ideal for crusty breads and yeast-risen products. Flour made from softer wheat (like cake flour) contains less protein and gluten, making it more appropriate for lighter, tenderer goods like cakes and biscuits.

A combination of hard and soft wheat is milled to produce all-purpose flour. The resulting medium protein content (between 9% and 12%) offers just the right balance of strength and tenderness for the everyday baker to make chewy breads, delicate tarts and everything in between.

Yeast

Many types of bread are leavened by yeast. The yeast used for leavening bread is *Saccharomyces cerevisiae*, the same species used for brewing alcoholic beverages. This yeast ferments carbohydrates in the flour, including any sugar, producing carbon dioxide. Baker's yeast has the advantage of producing uniform, quick, and reliable results, because it is obtained from a pure culture. Many artisan bakers produce their own yeast by preparing a 'growth culture' which uses in the making of bread.

There are 2 main types of yeast in bakery products.

- Fresh yeast
- Dry yeast

Instant-active dry yeast is select to use in strawberry bread for convenience purpose. The yeast is dry powder and very active and dose not require rehydration as the active dry yeast so it can be mixed directly with the flour before developing the dough.

Sugar

As a yeast food, the sweetener is consumed by yeast during the fermentation process. Sugar creates tenderness and fineness of texture, partly from weakening gluten structure, promote good crust color. The amount of sugar used is very important because it affects the yeast fermentation as same as the type of yeast used for fermentation. Also sugar helps retention moisture and prolonging shelf life.

Salt

Salt is used in order to highlight the other taste especially sweet flavor of bread. On the other hands, salt controls yeast activity by increasing osmotic pressure in dough at the fermentation stage. Without salt dough will be wet and sticky when kneading.

Fats or shortenings

Fats such as butter, vegetable oils, lard, or that contained in eggs affects the development of gluten in breads by coating and lubricating the individual strands of protein and also helping hold the structure together. If too much fat is included in bread dough, the lubrication effect will cause the protein structures to divide. A fat content of approximately 3% by weight is the concentration that will produce the greatest leavening action. In addition to their effects on leavening, fats also serve to tenderize the breads they are used in and also help to keep the bread fresh longer after baking.

In this product, unsalted butter is used as shortening. Butter is a dairy product made by churning fresh or fermented cream or milk. It is used as a spread and a condiment, as well as in cooking applications such as baking, sauce making, and frying. Butter consists of butterfat, water and milk proteins.

Liquids

Water, or some other liquid, is used to form the flour into a paste or dough. The volume of liquid required varies between recipes, but a ratio of 1 part liquid to 3 parts flour is common for yeast breads while recipes that use steam as the primary leavening method may have a liquid content in excess of one part liquid to one part flour by volume. In addition to water, other types of liquids that may be used include dairy products, **fruit juices**, or beer. In addition to the water in each of these they also bring additional sweeteners, fats, and/or leavening components.

Strawberry juice

Doi Kham ready-to-drink fruit juices are selected to be made from highly nutritious fresh fruits that have undergone a UHT production process for sterilization before being processed which contain no artificial colors, flavors or preservatives. That is ready-to-drink 100% natural fruit juice strawberry.

Strawberry bread making

Straight dough technique is used in this product that is one type pf dough making process. Straight dough, all of the ingredients is combined in one step, and the dough baked after the rising time. Alternatively, dough can be made using a preferment, when some of the flour, water, and the leavening are combined a day or so ahead of baking, and allowed to ferment overnight. On the day of the baking, the rest of the ingredients are added, and the rest of the process is the same as that for straight dough. This produces more flavorful bread with better texture. Many bakers see the starter method as a compromise between the highly reliable results of baker's yeast, and the flavor/complexity of a longer fermentation. It also allows the baker to use only a minimal amount of baker's yeast, which was scarce and expensive when it first became available.

Process of sweet bread making

- Preparation or raw material starting from selection
- Mixing and kneading
- Fermentation
- Punching
- Scaling
- Benching
- Makeup and rounding
- Baking
- Cooling
- Storage

Sensory evaluation

Sensory evaluation (or sensory analysis) is a scientific discipline that applies principles of experimental design and statistical analysis to the use of human senses (sight, smell, taste, touch and hearing) for the purposes of evaluating consumer products. The discipline requires panels of human assessors, on whom the products are tested, and recording the responses made by them. By applying statistical techniques to the results it is possible to make inferences and insights about the products under test. Most large consumer goods companies have departments dedicated to sensory analysis.

Sensory analysis can generally be divided into three sub-sections:

- Effective testing (dealing with objective facts about products)
- Affective testing (dealing with subjective facts such as preferences)
- Perception (the biochemical and psychological aspects of sensation)

Hedonic scale test

Hedonic scale test is used to evaluate the degree of liking or disliking of sample. It is the most commonly used test for measuring the degree of liking of a sample is the hedonic scale. The hedonic scale assumes that the consumer preferences exist on a continuum and that preference can be categorized by responses based on likes and dislikes. Scales of varying lengths can be used, but the most common hedonic scale is the 9-point hedonic scale. Samples were served to panelists monadically or stimultaneously, and the panelists were asked to indicate their hedonic response to the sample on the scale.

Affective test: Hedonic test with Just about right scale

The most quantitative consumer research conducted in support of product development proposes to determine consumer's affective reaction to new or revise products. In such studies, the level of consumer acceptability is often assessed by asking consumers to rate how much they like a product overall, using, for sample, the nine-point hedonic scale.

The product developers do not only need to know the degree of overall liking, but also what about a product people like and dislike, and how these attributes might be changed to increase acceptability. For this reason, studies often include, in addition to overall liking, questions of the product attributes that are likely t determine the level of overall liking. In test of food acceptability, these questions often concern the sensory properties of the food, such as its aroma, flavor and texture.

This affective test is used to test the product in this research in order to provide the direction (more or less of the intensity of each attribute) for the further development and the relative magnitude of different.

Materials and methods

1. Materials and Apparatus

- 1) Strawberry juice, Doi Kham Food Product CO., LTD.
- 2) Strawberry jam, Best Food
- 3) Wheat flour, Diamond
- 4) All-purpose flour, Kite
- 5) Instant active dry yeast, Fermipan
- 6) Sugar
- 7) Salt
- 8) Eggs
- 9) Unsalted butter, Alloweries
- 10) Strawberry flavor additive compound
- 11) Utensils for bread baking
- 12) Oven

2. Methods

2.1 Preliminary experiment

Doughs made from two different types of instant-active dry yeast, the normal dry yeast for regular bread and dry yeast for sweet bun were used to compare their activities in 1-hour fermentation using the basic fruit juice bread according to Thitima's formula (2007).

Breads prepared from 2 types of yeast using straight dough method were evaluated using 20 students who took FT 4114 (Bakery Technology) course in 2007.

