PRODUCT DEVELOPMENT OF BREAD WITH SANGYOD RICE FLOUR SUBSTITUTED FOR WHEAT FLOUR

Jiraporn Weenuttranon

Faculty of Science and Technology, Suan Sunandha Rajabhat University, Bangkok, Thailand
Email: jiraporn.we@ssru.ac.th

ABSTRACT

The development of bread products from Sangyod rice flour substituted for wheat flour into bread product. The research purpose aimed to increase the value of Sangyod rice and to increase the choice for consumers. The results of the sensory quality assessment of the 3 types of bread were used to select the standard recipes for the development of bread from the Sangyod rice flour. This study found that the most appropriate recipe was the 1st recipe, which consisted of 500 grams of wheat flour, 5 grams of yeast, 50 grams of sugar, 8.75 grams of salt, 300 grams of milk, 20 grams of milk and 30 grams of white butter. This study aimed to investigate the ratio of Sangyod rice flour substituted for wheat flour in the bread production was 15:85, as the cost of standard recipe was 58.59 baht. Then, the physical properties were determined by using a Texture Analyzer. The hardness tended to increase by 1.69. Springiness, cohesiveness and chewiness tended to decrease by 0.87, 0.62 and 9.25, respectively. Color analysis were performed by using the HunterLab, in the system shared the value of L * a * b * at 51.56 2.91 and 8.29 respectively, then, the consumer's acceptance of the product of Sangyod rice flour was studied; number of samples were 339 people. Part 1: the study of general information included; there were female more than male, 53.4% were female, there were 38.9% % of students in the aged group of 20 years old, 71.1% were in the second year, 16.2% were in the computer science field, and 45.7% had the monthly income of less than 5,000 baht. Part 2: the study of consumption behavior in the purchase of bread products; found that consumers purchased 100 baht per visit; 71.1 percent of the time, the purchase amount of bread products were less than 2 times a week, 44.5 percent. Whoever had an influence in buying bread products, the study found 71.7% were themselves. The period of time they usually bought bread products, which was that before 9.00 am 23.6 percent. The main reason for choosing the products of each type of bread was that it depended on taste, 48.1% and the place where you chose to buy bread products was 54.6% convenience store. Part 3: the study results of marketing mix factors included, the most agreeable aspect of the bread product were; consumers think the obvious label specified the date / month / year affected the purchasing decision. In the most agreeable aspect of price were the products with the price tag clearly affected the purchase of bread products by 43.1 percent. The most agreeable aspect of the distribution channel was distribution of bread products using the convenience store by 53.1%. The marketing promotion, which was very agreeable, was advertisement of bread products this affect the purchasing decision of bread products by 45.1 percent. And Part 4. The results of the packaging design found that were the color of the packaging, packaging design, logo, letter and overall preference of packaging. Overall, the packaging was very satisfying. In the field of product acceptance, they accepted the product "Sangyod Rice Flour Bread" 92.6 percent and if it was available. "Sangyod Rice Flour Bread" would buy 59.3% and if the price was found to be 15 baht, or at 37.8%.

Keywords: Bread, Sangyod Rice, Wheat flour, Sangyod Rice Flour

INTRODUCTION

Bread is one of the types of baked snack products that consumers like to eat with milk, tea and coffee, and most of the city society has a life in a hurry to do activities that require quick access. The reason is the impact of changes in consumer behavior especially breakfast because the bread's consumption is easy to eat instead of breakfast, it is affordable and easy to buy. Bread is a product; the highest value in the bakery market is 12.8 billion baht and is likely to continue to grow (Prawetvut Raiwan, 2016) [1]. The main ingredients in making bread include wheat flour, sugar, milk fat, salt water and yeast. The main ingredient is wheat flour, which is 47 to 50% of the total weight of the ingredients. Wheat flour contains two important proteins in a similar proportion , Gliadin and Glutenin, when kneaded with water, gluten is added. This gluten effect makes the dough elastic. The special characteristic of gluten make wheat flour suitable for making bread than other types of product (Kankanit Arrunphanid, 2010) [2].

Sangyod Rice is a scientific name as "Oryza sativa L.", which is a native rice type of the South, originally planted in Phatthalung Province. The farmers have grown for a long time from the ancestors to the present. Phatthalung's Sangyod rice has 2 types of rices, general Sangyod rice and Phatthalung's Sangyod rice, Phatthalung's Sangyod rice is the first Thai rice that has been registered as Geographical Indication. Geographical Indication (GI) from Department of Intellectual Property, Ministry of Commerce. "Sangyod Rice

in Phatthalung". This type of rice is beneficial to the human body and is popular. Sangyod rice is higher than other varieties of rice is higher in fiber than other varieties of rice, it is useful to slow aging. Iron and niacin are higher than those of other varieties, which are useful in blood maintenance, strengthen the body and prevent mental illness. It also contains antioxidants, oryzanol and Gamma Amino Butyric Acid (GABA), which reduces the risk of cancer. Sangyod rice is a native rice species with high nutritional value (Sumreung Saetan, 2007) [3].

