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## Development of rice paper by using germinated Homnin brown rice flour

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### Abstract

Health food is now being promoted among consumers due to its benefits such as reducing risk of non-communicable diseases. Germinated Homnin brown rice flour (GHNF) contains various health-promoting components such as dietary fiber, phytic acid, vitamins, gamma-aminobutyric acid (GABA), gamma-oryzanol and anthocyanin. Therefore, the objective of this study was to develop rice papers by using GHNF. Then, the effect of the ratio of GHNF:tapioca flour at 3 levels (45:55, 52:48 and 58:42) on the physical and chemical properties was determined, using rice papers made from rice flour as a reference. Moreover, sensory evaluation was conducted by 9-point hedonic scale. The results showed that water activity of all GHNF papers were in the range of 0.52-0.53. The tensile strength, cutting force and brittleness of 58% GHNF paper were not significantly different from the control ( $p \geq 0.05$ ). The lightness ( $L^*$ ) were decreased while the redness ( $a^*$ ) was increased. However, the yellowness ( $b^*$ ) of all formulas were similar. The sensory evaluation indicated that the overall liking score of 58% GHNF paper obtained the highest score at 7.5 (like moderately to like very much). The chemical analysis found that the developed product had higher antioxidant activity and GABA content than control formula. Moreover, the GHNF rice papers showed medium glycemic index (GI). Therefore, this product was suitable for people who were health-exercising or the NCDs patients. Moreover, this can be an alternative option for adding value to the product and Thai rice.

**Keywords:** germinated Homnin brown rice flour, rice paper, antioxidant activity, gamma-aminobutyric acid, glycemic index

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## 1. Introduction

Rice papers are common in a wide variety of Asian cuisine, most commonly Vietnam. The product is made from rice flour. Production of rice paper is similar to the noodles producing. Flour mixtures are smeared into thin strips then steamed until its cooked. Rice papers are dried and cut to the desired size and shape. The characteristic of rice paper is a thin transparent white and need to be soaked in the water to make its chewy before used [1]. Rice flour which has been used to produce rice paper should contain high amount of amylose (27-33%) [2]. This is because amylose has an important role to create a gel network after gelatinization. Therefore, starch gel becomes more stable and toughness. Moreover, the amount of protein content is also important factor for rice paper producing due to protein can cover starch granule and results in cleaves of rice paper. Therefore, if protein has been removed from flour by soaking with salt, the texture of rice paper becomes softer [3].

Rice is the staple food of Thailand. It is believed to provide more health benefits than other carbohydrate base food. This is due to it contains several nutrients and anti-oxidative compounds [4]. Homnin Brown rice is a Thai rice variety which contains various health-promoting components such as dietary fiber, phytic acid, vitamins, gamma-aminobutyric acid (GABA), gamma-oryzanol and anthocyanin. However, it is not widely consumed due to its poor cooking and textural properties. Geminated brown rice has been consumed as an alternative because it can help to improve eating

quality and health-promoting function [5]. Germinated Homnin brown rice (GHN) has a medium glycemic index (GI). Therefore, the development of food products from GHN might be a good way for consumers who are health conscious. The development of new products is a strategic area of the food industry. Consumers are demanding foods that show two main properties, with the first dealing with the traditional nutritional aspects of the food, whereas, as a second feature, additional health benefits are expected from its regular ingestion. These kinds of food product are often called nutraceutical foods [6]. Researchers have tried to use various composite flours with added value are growing rapidly. For noodle and the similar food type like pasta, numerous natural additive sources, such as cereal starches, banana flour and E-glucan, purple yam flour, protein from lupine, green tea powder, broccoli powder, konjac glucomannan, sweet potato and water chestnut flours have been studied so as to improve the nutritional value and functional properties of the product [7]. Therefore, the objective of this project was to use Germinated Homnin brown rice flour (GHNF) as an ingredient to make rice papers of high nutritional quality. The effect of GHNF was investigated in terms of physical, chemical, textural and sensory of rice papers.

## 2. Materials and Experiment

### 2.1 Raw material

The materials used were rice flour and tapioca flour (Bangkok Inter Food Co., Ltd, Thailand) and germinated Homnin brown rice flour

(GHNF) (Nuttakeitkhan agritech Co., Ltd, Thailand)

## 2.2 Preparation of rice paper

The basic rice paper formula consisted of 15 g of rice flour, 22 g of tapioca flour, 62 ml of distilled water and 1 g of salt. Three additional rice paper samples were prepared by using the ratio of germinated Homnin brown rice flour (GHNF) and tapioca flour at 45:55, 52:48 and 58:42 (w/w). The different formulations were processed into rice papers. All ingredients were mixed at room temperature ( $25\pm 2^\circ\text{C}$ ) to obtain uniform flour mixture. Then flour mixtures were smeared into thin strips and steamed until cooked. Rice papers were dried and cut to the desired size and shape (9x9cm).