Table 1: Basic formula of bread with fruit juice

Incurdiants	Percentage (%)
Ingreatents	as flour weight base
Wheat flour	100.00
Yeast	2.00
Salt	2.00
Sugar	6.50
Unsalted butter	4.00
Strawberry juice	59.00

2.1.1 Measurement of dough volume with different types of yeast

Doughs obtained in 2.1 were placed in the volumetric cylinders to measure the increased volume in milliliters from 0-60 minutes during yeast fermentation to select the suitable yeast to use in the strawberry bread.

2.1.2 Evaluation of bread made from different yeasts

Breads made from the different types of yeast, the normal dry yeast for regular bread and dry yeast for sweet bun were evaluated based on the quality of bread scoring criteria (Appendix A-2)

The scoring criteria were volume, symmetry of loaf, uniform of bake, texture, color of crumb, grain, aroma, test, color and nature of crust.

2.2 Product development steps and final product testing

The selected yeast was used in the sweet bun formula. Bread made from sweet bun formula was evaluated by the previous group of test panelists for the study of bread quality and developing steps in the further study.

Ingredients	Percentage (%)
HIGT CURLEDOR	as flour weight base
Bread flour	80.0
All purpose flour	20.0
Yeast	2.0
Salt	2.0
Sugar	20.0
Unsalted butter	20.0
Egg	9.8
Water	42.0

Table 2: Basic formula of sweet bun

THE ASSUMPTION UNIVERSITY LIBRARY

2.2.1 Preparation of bread using sweet bun formula by substituting with strawberry juice 958 e^{-1}

By substituting water with strawberry juice, the sugar content in strawberry juice was determined to 13°C and used in reducing with the amount of sugar as listed in the sweet bun formula (Table 2).

Bread made from the basic formula of strawberry bread was tested by the same test panelists using just about right test (Appendix B-1) and determined the bread quality as in 2.1.2.

Table 3: Adjusted formula of strawberry bread

Ingradiants	Percentage (%)					
ingreatents	as flour weight base					
Bread flour	80.0					
All purpose flour	20.0					
Yeast	2.0					
Salt	2.0					
Sugar	14.6					
Unsalted butter	20.0					
Egg	9.8					
Strawberry juice	42.0					
* SINCE 1060	*					

(a) Just about right test of the bread

The just about right test was used to analyze the preference level of the test panelists for the product in 4 attributes, including softness, strawberry aroma, sweetness and overall liking.

2.2.2 Improving of sweet bread made with strawberry juice

For the improvement of the bread quality, the product development was continued by varying the amount of ingredients and an addition of the additive compounds to improve the product preferences of the test panels following the product development method. 9-point hedonic score was used in determining preference of the bread using the same group of test panelists.

(a) Varying the amount of strawberry juice

Sweet bread obtained from 2.2.1 was improved its quality by increasing the amount of strawberry juice from 52.50 to 65.00 %. The best formula was selected for further study.

Inguadianta	Percentage (%)						
ingreutents	as flour weight base						
Bread flour	80.0						
All purpose flour	20.0						
Yeast	2.0						
Salt	2.0						
Sugar	14.6						
Unsalted butter	20.0						
Egg	9.8						
Strawberry juice	42.0 and 52.0						

Table 4: Strawberry bread formula varying the amount of strawberry juice

(b) Addition of strawberry flavor

Strawberry sweet bread obtained from (a) was selected for the improvement of strawberry flavor by the addition of strawberry flavor by varying the percentage of artificial strawberry flavor from 0.00%, 0.01% and 0.05% fbw.

Table 5: Strawberry bread formula varying the strawberry flavor

โกgradients	Percentage (%)
ingreatents	as flour weight base
Bread flour	80.0
All purpose flour	20.0
Yeast	2.0
Salt	2.0
Sugar	14.6
Unsalted butter	20.0
Egg	9.8
Strawberry juice	52.0
Additive flavor	0.00%, 0.01% and 0.05%

THE ASSUMPTION UNIVERSITY LIBRARY

(c) Incorporation of strawberry jam

The most preferred formula obtained from (b) was used for further study by incorporating strawberry jam inside the bread dough in the rolling step of bread making. Bread made by incorporating strawberry jam was compared with bread without strawberry jam by sensory evaluation using 9-point hedonic score preference test with the same group of test panelists.

Ingradiants	Percentage (%)						
ingreutents	as flour weight base						
Bread flour	80.0						
All purpose flour	20.0						
Yeast	2.0						
Salt	2.0						
Sugar	14.6						
Unsalted butter	20.0						
Egg	9.8						
Strawberry juice	52.0						
Additive aroma	2.0						
Strawberry jam	0.00 and 5.00						

Table 6: Strawberry bread formula with addition of strawberry jam

2.2.3 Consumer test

The most suitable formula from (c) was selected to run in the final product testing by the sensory evaluation based on the hedonic test with 100 consumers who were ABAC students, staffs, and lecturers.

The 9-point hedonic scale was used in order to analyze the satisfaction level of the consumers for the final product testing.

3. Statistical analysis

The scores from the screening tests in 2.2.1 (a), (b), and (c) with 20 test panelists were analyzed using Complete Randomized Design (CRD). The means were compared using uni-variate test from SPSS version 15.

4. Experimental location

- 4.1 Pilot plant, E-Building, Faculty of Biotechnology, Assumption University
- 4.2 E81 laboratory, Faculty of Biotechnology, Assumption University
- 4.3 Consumer acceptance test at Assumption University, Hua mak campus

5. Time planning and research place

 Table 7: Job description timeline

Job	Description
1	Discuss with advisor and searching for the special project topic
2	Research information on the related research
3	Discover material and method
4	Implement special project, collect the data and analyze the data
5	Consumer survey test
6	Preparation of report and presentation
7	Last approval of special project by advisor
8	Special project Presentation
L.	LABOR VINCE

The following Grant chart shows the schedule of each task and its planned completion period. The plan is constructed in order to complete the job description follow the time line.

Table 8: Product Development Time Line in 2008

		A	oril			M	ay			Ju	ine			J	uly			Au	gust		5	Sept	emb	er
Task	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
1												[
2																								
3																								
4																			_					
5																								
6																								
7																						4		
8																								

Results and Discussion

2.1 Preliminary experiment

Doughs made from two different types of instant-active dry yeast, the normal dry yeast for regular bread and dry yeast for sweet bun, were compared their activities in 1-hour fermentation period. The increased volumes of dough were compared after 60 minutes inside the volumetric cylinder.

Bread made from two different types of instant-active dry yeast, the normal dry yeast for regular bread and dry yeast for sweet bun were evaluated by the bread scoring test (Pyler, 1973).

2.1.1 Measurement of dough volume with different types of yeast

By measuring the expansion volume of doughs obtained in 2.1 in the volumetric cylinders from 0-60 minutes during yeast fermentation, the result was shown in the figure 1 to 4.