Therefore, the researcher is interested to study the Sangyod rice flour. This study intend to use Sangyod rice flour for replacing some wheat flour. It is also an option for consumers, can increase the value of rice to farmers and can be produced as a household industry.

METHODOLOGY

1. Study the standard recipe of bread making process.

Studied the standard recipe of 3 recipes were used, when the 3 recipes were taken to test the sensory quality using the acceptance test method of the 9-Hedonic Scale, then used to evaluate the characteristics of the species, such as appearance, color, aroma, taste, texture and overall preference. The experimental study used testers 30 peoples; the experimental design was Randomized Complete Block Design: RCBD, analysis of variance used the computer program to calculate the statistical value, and compared the difference between the averages by Duncan's New Multiple Range Test method at the 95% confidence level. The selection of the standard recipe that was the highest acceptable score, it was used as a standard recipe in the production of Sangyod rice flour bread.

2. Study the ratio of Sangyod rice flour to wheat flour in bread making.

Studied the ratios of Sangyod rice flour to wheat flour, which using the accepted standard recipe with the study on the 3 different ratio of Sangyod rice flour to wheat flour, were 15:85, 25:75 and 35:65, respectively. Then, the process of fresh bread production was to investigate the physical properties of Sangyod rice flour substituted for some wheat flour. The following method conducted the accepted standard recipe of Sangyod rice flour bread that were analyzed to determine the physical quality of the Sangyod rice flour bread; Texture Analyzer measured for the analysis of Hardness, Springiness, Cohesiveness and Chewiness. The HunterLab was used to display the results in terms of luminosity (L*), red (a*) and yellow (b*); the experimental design was Completely Randomized Design (CRD), analysis of statistical variance, and compared the difference between the average by Duncan's New Multiple Range Test method at the 95% confidence level.

3. Study the consumers' acceptance of Sangyod rice flour products.

The method of acceptance test of bread products made from Sangyod rice floure partial substituted for wheat flour; the experimental design was Randomized Complete Block Design (RCBD) for the general consumer using 345 questionnaires, the questionnaire was used to test consumers' acceptance of bread products using Sangyod rice flour substituted for wheat flour. The questionnaire was used as the Likert scale. The sample size was determined by the finite population. The application of Taro Yamane formula was shown in the following formula (Teerada Pinyo and Ardisai Thowicha, 2015) [4].

Step 1: Selected population that was students in the Faculty of Science and Technology, the researcher selected the samples studied in the Faculty of Science and Technology, Suan Sunandha Rajabhat University.

Step 2: Selected the sample using a purposive sampling method. The researcher set the sample by using a purposive sampling method; the total of 339 peoples using the Taro Yamane formula.

RESULTS

1. The results of the standard recipe of bread making.

The results of sensory quality assessment of 3 recipes of bread making to develop the product of Sangyod rice flour substituted for wheat flour as shown in Table 1

Table 1
The results of sensory characteristics of standard recipe of 3 bread recipe

Sensory Characteristic	Standard Recipe		
	1	2	3
Appearance	7.30 ± 1.02^a	6.16 ± 1.34^b	6.03 ± 1.60^b
Color	7.33 ± 1.09^a	6.12 ± 1.22^b	6.23 ± 1.45^b
Odor [ns]	6.20 ± 1.27	6.50 ± 1.63	5.90 ± 1.62
Taste [ns]	6.46 ± 1.27	6.16 ± 1.51	6.33 ± 1.34
Texture (Softness)	6.86 ± 1.47^a	5.66 ± 1.51^b	5.53 ± 1.71^b
Overall	6.93 ± 0.98^a	6.33 ± 1.29^{ab}	6.03 ± 1.42^b

Notes; letters that are different in the horizontal indicate the distinct average were statistically significant at 95% confidence level.
Mean ± standard deviation
[a,b,c..] Means with the different letters are significantly different $(p\square0.05)$.
[ns] Means are not significantly different $(p>0.05)$.