## 2.3 Physical analysis

Water activity of the control and three different formulas of GHNF rice paper were determined by using a portable water activity meter set  $A_w$  (model ms1, Novasina, Switzerland). Color values of top surface of samples were measured by a spectrophotometer (ColorFlex EZ, Hunter Associates Laboratory Inc., Virginia, USA). Three replicates of each rice paper formula were determined from three different locations. The CIE color values were recorded as  $L^*$  (lightness),  $a^*$  (redness) and  $b^*$  (yellow). The tensile strength, cutting force and brittleness of 20 pieces of the three different formulas of GHNF rice paper were determined by a texture analyzer (TA. XT plus, Stable Micro Systems Ltd, YL, UK).

## 2.4 Chemical analysis

Ten grams of sample were mixed with 50 ml of absolute ethanol and left to stand at room temperature (approximately  $25\pm 1^\circ\text{C}$ ) for 24 hours, then centrifuged at 8,000 rpm for 15 minutes. The clear supernatant was separated for analysis of total phenolic compounds using the Folin-Ciocalteu colorimetric method [8] and antioxidant activity using the ORAC (oxygen radical absorbance capacity) assay which was developed from Ou et al. [9] and also by the FRAP (Ferric reducing antioxidant power) method, measuring light absorbance at 593 nm and comparing to standard Trolox solution [10]. The GABA content and glycemic index were calculated by the methods of Tsukatani et al. [11] and Granfeldt et al. [12], respectively.

## 2.5 Sensory analysis for GHNF rice paper

Sensory characteristics of rice paper at 3 levels of the ratio of GHNF:tapioca flour (45:55, 52:48 and 58:42) were assessed. Sensory quality characteristics were evaluated by a 1-9 point hedonic scale of liking, where 9 = like extremely; 8 = like very much; 7 = like moderately; 6 = like slightly; 5 = neither like nor dislike; 4 = dislike slightly; 3 = dislike moderately; 2 = dislike very much; 1 = dislike extremely. The rice papers were evaluated for their color, appearance, odor, texture and overall liking by 30 untrained panelists. The sensory panelists, both female and male, are from Institute of Nutrition, Mahidol University.

## 2.6 Statistical analysis

Data were analyzed using analysis of variance and t-test. Duncan multiple range test was used to determine significant difference among the various samples in triplicate. Data were analyzed using the software, Statistical Package for Social Science (SPSS) version 19 SPSS Inc., Chicago, IL, USA at the 0.05 level.

## 3. Results and Discussion

### 3.1 Effect of GHNF on physical properties of rice paper

Water activity is water in food which is not bound to food molecules and can support the growth of bacteria, yeasts and molds (fungi). According to the Table 1, the results showed that water activity of four rice paper formulations were in range of 0.52 to 0.53. Normally, rice paper is contaminated by fungi which can growth fast at water activity of 0.6-0.89 [13]. Therefore, all rice paper formulations are not suitable for fungi growth. Color is one of the most important factors in determining consumer acceptance. The GHNF significantly affected the color of the rice papers. The rice paper containing GHNF displayed lower lightness ( $L^*$ ) but higher redness ( $a^*$ ) than the control formula. However, the yellowness ( $b^*$ ) of all formulas were similar. That was affected by the natural color of GHNF used for rice paper preparation. The rice flour used in this study has high anthocyanin pigment caused dark flour color [14]. Furthermore, the cooking process as well as the alkaline condition could degrade anthocyanin

pigment in rice papers made from GHNF. The texture parameter of rice papers made from rice flour (control) and GHNF also were compared in Table 1. The results indicated that tensile strength and cutting force and brittleness of GHNF rice papers with ratio of 52:48 (GHNF:Tapioca flour) were not significantly different with the control formula. This is might be due to the similar amount of protein content [15].

### 3.2 Sensory attributes of GHNF rice papers

The rice papers were evaluated for their sensory quality characteristics, appearance, color, odor, texture and overall liking as show in Table 2. The results indicated that the score of appearance, color, odor, texture and overall liking were not significantly different between the formulas. However, the rice papers with ratio of 52: 48 (GHNF:Tapioca flour) received the highest score of overall liking (7.50; like moderately to like very much) This finding might concluded that using GHNF as an ingredient for rice paper could obtain the similar quality and consumer acceptability as regular rice paper.