Figure 2: Volumes of 0 minute fermented dough making from different types of yeast



Figure 3: Volumes of 30minute fermented dough made from different types of yeast



Figure 4: Volumes of 40minute fermented dough made from different types of yeast



Figure 5: Volumes of 60minute fermented dough made from different types of yeast

From figure 1, the expansions of dough were different between two different kinds of yeast. In the first 30 minutes, the sweet bun yeast dough increased to 160 ml. whereas the regular bread yeast dough was 105 ml. After 40 minutes, the sweet bun yeast dough expansion volume reached 200 ml. while the regular bread yeast dough showed small increased in volume to 130 ml. By one hour fermentation, the sweet bun yeast dough volume was 215 ml. and the regular bread dough was 135 ml. The regular bread yeast dough volume was almost 50% smaller than the sweet bun yeast dough in higher extent and more rapid. It was noticed that both doughs had reached full expansion volumes before 60-minute fermentation as demonstrated in small increasing volume after 40 minutes of fermentation.

From the basic formula of bread with fruit juice, there was high sugar content. The yeast used for sweet bun could perform its ability well in such condition with more stability and providing good aroma to the product. In addition this type of yeast was also possessing good tolerance to high acid level produced from yeast fermentation of sugar in the dough. Therefore, the sweet bun yeast was suitable for selecting to use in the further experiment, www.fermipan.com

2.1.2 Evaluation of bread made from different yeasts

Breads made from the different types of yeast, the regular yeast bread and sweet bun bread were evaluated by scoring test.

The questionnaires used in scoring test (Appendix A-2) were given to 20 test panelists. The Results were shown in Table 8 and photographic comparison of breads in figure 5.

Table 9: Bread quality average score and standard deviation from scoring test on two

 different breads made from the different types of yeast

Type of yeast	Mean score ± SD*
Regular yeast	71.1 ± 10.48
Sweet bun yeast	86.3 ± 5.25

* Level of significance @ 0.05

From table 8, the average score of bread made from sweet bun yeast was more than bread made from regular yeast. Paired-Samples T Test was used to compare the means of these two samples which indicated that there was a significance difference between scores of bread made from two different types of yeast.



Figure 6: Photographic comparison between bread made from regular yeast (left) and sweet bun yeast (right)

From figure 5, bread made from sweet bun yeast had more volume and larger air cell. Due to the different types of yeast, the sweet bun yeast could perform well in the condition of the sweet bun formula therefore this supported the previous result to selected this types pf yeast in the further study.

2.2 Product development steps and final product testing

The sweet bun yeast was selected in the sweet bun formula. Bread made from sweet bun yeast was evaluated by the previous group of test panelist by just-about-right test.

2.2.1 Preparation of bread using sweet bun formula by substituting with strawberry juice

As water was substituted by strawberry juice, the amount of sugar in was reduced in order to balance the amount of sugar as listed in the sweet bun formula (Table 2).

THE ASSUMPTION UNIVERSITY LIBRARY

Bread made from the basic formula of strawberry bread was tested by the same panelists using bread quality scoring as in 2.1.2 and just-about-right test as in table 9.

Quality Attribute	Total score	Aver. score	Score as % of total score	
Volume	15	12.8	85	
Color and nature of crust	5	4.3	86	
Symmetry of form	5	4.2	84	
Uniform of bake	ERS5	4.1	82	
Texture	15	13.2	88	
Color of crumb	10	8.1	81	
Grain	10	8.7	87	
Strawberry Aroma	15	10.4	69	
Taste	20	817.7	88.5	
Total *	CE 1969	83.5		

Table 10: Scoring of Bread Quality

The quality of bread was scored by 20 test panelists. The average score was 83.5 from 100. The average total bread score from 20 test panelists of the strawberry juice bread fermented with sweet bun yeast was 83.5% indicating quite good quality. Though after converting the score from the attribute to percentage most quality attributes did not show any low scores below 50%, strawberry aroma received 69% that might imply some adjustment might be needed in this attribute.

(a) Just-about-right (JAB) test of the bread

The just-about-right test was used to analyze the proper level of the product based on 20 test panelists' preference level. The results were shown in Table 10.

 Table 11: Just-about-right test of the sweet bun formula by substituting water with strawberry juice

	Percentage					
Attribute	Much too little	Much tooSomewhatlittleToo little		Somewhat Too much	Much too Much	
Softness	0	50	50	0	0	
Strawberry aroma	50	IER35/7	15	0	0	
Sweetness	35	0	65	0	0	
Flavor	10	40	45	5	0	

From Table 10, the preference levels of 20 trained test panelists were analyzed by just-about-right test. As a result, 50% of all panelists thought that the softness of bread texture was just right but another 50% thought that it was too hard. The result indicated that the test panelists might need the product to be softer. Therefore, softness of the bread was adjusted in the further study.

For the aroma of strawberry, 75% of test panelists that the product contained low strawberry aroma. The result confirmed with the result from the study on the bread quality. Thus this attribute needed to be adjusted in the further study.

For sweetness attribute, 65% of test panelists' preference levels were shown that the sweetness was just right while 35% of them thought that there was much too little. Therefore this attribute would not be adjusted in the further study.

For flavor, 45% of the test panelists said it was just right while 10% much too little, 40% somewhat too little and 5 somewhat too much. The result demonstrated a tendency of too little flavor in the product. This attribute would be adjusted in the further study.

From the JAB test, two attributes of the bread required adjustments those were softness and strawberry aroma.

2.2.2 Improving of sweet bread made with strawberry juice

Based on the study, the product flavor did not affect the product preference level therefore the overall liking attribute was measured instead of flavor attribute. The product improvement was continued by varying the amount of ingredients and an addition of the additive compounds for the product improvement.

(a) Varying the amount of strawberry juice

It was expected with increasing the amount of strawberry juice might help improving both softness and aroma of the product. Thus, sweet bun containing strawberry juice formula obtained from 2.2.1 was adjusted by increasing the amount of strawberry juice from 52.50% and 65.00%. Two samples were tested by the previous test panelists using 9-point hedonic test. Analysis using SPSS was conducted to determine significance of the scores from the samples.

N	Attribute average score ± Standard Deviation						
Sample	Softness	Strawberry aroma	Sweetness	Overall liking			
52.5% Strawberry juice	5.6 ± 0.50	5.6 ± 0.75	5.6 ± 0.48	5.9 ± 0.68			
65.0% Strawberry juice	6.5 ± 0.51* SINCE	5.65 ± 0.48	6.2 ± 0.44*	6.3 ± 0.65			

Table 12: Hedonic score of breads varying the amount of strawberry juice

* Significant difference at 0.05

From table 11, there was significantly difference between two average scores of softness and sweetness of the strawberry sweet bread. The amount of strawberry juice affected the preference level by increasing the tenderness in the bread texture. Therefore 65.0% strawberry juice was selected for further study.