From Table 1, it found that the sensory quality assessment of the standard bread recipe and the acceptance test of the 9-point Hedonic scale were evaluated by the university students amounting to 30 people in Suan Sunandha Rajabhat University. The results of the sensory quality assessment; it found that the sensory quality factors in the aspect of odor and taste, the scores of preference were not significantly different at the 95% confidence level. The preference scores of appearance, color, texture (Softness) and overall preference; there was a statistically significant difference at the 95% confidence level, as shown in Table 1 The first recipe had the preference score of color and appearance was in the moderate range, because the 1st recipe contained a mixture of milk which were different from other recipes. Milk when combined with other ingredients together, it helped the dough structure when combined with water. And when it melted with sugar, it made the product soft, milk contained fat and lactose. Therefore, the appropriate formulation for the development of the product of Sangyod rice flour was the first recipe and would be developed for the following purposes.

2. The results of the ratio of Sangyod rice flour substituted for wheat flour in bread making.

The results of sensory quality assessment to study the ratio of Sangyod rice flour substituted for wheat flour in bread making as shown in Table 2. The preparation process of Sangyod rice flour, that is, start the preparation with taking it into a baking tray in a hot air oven then sieve through the a 100-mesh sieve size. Thus, as the result of the above preparation will get the flour characteristics as the Figure 1.

Figure 1
Characteristic of Sangyod rice flour

Table 2
The results of color tests of Sangyod rice flour substituted for wheat flour in bread.

Color Value	Quantity Ratio of Sangyod Rice Flour to Wheat Flour (%)			
	Controller	15:85	25:75	35:65
Brightness (L*)	57.28±0.07[a]	51.56±0.98[b]	47.93±0.40[c]	46.41±0.10[d]
Red (a*)	0.31±0.50[d]	2.19±0.05[c]	2.79±0.12[b]	3.95±0.01[a]
Yellow (b*)	7.24±0.57[c]	8.29±0.06[ab]	7.81±0.47[bc]	8.72±0.04[a]

Notes; letters that are different in the horizontal indicate the distinct average were statistically significant at 95% confidence level.
Mean ± standard deviation
[a,b,c..] Means with the different letters are significantly different ($p\square0.05$).

From Table 2, The brightness of the Sangyod rice flour bread was the ratios of 15:85, 25:75 and 35:65, found that was significantly different at the 95% confidence level with a brightness value of 46.41. - 51.56, resulting in lower brightness compared to wheat flour, the total wheat flour (Control) was 57.28. This is because adding quantity of rice berry flour impacted to make the bread to be more firm and has not risen. Moreover it made the bread to have more dark colour (Patthama Hirunyophat, 2015)[5].

The red and yellow values of 15:85, 25:75 and 35:65, respectively, showed a statistically significant difference at the 95% confidence level. The color value tended to increase when using Sangyod rice flour; red values ranged from 2.91 to 3.95 and yellow values ranged from 8.29 to 8.71.

In terms of color values (L*a* and b*), the values of the samples were studied. The L* values near 100 indicated that the sample was very bright or white. If the value of L* approaches 0, it meant that the sample was less bright and darker. The positive value of a* indicated that the sample was red, but the negative value of a* indicated that the sample was green and the value of b* was positive the sample was yellow, but if the value was negative b* indicated that the example was blue (Aruntip Haematulin et al, 2012)[6].

Table 3
The results of the study of the physical examination of Sangyod rice flour bread using a Texture Analyzer

Textural properties	Sangyod rice flour quantity per wheat flour (percent)			
	Control	15:85	25:75	35:65
Hardness	1.72±326.92[b]	1.69±231.18[b]	1.90±364.82[b]	3.11±224.31[a]
Springiness	0.88±0.01[a]	0.87±0.01[a]	0.88±0.01[a]	0.80±0.04[b]
Cohesiveness	0.64±0.06[a]	0.62±0.02[a]	0.61±0.04[a]	0.54±0.03[b]
Chewiness	9.75±179.49[b]	9.25±122.06[b]	1.01±128.84[b]	1.38±209.23[a]

Notes; letters that are different in the horizontal indicate the distinct average were statistically significant at 95% confidence level.
Mean ± standard deviation
[a,b,c..] Means with the different letters are significantly different ($p\square0.05$).