### 3.3 Antioxidant activity, total phenolic compounds and glycemic index of GHNF rice paper

The total phenolic compound, antioxidant activity and GABA of rice papers containing GHNF were significantly higher than those without ( $p < 0.05$ ). These results were similar to those reported by Cáceres et al. [16]. Germination can improve GABA, total phenolic content and antioxidant activity in Ecuadorian brown rice

sprouts. However, many factors had the effect of total phenolic content such as extraction methods, varieties, growing condition and germination time [17]. Moreover, glycemic index (GI) of rice papers containing GHNF was lower than the control formula. The low level of GI in GHNF rice paper might be because of higher fiber content of GHNF than rice flour which slows the gastric emptying

rate. The GHNF rice paper had GI at 64 which could be concluded that this product is in the medium GI group (56-69). Many researchers found that the consumption of medium and low GI food could prevent risk of obesity, colon cancer and breast cancer [18, 19]. Moreover, this could help to improve insulin sensitivity in diabetes mellitus patients and increase HDL-cholesterol [19].

**Table 1.** Physical properties of GHNF rice paper

Physical properties	Rice paper (Control)	GHNF rice paper (ratio of GHNF:Tapioca flour, w/w)		
		45:55	52:48	58:42
Water activity	0.53±0.01 <sup>a</sup>	0.52±0.01 <sup>a</sup>	0.53±0.01 <sup>a</sup>	0.52±0.01 <sup>a</sup>
Colour (L*)	67.44±0.10 <sup>a</sup>	44.00±0.07 <sup>c</sup>	45.43±0.22 <sup>b</sup>	40.30±0.12 <sup>d</sup>
Colour (a*)	1.10±0.02 <sup>d</sup>	11.18±0.01 <sup>b</sup>	10.06±0.03 <sup>c</sup>	12.15±0.04 <sup>a</sup>
Colour (b*)	13.60±0.06 <sup>a</sup>	13.43±0.02 <sup>a</sup>	13.34±0.01 <sup>a</sup>	13.74±0.05 <sup>a</sup>
Tensile strength (N)	0.02±0.00 <sup>a</sup>	0.01±0.00 <sup>b</sup>	0.01±0.00 <sup>b</sup>	0.02±0.01 <sup>a</sup>
Cutting force (N)	5.11±0.68 <sup>a</sup>	4.17±0.48 <sup>b</sup>	4.63±0.37 <sup>ab</sup>	5.10±0.61 <sup>a</sup>
Brittleness* (N)	14.38±1.16 <sup>a</sup>	14.38±3.54 <sup>a</sup>	14.05±2.00 <sup>a</sup>	14.05±2.80 <sup>a</sup>

<sup>a,b,c</sup> Means followed by a different letter within the same row are significantly different (p<0.05)

\*the analysis was done by using dry rice papers

**Table 2.** Sensory attribute score of liking of rice paper with different ratio of GHNF and Tapioca flour

Attributes	GHNF rice paper (ratio of GHNF:Tapioca flour, w/w)		
	45:55	52:48	58:42
Appearance	6.95±1.23 <sup>a</sup>	7.00±1.03 <sup>a</sup>	7.10±1.17 <sup>a</sup>
Color	7.60±1.05 <sup>a</sup>	7.60±0.88 <sup>a</sup>	7.45±0.89 <sup>a</sup>
Odor	7.10±1.74 <sup>a</sup>	7.20±1.01 <sup>a</sup>	7.20±1.54 <sup>a</sup>
Texture	6.45±1.99 <sup>a</sup>	7.00±1.26 <sup>a</sup>	6.95±1.28 <sup>a</sup>
Overall liking	7.05±0.83 <sup>a</sup>	7.30±0.73 <sup>a</sup>	7.50±0.95 <sup>a</sup>

<sup>a,b,c</sup> Means followed by a different letter within the same row are significantly different (p<0.05)

**Table 3.** Total phenolic compound, antioxidant activity, GABA content and glycemic index of different GHNF rice paper formulas

Rice paper formula	Total phenolic compound ( $\mu\text{gGAE/g dry weight}$ )	Antioxidant activity		GABA content ( $\text{mg/100 g}$ )	Glycemic index (GI)
		FRAP method ( $\mu\text{mol Trolox/g dry weight}$ )	ORAC method ( $\mu\text{mol Trolox/g dry weight}$ )		
Control	26.52 $\pm$ 1.97	0.16 $\pm$ 0.01	0.49 $\pm$ 0.04	0.00 $\pm$ 0.00	66.0
GHNF	249.24 $\pm$ 6.54*	1.89 $\pm$ 0.09*	3.81 $\pm$ 0.38*	5.60 $\pm$ 0.08*	64.0

\*significantly different ( $p < 0.05$ )

#### 4. Conclusions

The study revealed that GHNF can produce rice paper with a quality similar to those produced commercially. However, GHNF produced a reddish color and dark to the rice papers. The content of total phenolic compounds and antioxidant activity as measured by FRAP and ORAC methods showed higher in GHNF rice papers than the control. Moreover, GHNF was classified as medium glycemic index food. Hence, development and utilization of such functional foods will not only improve the nutritional status of the population but also helps those suffering from degenerative diseases.

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