For this study, although the amount of strawberry juice was increased to 65%, it had little effect on strawberry aroma of the bread. Both samples had received scores around 5.6 out of 9, indicating 'neither like nor dislike' with a trend toward 'slightly like'. This could be due to the bread had lost its aroma during baking in the oven. Thus, the next study was focused on improving flavor and aroma of the product.

(b) Addition of strawberry flavor

To solve the problem of low strawberry aroma, an artificial strawberry flavor was added. By varying the percentage of artificial strawberry flavor in the bread from 0.00%, 0.01% and 0.05% fwb, the bread samples were tested with 20 test panelists using 9-point hedonic score and the results were shown in table 12.

~ •	Attribute average score \pm Standard Deviation					
Sample	Softness	Strawberry aroma	Sweetness	Overall liking		
0.00% fwb	6.7 ± 1.34	5.7 ± 1.48	5.6 ± 0.48	6.4 ± 1.10		
0.01% fwb	7.2 ± 0.91	6.8 ± 1.36*	7.05 ± 0.88	7.1 ± 1.07		
0.05% fwb	6.9±1.29	6.4 ± 1.64	6.5 ± 1.00	6.3 ± 0.65		

Table 13: Hedonic score of breads varying the amount of strawberry flavor

* Significant difference at 0.05

From table 12, the average hedonic preference scores of 0.01% strawberry flavor received the highest scores in all attributes. It gained significantly highest scores in strawberry aroma and overall liking. As percentage of flavor increased, the test panelists gave lower scores but higher than not adding. This could be due to too high intensity of the flavor in the sample. The bread gained acceptance at moderately like.

Therefore the addition of 0.01% strawberry flavor based on flour weight was selected in the formula in order to improve strawberry aroma of the sweet bread.

(c) Incorporation of strawberry jam

After obtaining the most preferred formula from (b), bread made by incorporating strawberry jam was compared in order to increase preference score of the product. Two sweet bread samples were prepared with and without strawberry jam. They were determined by sensory evaluation using 9-point hedonic score preference test with the same group of test panelists. The result was shown in the table below.

Sample	Attribute average score ± Standard Deviation*						
	Softness	Strawberry aroma	Sweetness	Overall liking			
No jam	6.80 ± 0.95	6.4 ± 0.88	6.9 ± 0.64	6.85 ± 0.67			
Rolled-in-jam	7.05±0.60	7.2 ± 0.71*	7.5±0.60*	7.65±0.49*			

Table 14: Hedonic score of strawberry breads not contained jam and strawberry bread

 with rolled-in-jam

* Significant difference at 0.05

From table 13, there was not only the average score of all attributes of jam rolled bread that were higher than non jam rolled bread but their mean scores were significantly difference in strawberry aroma, sweetness and overall liking. Strawberry jam affected three attributes by providing more strawberry aroma, more sweetness of bread and contributed to increasing of the overall liking. Therefore the jam rolled bread was selected to incorporate in the final product used in the consumer test.



Figure 7: Strawberry bread without strawberry jam (left) and strawberry bread incorporate with strawberry jam

From figure 7, the loaf of non jam rolled bread was more symmetric than jam rolled bread. Non jam rolled was made by simple rolling technique whereas jam caused difficulty in rolling the loaf.

2.2.3 Consumer test

The final product was selected to run in the final product testing by the sensory evaluation based on the hedonic test with 100 consumers who were ABAC students, staffs, and lecturers.

The questionnaire (Appendix C-1) consisted of demographic part, consumer behavior part, product acceptance and purchasing intention part. The data were analyzed by using SPSS program version15.

The analyzed results were shown in the Appendix (C-2); there were 60% female and 40% male in the consumer test at the tested location, Assumption University, Hua mak campus. In fact, the majority of gender in the university was female; therefore, female consumers were more than male consumers in this location and the majority of age in the tested location was between 20-25 years old because the tested consumers were ABAC students that had monthly income less than 10,000 Baht.

For the consumer behavior, the consumers were asked about frequency of consumption, favorite brand and the other consumption behavior. As a result, more than 90% of the consumers usually consume bread. 54% of the consumers consumed bread as snack whereas 40% usually consumed as breakfast and the rest consumed as lunch and desert. The most favorite bread brand was Farmhouse; the second and third was Yamazaki and S&P. For frequency of the consumption, more than half of the consumers consumed bread for 2-3 times a week. The consumers preferred buying single slice or small size rather than the large loaf for their consumption.

For the purchase intention part, the consumers were asked whether they would buy the strawberry bread if the product was available in the market. As a result, 88% of the consumers had intention to buy the product whereas 12% would not buy a product if it was launched into the market.

For the sensory evaluation, the consumers were asked for the product preference based on 9-points hedonic scale and the average scores were shown in the table 14.

 Table 15: Average scores and standard deviation of the final product based on hedonic

 test by 100 consumers

Attributo	Hedonic Score				
Attribute	Average score	Standard Deviation			
Softness	7.5	1.0			
Strawberry aroma	7.6	0.9			
Sweetness	7.6	0.8			
Overall liking	7.8	0.8			

From table 14, the preference levels of 100 consumers were analyzed by hedonic preference test. As a result, average score for softness of the final product was 7.5 out of 9, referring to 'like moderately' to 'like very much', indicating that thus softness had quite good quality in tendency.

For strawberry aroma, the consumers rated this attribute around 7.6 out of 9, that was the same as sweetness average score indicating 'like moderately' with a trend toward 'like very much', the same preference range as the softness. The final product received quite a good preference level for the consumers.

Therefore, three attributes contributed to increase the overall liking of product preference level to 7.8 out of 9, having high trend toward 'like very much' of the product preference level.

Conclusion

From the study, bread containing fruit juice was improved following the design method. The sweet bun yeast was selected to be the suitable yeast for strawberry bread to get more fermentation power and to improve the overall bread quality. The bread formulas were adjusted by the product development procedure in order to improve the texture, strawberry aroma and overall liking. The final product obtained from the adjustment of the formula was tested by the consumers to approve the product acceptance.

- 1. The sweet bun yeast was selected to use in fermentation.
- 2. The sweet bun yeast resulted more fermentation power and contribute to good quality of texture of the sweet strawberry bread that made it to become more tenderness than the normal yeast used by Thitima (2007).
- The final improved formula of strawberry consisted of bread flour 80%, all purpose flour 20%, yeast 2%, salt 2%, sugar 14.6%, unsalted butter 20%, egg 9.8%, strawberry juice 52%, additive aroma 0.01% and strawberry jam 5% (based on 100 portion of flour).
- 4. The consumers had rated the product preference more than 7.5 for all attributes on 9-point hedonic scale indicating the consumers liked the product from moderately like to like very much.
- 5. 100% of the consumers accepted the product whereas 88% of the consumers had an intention to purchase the product.
- 6. 44% of the consumers accepted the price at 45 Baht while 26% accepted at 40 Baht.