From Table 3, Texture analysis of bread, which added Sangyod rice flour substituted for wheat flour in different ratios. The hardness of Sangyod rice flour in the all 3 ratios of Sangyod rice flour to wheat flour were 1.69 - 3.11 (Hardness). The texture of the whole wheat bread (Controller) was 1.72. Due to the fact that Sangyod rice flour had Amylose; when added to the bread, the hardness of the bread increased. Amylose was associated with gelatinization. When the dough was heated, the hydrogen bond was released. The dough would absorb water and swell. The flour solution was viscous and clear because of the free water molecules around the grain, the effect of the free water molecules around the starch granules (Patpon Puphet, 2009)[7]. When considering the springiness of bread with the use of Sangyod rice flour substituted for wheat flour in bread products. The restoration value was 0.80 - 0.88, resulting in a decrease in springiness compared to the springiness of whole wheat flour bread, the (Controller) was 0.88. The cohesiveness of bread using Sangyod rice Flour substituted for wheat flour; the cohesiveness was 0.54 - 0.62, resulting in lower cohesiveness compared to whole wheat flour (Controller) was 0.64. In wheat flour, there were two types of protein, Glutenin and Gliadin. The correct ratio would produce a substance called gluten. (Rachan Amphanthong, 2009)[8]. The chewiness of bread with   Sangyod rice flour substituted for wheat flour; the chewiness was 1.01 - 9.25, resulting in a
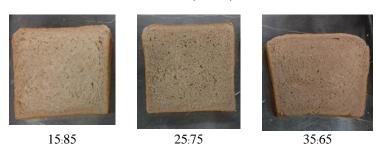
decrease in the chewiness compared with fresh whole wheat flour (Controller), it was 9.75 compared to protein from Sangyod rice because the protein of Sangyod rice did not cause gluten, the dough could not catch the gas (Patpon Puphet, 2009) [7]. Rice flours were 18.30–33.80 % amylose and high a amount of carbohydrate contributed to high amylose content (Kraithong, S., Lee, S., & Rawdkuen, S, 2018) [9]. which higher amounts of carbohydrate tend to increase amylose content, yet this also results in low values of other components such as ash, protein, lipid, and fiber (Oko and Ugwu, 2011) [10]. Low amylose rice flour generally offers dampness, softness, and chewiness to product textures. These qualities can also be applied in puddings, and soft cakes (Falade and Christopher, 2015) [11]. high amylose rice can provide firmness and crispness to products due to a three-dimensional network formation (Wang, L, 2016) [12].

Table 4
Sensory characteristics of bread using ratio of Sangyod rice flour to wheat flour.

Sensory characteristics	Sangyod rice flour to wheat flour		
	15:85	25:75	35:65
Appearance [ns]	7.00±1.50	7.03±1.32	6.80±1.78
Color [ns]	6.90±1.24	7.00±1.05	6.86±1.67
Odor [ns]	6.66±1.70	6.66±1.68	6.10±1.80
Taste [ns]	6.53±1.63	6.70±1.41	6.80±1.44
Texture (Softness)[ns]	6.53±1.81	6.50±1.71	6.20±1.54
Overall [ns]	6.96±1.90	6.93±1.28	6.66±1.64

Notes; letters that are different in the horizontal indicate the distinct average were statistically significant at 95% confidence level.
Mean ± standard deviation
[ns] Means are not significantly different ($p > 0.05$)

Figure 2
Characteristic of bread made of Sangyod rice flour which has ratio of Sangyod rice flour to wheat flour at 15:85, 25:75, 35:65

| 15:85 | 25:75 | 35:65 |

From Table 4, It found that the sensory quality assessment on the 1st bread recipe was chosen to study the ratio of Sangyod rice flour to wheat flour for bread production. The test was accepted by the testers using a   9-point Hedonic scale, evaluated by 30 students in Suan Sunandha Rajabhat University. This study found that the ratio of Sangyod rice flour to wheat flour were 15:85, 25:75 and 35:65. The sensory quality scores were not significantly different at 95% confidence level. Based on the above results, the researcher selects the recipe from the standard recipe cost, considering the raw materials used to replace the wheat flour for making bread, which was the main raw material, and concentrated on the development of the rice kernel; it can be seen that there was an increase in the production of business to develop a product of bread from the Sangyod rice flour. The ratio of Sangyod rice flour to wheat flour was used as the standard recipe; the total cost was 58.59 baht, 64.37 baht and 66.8 baht, respectively. Therefore, the 1st recipe was selected to develop the bread product, which the ratio of Sangyod rice flour to wheat flour was by 15:85. The cost of the standard recipe was 58.59 baht, this was the lowest cost.

3. The results of the consumers' acceptance of Sangyod rice flour products.

The result of the respondent to the questionnaire's satisfaction towards package format which are colour, design, symbol, letters and overall preference as shown in Table 5.

Table 5
The results of the packaging characteristics of Sangyod rice bread

Format package	Average	Standard Deviation	Satisfaction
Colour of package	3.83	.874	much
Design of package	3.75	.889	much
Symbol	3.87	.933	much
Letter	3.81	.954	much
Overall preference towards package	3.90	.969	much
Overall picture	3.83	.041	much

Figure 3
The product package of Sangyod rice bread

From Table 5, the results of the packaging characteristics of Sangyod rice bread according to the picture of package format, the findings were that overall picture, satisfaction level was at much ($\bar{x}$ = 3.83, S.D. = .041) considering each aspect, satisfaction level was at the most level in every aspect the first rank was overall preference of the package ($\bar{x}$ = 3.90, S.D. = .969) The next rank was symbol of the product ($\bar{x}$ = 3.87, S.D. = .933) the Colour of package ($\bar{x}$ = 3.83, S.D. = .874) The last rank was letter ($\bar{x}$ = 3.81, S.D. = .954) respectively.

CONCLUSION AND FUTURE WORK

1. *Study the standard recipe of bread for making bread from Sangyod Rice Flour.*

The standard recipe of all three recipes was studied. When the 3 recipes were tested for sensory quality, there was a significant difference at the 95% confidence level. The first recipe was suitable for the development of bread from the Sangyod rice flour substituted for wheat flour, which the 1st recipe of making bread contained: 500 grams of wheat flour, 5 grams of yeast, 50 grams of sugar, 8.75 grams of salt, 300 grams of milk, 20 grams of milk and 30 grams of white butter.

2. *Study the ratio of Sangyod rice flour to wheat flour in bread making.*

The color analysis of the Sangyod rice flour at the ratio of 15:85, 25:75 and 35:65 showed a statistically significant difference at the 95% confidence level with a value of 46.41. - 51.56, resulting in lower brightness. The red and yellow values of bread at 15:85, 25:75 and 35:65 ratios were significantly different at the 95% confidence level; used Sangyod rice flour that had the red values ranged from 2.91 to 3.95 and yellow values ranged from 8.29 to 8.71.

The texture analysis of Sangyod rice flour substituted for wheat flour in different ratios; when considering the hardness of Sangyod rice flour bread in all 3 ratios of Sangyod rice flour to wheat flour was 1.69 - 3.11, this study found the hardness increased. When considering the springiness of Sangyod rice flour bread using Sangyod rice flour as a substitute for wheat flour in bread products, the restoration value is 0.80 - 0.88, resulting in a decrease in springiness. The cohesiveness of bread using Sangyod rice flour replacing wheat flour; the

cohesiveness was 0.54 - 0.62, resulting in lower cohesiveness. And the chewiness of the Sangyod rice flour bread substituted for wheat flour for bread making; showed that the chewiness was 1.01 - 9.25.

The study results of the sensory quality assessment on the ratio of Sangyod rice flour to wheat flour; it found that the ratio of Sangyod rice flour was 15:85 25:75 35:65, respectively. The sensory quality assessment was not significantly different at the 95% confidence level. The first standard recipe with the ratio of Sangyod rice flour to wheat flour 15:85; and the standard cost of 58.59 baht, which was the lowest cost.

3. Study the consumers' acceptance of Sangyod rice flour products.

Part 1: the study results of general information included sex, age, education level, the educational field sampling group amounting to 339 students, there were female more than male, 53.4% were female, There are 38.9% % of students in the age group of 20 years old, 71.1% in the second year, 16.2% in the computer science field, and 45.7% has the monthly income of less than 5,000 baht.

Part 2: the study results of consumption behavior in the purchase of bread products; found that consumers purchased 100 baht per visit. With 71.1 % of the time, the purchase amount of bread products were less than 2 times a week, 44.5 %; who had an influence in buying the bread products, the study found 71.7% was themselves. The period of time they usually bought bread products, which was before 9.00 am 23.6 %. The main reason for choosing the products of each type of bread was that it depended on taste, 48.1% and the place where they chose to buy bread products was 54.6% convenience store.

Part 3: the study results of marketing mix factors included, the most agreeable aspect of the bread product were; consumers thought the obvious label specified the date / month / year affected the purchasing decision. In the most agreeable aspect of price were the products with the price tag clearly affected the purchase of bread products by 43.1 percent. The most agreeable aspect of the distribution channel was distribution of bread products using the convenience store by 53.1%. The marketing promotion, which was very agreeable, was advertisement of bread products this affect the purchasing decision of bread products by 45.1 percent.

Part 4: the study results of the packaging characteristics were the colors of the packaging, packaging design, logo, letter and overall preference of packaging. Overall, the packaging was very satisfying. In the field of product acceptance, the product acceptance were "Sangyod Rice Flour Bread" 92.6 %. And if "Sangyod Rice Flour Bread" was available consumers would buy 59.3% and if the price was found to be 15 baht 37.8%.

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