Recommendations

- The amount of strawberry jam should be around 5-10% of flour weight base to prevent jam from splitting off the loaf during rolling the dough.
- There was a possibility to create new variety of fruit bread by changing the types of juice and incorporation of the different kinds of jam the same way as strawberry bread.



References

Nootrudee Siriboon and Wunwisa Krasaekoopt (2007). Bakery Technology Laboratory Manual, Department of food Technology, Faculty of Biotechnology. Page 4-14

Pyler, E.J. (1973). Bread Science and Technology. Siebel Publishing Company, Chicago, Ill.

Thitima, T. (2007). Development of Bread Using Fruit and Fruit Juice. Special Project, Faculty of Biotechnology, Assumption University.

http://www.bigoven.com/whatis.aspx?id=All-Purpose%20Flour (04/08/08)

http://www.doikham.thailand.com/royal_project_products.htm (04/08/08)

http://www.answers.com/topic/sensory-analysis?cat=health (15/09/08)

http://images.google.com/imagescom.microsoft%3A*&q=strawbery+bread (28/09/08)



Appendix A Preliminary experiment

(A-1) Measurement dough volume (ml) from 0-60 minute's fermentation

Type of yeast	0 min	30 min	40 min	60 min
regular bread yeast	90	105	130	135
sweet bun yeast	90	160	200	215

(A-2) Questionnaire: scoring test of strawberry bread made from sweet bun yeast

Scoring test

Product: Sweet bread containing fruit juice

Name:

l

Date:

Instruction

- 1. Please rinse your mouth with water before starting
- 2. Please taste the sample and rate the sample in each attribute from most preferred to least preferred using the following number

Quality Attribute	Score	Sample	Sample
Volume	15		
Color and nature of crust	5		
Symmetry of form	5 🛪		
Uniform of bake SINCE	5969		
Texture	15 3950		
Color of crumb	10		
Grain	10		
Strawberry Aroma	15		
Taste	20		
Total	100		

Scoring of Bread Quality

(A-3) Result from paired sample test between bread made from different kind of yeast

T-Test

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Regular yeast	71.1000	10	10.48226	3.31478
	Sweet bun yeast	86.3000	10	5.25040	1.66032

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Regular yeast & Sweet bun yeast	10	.605	.064

Paired Samples Test

		Paired Differences							
		e e		Std. Error	95% Cor Interva Differ	nfidence I of the rence			
		Mean	Std. Deviation	Mean	Lower	Upper	t	df	Sig. (2-tailed)
Pair 1	Regular yeast - Sweet bun yeast	-15.20000	8.41691	2.66166	-21.22110	-9.17890	-5.711	9	.000



Appendix B Product development

(B-1) Questionnaire: scoring test of strawberry bread made from sweet bun yeast

Scoring test

Product: Sweet bread containing fruit juice

Name:

Instruction

- 3. Please rinse your mouth with water before starting
- 4. Please taste the sample and rate the sample in each attribute from most preferred to least preferred using the following number

Date:

Quality Attribute	Score
Volume	15
Color and nature of crust	5
Symmetry of form	5
Uniform of bake	5
Texture	15
Color of crumb	10
Grain	10
Strawberry Aroma	15
Taste	20
Total	100

Scoring of Bread Quality



Quality Attribute	Total score	Aver. score	Score as % of total score
Volume	15	12.8	85
Color and nature of crust	5	4.3	86
Symmetry of form	5	4.2	84
Uniform of bake	5	4.1	82
Texture	15	13.2	88
Color of crumb	10	8.1	81
Grain	10	8.7	87
Strawberry Aroma	15	10.4	69
Taste	20	17.7	88.5
Total	100	83.5	

(B-2) Result from scoring of Bread Quality

(B-3) Questionnaire: Just about right test of the sweet bread using strawberry juice

Please make a $\sqrt{}$ mark on the table provided below according to the just about right test **Instruction:**

- 1. Please rinse your mouth with water before starting. You may rinse again at anything during the test
- 2. Please taste the sample and rate the sample by ticking in this following table

Attribute	Much too little	Too little	Just right	Too much	Much too much
Softness					
Strawberry aroma					
Sweetness					
Flavor	14.	VERS/	71.		

(B-4) Frequency result from just about right test

Attribute	Much too little	too little	Just right	too much	Much too much
softness	0	10	10	0	0
Strawberry aroma	10	7	3	0	0
Sweetness	0	7	13	0	0
Flavor 🔬	2	8	9	1	0

34

(B-5) Questionnaire: hedonic preference test varying amount of juice

Hedonic Preference Test

Product: Sweet bread containing fruit juice

Date:

Instruction

Name:

- 1. Please rinse your mouth with water before starting
- 2. Please taste the sample and rate the sample in each attribute from most preferred to least preferred using the following number
- 1 = dislike extremely = like slightly 6 2 7 = dislike very much = like moderately = dislike moderately 8 = like very much 3 4 = dislike slightly 9 = like extremely 5 = neither like nor dislike Sample Sample **Attributes** Softness Strawberry Aroma Sweetness **Overall Liking**

(B-6) Result from preference test varying amount of strawberry juice

Univariate Analysis of Variance

Between-Subjects Factors

		Value Label	N
trt	1.00	52.50% juice	20
	2.00	65.00% juice	20

Descriptive Statistics

Dependent Variable: softness

trt	Mean	Std. Deviation	N
52.50% juice	5.6000	.50262	20
65.00% juice	6.5500	.51042	20
Total	6.0750	.69384	40
		MALLIN	

Tests of Between-Subjects Effects

Dependent Variable: softness

Source	Type III Sum of Squares	df 🚺	Mean Square	F	Sig.
Corrected Model	9.025(a)	1	9.025	35.174	.000
Intercept	1476.225	1	1476.225	5753.492	.000
trt 📁	9.025	1	9.025	35.174	.000
Error	9.750	38	.257		
Total	1495.000	40			
Corrected Total	18.775	39	VINCI		

a R Squared = .481 (Adjusted R Squared = .467)

Tests of Between-Subjects Effects

Dependent Variable: aroma

Dependent Variable	: aroma	ຍດດັບດີດີ	งลั ^{มข} ั		
Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	.025(a)	1	.025	.062	.805
Intercept	1265.625	1	1265.625	3133.143	.000
trt .	.025	1	.025	.062	.805
Error	15.350	38	.404		
Total	1281.000	40			
Corrected Total	15.375	39			

a R Squared = .002 (Adjusted R Squared = -.025)

Tests of Between-Subjects Effects

Dependent Variable: sweetness					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	3.600 ^a	1	3.600	16.482	.000
Intercept	1416.100	1	1416.100	6483.349	.000
trt	3.600	1	3.600	16.482	.000
Error	8.300	38	.218		
Total	1428.000	40			
Corrected Total	11.900	39			

a. R Squared = .303 (Adjusted R Squared = .284)

..

Tests of Between-Subjects Effects

Dependent Variable: overall					
Source	Type III Sum of Squares	E df	Mean Square	Ч	Sig.
Corrected Model	1.225 ^a		1.225	2.714	.108
Intercept	1500.625	1	1500.625	3325.000	.000
trt	1.225	1	1.225	2.714	.108
Error	17.150	38	.451		
Total	1519.000	40	KSm -		
Corrected Total	18.375	39	3.6 7		

a. R Squared = .067 (Adjusted R Squared = .042)

Grand Mean

Dependent Variable: softness SINCE 1969

		95% Confidence Interval		
Mean	Std. Error	Lower Bound	Upper Bound	
6.075	.080	5.913	6.237	

(B-7) Questionnaire: hedonic preference test in addition of strawberry flavor

Hedonic Preference Test

Product: Sweet bread containing fruit juice Name:

Date:

Instruction

- 1. Please rinse your mouth with water before starting
- 2. Please taste the sample and rate the sample in each attribute from most preferred to least preferred using the following number
- 1 = dislike extremely
- 2 = dislike very much
- 3 = dislike moderately
- 4 = dislike slightly
- 5 = neither like nor dislike
- At

Soft

Stra

Swe

Ove

38

- 6 = like slightly
- 7 = like moderately
- 8 = like very much
- 9 = like extremely

	Sample	Sample	Sample
ttributes	<u> </u>		<u></u>
tness	Le :	<u> </u>	
wberry Aroma		P	
eetness	GLERIEL	S	
erall Liking	The second		

(B-8) Result from preference test in addition of strawberry

Univariate Analysis of Variance

		Value Label	N
trt	1.00	0.01%	20
	2.00	0.05%	20
	3.00	control	20

Between-Subjects Factors

Descriptive Statistics

	trt	Mean	Std. Deviation	N
softness	0.01%	7.2500	.91047	20
	0.05%	6.9000	1.29371	20
	control	6.7000	1.34164	20
	Total	6.9500	1.19922	60
aroma	0.01%	6.8000	1.36111	20
1	0.05%	6.4000	1.63514	20
i	control	5.7500	1.48235	20
	Total	6.3167	1.53481	60
sweetness	0.01%	7.0500	.88704	20
	0.05%	6.5000	1.00000	20
	control	6.5000	.94591	20
	Total	6.6833	.96536	60
overall	0.01%	7.1000	1.07115	20
	0.05%	6.7000	1.26074	20
	control	6.4000	1.09545	20
	Total	6.7333	1.16250	60

* SINCE 1969 * ราการ์ยอัส^{ลัมปั}ชง

Softness

Tests of Between-Subjects Effects

Dependent Variable: softness

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	3.100(a)	2	1.550	1.081	.346
Intercept	2898.150	1	2898.150	2020.728	.000
trt	3.100	2	1.550	1.081	.346
Error	81.750	57	1.434		
Total	2983.000	60			
Corrected Total	84.850	59			

a R Squared = .037 (Adjusted R Squared = .003)

Post Hoc Tests trt

Multiple Comparisons

Dependent Variable: softness							
		0	Mean Difference		0	95% Confidence Interval	
	(I) trt_	(J) trt	(I-J)	Std. Error	Sig.	Lower Bound	Upper Bound
LSD	0.01%	0.05%	.3500	.37871	.359	4084	1.1084
	Q	control	.5500	.37871	.152	2084	1.3084
1	0.05%	0.01%	3500	.37871	.359	-1.1084	.4084
ł		control	.2000	.37871	.599	5584	.9584
l	control	0.01%	5500	.37871	.152	-1.3084	.2084
l		0.05%	2000	.37871	.599	9584	.5584

Based on observed means.

Homogeneous Subsets ICE 1969

softness วิทยาลัยอัลลิ

			Subset
	trt	N	1
Duncan ^{a,b}	control	20	6.7000
	0.05%	20	6.9000
	0.01%	20	7.2500
	Sig.	i	.176

Means for groups in homogeneous subsets are displayed. Based on Type III Sum of Squares

The error term is Mean Square(Error) = 1.434.

a. Uses Harmonic Mean Sample Size = 20.000.

b. Alpha = .05.

Aroma

Tests of Between-Subjects Effects

Source	Type III Sum of Squares	df	Mean Square	_ F_	Sig.		
Corrected Model	11.233(a)	2	5.617	2.506	.091		
Intercept	2394.017	1	2394.017	1068.172	.000		
trt	11.233	2	5.617	2.506	.091		
Error	127.750	57	2.241				
Total	2533.000	60					
Corrected Total	138.983	59					

Dependent Variable: aroma

a R Squared = .081 (Adjusted R Squared = .049)

Post Hoc Tests trt

Multiple Comparisons

Dependent Variable: aroma								
		0	Mean Difference	9	2	95% Confidence Interval		
	(I) trt	(J) trt	(I-J)	Std. Error	Sig.	Lower Bound	Upper Bound	
LSD	0.01%	0.05%	.4000	.47342	.402	5480	1.3480	
		control	1.0500*	.47342	.031	.1020	1.9980	
	0.05%	0.01%	4000	.47342	.402	-1.3480	.5480	
}		control	.6500	.47342	.175	2980	1.5980	
Į	control	0.01%	-1.0500*	.47342	.031	-1.9980	1020	
	<u> </u>	0.0 <mark>5%</mark>	6500	.47342	.175	-1.5980	.2980	

Based on observed means.

* The mean difference is significant at the .05 level.

Homogeneous Subsets

			Subset		
	trt	Ν	1	2	
Duncan ^{a,b}	control	20	5.7500		
	0.05%	20	6.4000	6.4000	
	0.01%	20		6.8000	
	Sig.		.175	.402	

Means for groups in homogeneous subsets are displayed. Based on Type III Sum of Squares

The error term is Mean Square(Error) = 2.241.

a. Uses Harmonic Mean Sample Size = 20.000.

b. Alpha = .05.

Sweetness

Tests of Between-Subjects Effects

Dependent Variable: sweetness

	Type III Sum				
Source	of Squares	df	Mean Square	F	Sig
Corrected Model	4.033 ^a	2	2.017	2.256	.114
Intercept	2680.017	1	2680.017	2998.252	.000
trt	4.033	2	2.017	2.256	.114
Error	50.950	57	.894		
Total	2735.000	60			
Corrected Total	54.983	59			

a. R Squared = .073 (Adjusted R Squared = .041)

Post Hoc Tests trt

Multiple Comparisons

Depen	dent Varia	ble: sweeti	ness				
		0	Mean Difference	- 9	2	95% Confide	ence Interval
	(I) trt	(J) trt	(I-J)	Std. Error	Sig.	Lower Bound	Upper Bound
LSD	0.01%	0.05%	.5500	.29897	.071	0487	1.1487
Ì		control	.5500	.29897	.071	0487	1.1487
Í	0.05%	0.01%	5500	.29897	.071	-1.1487	.0487
ł		control	.0000	.29897	1.000	5987	.5987
	control	0.01%	5500	.29897	.071	-1.1487	.0487
L		0.05%	.0000	.29897	1.000	5987	.5987

Based on observed means.

Homogeneous Subsets ICE 1969

Homogeneous Subsets sweetness							
		N	Subset				
	trt	1	1				
	0.05%	20	6.5000				
Duncan(a	control	20	6.5000				
,b)	0.01%	20	7.0500				
	Sig.		.087				

Means for groups in homogeneous subsets are displayed. Based on Type III Sum of Squares

The error term is Mean Square(Error) = .894.

a Uses Harmonic Mean Sample Size = 20.000.

b Alpha = .05.

Overall liking

Tests of Between-Subjects Effects

Dependent Variable: overall

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	4.933(a)	2	2.467	1.880	.162
Intercept	2720.267	1	2720.267	2072.930	.000
trt	4.933	2	2.467	1.880	.162
Error	74.800	57	1.312		
Total	2800.000	60			
Corrected Total	79.733	59			

a R Squared = .062 (Adjusted R Squared = .029)

Post Hoc Tests trt

Multiple Comparisons

Depen	ident Varia	ble: overal		Y and	0		
	71		Mean Difference		11	95% Confide	ence Interval
	(I) trt	(J) trt	(I-J)	Std. Error	Sig.	Lower Bound	Upper Bound
LSD	0.01%	0.05%	.4000	.36225	.274	3254	1.1254
]		control	.7000	.36225	.058	0254	1.4254
}	0.05%	0.01%	4000	.36225	.274	-1.1254	.3254
		control	.3000	.36225	.411	4254	1.0254
	control	0.01%	7000	.36225	.058	-1.4254	.0254
		0.05%	3000	.36225	.411	-1.0254	.4254

Based on observed means.

Homogeneous Subsets

overall

			Subset
	trt	N	1
Duncan ^{a,b}	control	20	6.4000
	0.05%	20	6.7000
	0.01%	20	7.1000
	Sig.		.072

Means for groups in homogeneous subsets are displayed. Based on Type III Sum of Squares

The error term is Mean Square(Error) = 1.312.

a. Uses Harmonic Mean Sample Size = 20.000.

b. Alpha = .05.

(B-9) Questionnaire: hedonic preference test by the incorporation of strawberry jam

Hedonic Preference Test

Product: Sweet bread containing fruit juice Name:

Date:

Instruction

- 1. Please rinse your mouth with water before starting
- 2. Please taste the sample and rate the sample in each attribute from most preferred to least preferred using the following number

Sample

- 1 = dislike extremely = like slightly 6
- 2 = dislike very much
- 3 = dislike moderately
- 4 = dislike slightly
- = neither like nor dislike 5
- **Attributes**

Softness

Strawberry Aroma

Sweetness

Overall Liking

9

7 = like moderately8 = like very much

= like extremely

Sample

(B-10) Result from preference test by the incorporation of strawberry jam General Linear Model

r			<u> </u>	
	sample	Mean	Std. Deviation	<u>N</u>
softness	jam	7.0500	.60481	20
	no jam	6.8000	.95145	20
	Total	6.9250	.79703	40
aroma	jam	7.2500	.71635	20
	no jam	6.4000	.88258	20
	Total	6.8250	.90263	40
sweetness	jam	7.5000	.60698	20
	no jam	6.9000	.64072	20
]	Total	7.2000	.68687	40
overall	jam	7.6500	.48936	20
	no jam	6.8500	.67082	20
L	Total	7.2500	.70711	40

Descriptive Statistics

Tests of Between-Subjects Effects

		Type III Sum				
Source	Dependent Variable	of Squares	df	Mean Square	F	Sig.
Corrected Model	softness	.625ª	1	.625	.983	.328
5	aroma	7.225 ^b	1	7.225	11.183	.002
	sweetness	3.600 ^c	1	3.600	9.243	.004
	overall	6.400 ^d	1	6.400	18.565	.000
Intercept	softness	1918.225		1918.225	3018.325	.000
J.	aroma	1863.225		1863.225	2884.014	.000
6	sweetness	2073.600		2073.600	5324.108	.000
	overall	2102.500	1	2102.500	6098.855	.000
trt	softness	.625	1	.625	.983	.328
	aroma	7.225	S 1	7.225	11.183	.002
	sweetness	3.600	1	3.600	9.243	.004
	overall	6.400	1	6.400	18.565	.000
Error	softness	24.150	38	.636		
	aroma	24.550	38	.646		
	sweetness	14.800	38	.389		
	overall	13.100	38	.345	í i	
Total	softness	1943.000	40			
	aroma	1895.000	40	[
	sweetness	2092.000	40			
	overall	2122.000	40			
Corrected Total	softness	24.775	39			
	aroma	31.775	39			
	sweetness	18.400	39			
	overali	19.500	39			

a. R Squared = .025 (Adjusted R Squared = .000)

b. R Squared = .227 (Adjusted R Squared = .207)

C. R Squared = .196 (Adjusted R Squared = .174)

d. R Squared = .328 (Adjusted R Squared = .311)

Appendix C Consumer acceptance

(C-1) Questionnaire: Consumer survey of the Prototype

"Strawberry Bread"

This is a part of FT 4190 special project, which would like to survey the consumer behavior and acceptance on sausage and new 'Strawberry bread''. Please kindly answer questions by checking in the provided space.

Part 1: Demographic Data

Gender:						
Age:	□ Less t □ 31-35	than 20 years old	ears old □ 20-25 years old □ 36-40 years old		old old	26-30 years oldMore than 40 yr.
Education leve	el: E	□ Primary Scho □ Bachelor Deg	ol [ree [High School Master Degree 	ee	DiplomaDoctorial Degree
Occupation:		□ Student □ Office Employ □ Business Own	yee I ner I	 House-Wife Government Others 	Office	r
Monthly incor	ne:					
□ Less than □ 30,001-40	10,000 Baht ,000 Baht	aht 🗆 10,001 t 🔤 40,001	1-20,00 1-50,00	00 Baht E	⊐ 20,0 ⊐ Mor	01-30,000 Baht e than 50,000 Baht
Part 2: Inform	nation of	consumer's be	ehavio	r on bread		
Do you usuall	y consum	e bread?	อัลจิ์	□ Yes		🗆 No
What brands c	of bread do	o you familiar tl	he mos	st? (Choose thre	ee bran	lds)
□ Farmhouse □ S&P □ Gateaux Ho	ouse	□ Gard □ Yam □ Villa	lenia Iazaki Ige		□ A- □ In □ Ot	Plus & Out her (please specify)
How often do you eat bread?Everyday2-3 times a weekOnce a week2-3 times a monthOnce a monthOthers ()						
You usually eat bread as:						

How many slice of bread do	you usually buy at one time?	
□ Single slice	□ Small loaf (less th	an 10)
□ Large loaf (more th	nan 10) 🗖 Others ()
Where do you usually buy br	ead? (Answer more than one)	
Convenience store	🗖 Seven Eleven	Family Mart
	Mini Mart at gas station	
	□ Other ()
□ Supermarket	□ Top Supermarket	□ Home Fresh Mart
	Tesco Lotus	Carrefour
	□ Others ()

Please try this strawberry bread and rate the product in the table provided.

Instruction:

Please taste the sample and rate the sample in each attribute from most preferred to least preferred by ticking in these following table.

Attributes	Dislike extremely	Dislike very much	Dislike moderately	Dislike slightly	Neither like nor dislike	Dislike slightly	Like moder ately	Like very much	Like very extremely
Softness	K			MA	Sen -	<u>.</u>			
Strawberry aroma	a M				2				
Sweetness				P D A	THE				
Overall liking	0		St R	a see					

Is this	s product acceptable?	□ Yes	*] No	
Deed	2. Duritaria				
Part	<u>3:</u> Purchase Intention				
Woul	d you buy this product i	f is commercially a	vailable?		
	□ Yes, because				
	□ Maybe, because		•••••		
	□ No, because		••••••••••••		
How	much do vou prefer for l	loaf of g	rams?		
110 W	$\square 251.14$		14115;		
	LI 35 bant	L 40 bant		LI 45 bant	
Sugge	estion				
				••••••••••••••••••••••	
	· · · · · · · · · · · · · · · · · · ·				

Thank You for your cooperation

(C-2) Result from consumer acceptance test Frequencies

Gender

	1	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	40	40.0	40.0	40.0
	Female	60	60.0	60.0	100.0
	Total	100	100.0	100.0	

		Frequency	_Percent_	Valid Percent	Cumulative Percent
Valid	Less than 20 yr	28	28.0	28.0	28.0
	20-25 years old	58	58.0	58.0	86.0
	26-30 years old	4	4.0	4.0	90.0
	31-35 years old	4	4.0	4.0	94.0
	36-40 years old	2	2.0	2.0	96.0
	More than 40 yr	4	4.0	4.0	100.0
	Total	100	100.0	100.0	

Age

Education Level

	D	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	High school	6	6.0	6.0	6.0
	Diploma	10	10.0	10.0	16.0
	Bachelor degree	76	76.0	76.0	92.0
i	Master degree	8	8.0	8.0	100.0
	Total	100	100.0	100.0	

Occupation

	1	Frequency	Percent	Valid Percent	Cumulative Percent						
Valid	Student	84	84.0	84.0	84.0						
ļ .	House wife	2	2.0	2.0	86.0						
	Office employee	6	6.0	6.0	92.0						
	Government officer	2	2.0	2.0	94.0						
	Business owner	6	6.0	6.0	100.0						
	Total	100	100.0	100.0							

Monthly Income

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than 10,000	78	78.0	78.0	78.0
ł	10,001-20,000	14	14.0	14.0	92.0
ł	20,001-30,000	4	4.0	4.0	96.0
[more than 50,000	4	4.0	4.0	100.0
	Total	100	100.0	100.0	

48

Bread consumption behavior

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Usually consume	94	94.0	94.0	94.0
l	Not usually consume	6	6.0	6.0	100.0
l	Total	100	100.0	100.0	

Frequency of consumption

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Everyday	18	18.0	18.0	18.0
	2-3 times a week	54	54.0	54.0	72.0
	Once a week	24	24.0	24.0	96.0
-	2-3 times a month	2	2.0	2.0	98.0
	Once a month	2	2.0	2.0	100.0
	Total	100	100.0	100.0	

	6	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	FarmHouse	74	24.7	24.7	24.7
	Gardenia	16	5.3	5.3	30.0
	A-Plus	14	4.7	4.7	34.7
	S&P	64	- 21.3	21.3	56.0
	Yamazaki	66	22.0	22.0	78.0
	In&Out	18	6.0	6.0	84.0
	Gateaux House	34	11.3	11.3	95.3
	Village	4	1.3	1.3	96.7
	Other	10	3.3	3.3	100.0
	Total 🕺	300	100.0	* 100.0	
	2	Consu	ime as	1 al GU	

Brands

Consume as

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Breakfast	40	40.0	40.0	40.0
	Lunch	2	2.0	2.0	42.0
	Snack	54	54.0	54.0	96.0
	Desert	4	4.0	4.0	100.0
	Total	100	100.0	100.0	

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Single slice	44	44.0	44.0	44.0
	Small loaf(less than 10)	44	44.0	44.0	88.0
	Large loaf (more than 10)	10	10.0	10.0	98.0
	Others	2	2.0	2.0	100.0
	Total	100	100.0	100.0	

Point of consumption

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Convenience store	22	22.0	22.0	22.0
	Supermarket	14	14.0	14.0	36.0
	Both	64	64.0	64.0	100.0
	Total	100	100.0	100.0	

Product Acceptance

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Accept	100	100.0	100.0	100.0

Buying decision

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Buy	88	88.0	88.0	88.0
	Not buy	12	12.0	12.0	100.0
	Total	100	100.0	100.0	

		2129-	S Price	1969 ລັນປິ່ດໄ	ж)
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	35ß	30	30.0	30.0	30.0
	40ß	26	26.0	26.0	56.0
	45ß	44	44.0	44.0	100.0
	Total	100	100.0	100.0	

Descriptive

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Softness	100	5.00	9.00	7.5200	1.02966
aroma	100	5.00	9.00	7.6000	.94281
Sweetness	100	6.00	9.00	7.6400	.84710
Overall	100	6.00	9.00	7.8000	.80403
Valid N (listwise)	100				

			Price			Total
			35ß	40ß	45ß	35ß
Buying decision	Buy	Count	22	22	44	88
		% within Buying decision	25.0%	25.0%	50.0%	100.0%
		% within Price	73.3%	84.6%	100.0%	88.0%
		% of Total	22.0%	22.0%	44.0%	88.0%
	Not buy	Count	8	4	0	12
		% within Buying decision	66.7%	33.3%	.0%	100.0%
		% within Price	26.7%	15.4%	.0%	12.0%
		% of Total	8.0%	4.0%	.0%	12.0%
Total		Count	30	26	44	100
		% within Buying decision	30.0%	26.0%	44.0%	100.0%
		% within Price	100.0%	100.0%	100.0%	100.0%
		% of Total	30.0%	26.0%	44.0%	100.0%
	2	ABOR	35			

Buying decision * Price Cross tabulation

THE ASSUMPTION UNIVERSITY LIBRARY

