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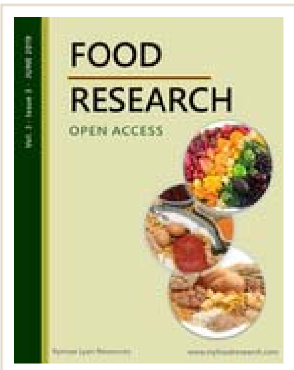

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Volume 3, Issue 3

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SHORT COMMUNICATION

Incorporating *Monascus*-fermented durian seeds and rice bran into bread: study on the bread physicochemical and sensory properties

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Abstract

Monascus-fermented durian seeds (MFDS) and rice bran (RB) have been incorporated into bread dough formulation. This research was aimed at physicochemical and sensory evaluation of bread formulated with both active ingredients. Bread made from four dough formulas i.e. control, with MFDS, RB and MFDS-RB-incorporating have been evaluated the physicochemical and sensory properties. The results suggested that no significant differences on both physicochemical and sensory properties of bread with MFDS-incorporating and control ($p>0.05$). Ash, crude fiber and total phenolic contents found on bread with RB and MFDS-RB incorporating were significantly higher than those of control ($p<0.05$). The bread was being in further evaluation of the functional properties of anti-hypercholesterol and anti-hyperglycemia activities.

1. Introduction

Bread is one of the oldest foods and popular around the world. In the breadmaking, wheat flour, water, salt, sugar and yeast are mixed into viscoelastic dough subjected to fermentation and baking (Sivam *et al*., 2010). Incorporating active ingredients into bread have grown rapidly, since the increased consumer awareness of health. Purple sweet potato flour, soy flour, flaxseed, green tea extract, whole grain rye, coriander leaf powder, grape seed and garlic have been incorporated into bread (Conforti and Davis, 2006; Wang *et al*., 2007; Zielinski *et al*., 2007; Hardoko *et al*., 2010; Das *et al*., 2012; Meral and Dogan, 2013; Suleria *et al*., 2015).

Monascus fermented-durian seed is a product of solid state fermentation with *Monascus purpureus* culture on durian seed substrate (Srianta, Novita and Kusumawati, 2012; Srianta *et al*., 2012). The MFDS potential as an anti-diabetes agent with α-glucosidase inhibition, antioxidant and in vivo anti-hyperglycemic activities (Srianta *et al*., 2013; Srianta *et al*., 2014; Nugerahani *et al*., 2017). MFDS has not been incorporated into food product. On the other hand, rice bran is also known as a potential ingredient for the development of anti-diabetic food. Qureshi *et al*. (2002) reported that consumption of 20 g of rice bran can reduce blood glucose levels in patients with type I and II diabetes mellitus. The content of tocopherol, tocotrienol, oryzanol, and polyphenols in rice bran also plays a role in controlling blood sugar levels. Trisnawati and Sutedja (2010) reported that rice bran has been used in the development of functional food products, i.e. cake with rice flour.

The aim of this research was to study the physicochemical and sensory properties of bread with *Monascus*-fermented durian seeds and rice bran incorporation.

2. Materials and methods

2.1 Materials, microorganism and chemicals

All ingredients except MFDS were obtained from local distributors. MFDS was prepared in the laboratory. Durian seeds were obtained from durian processing home industry. *Monascus purpureus* M9 was used in the MFDS preparation. It was maintained and subcultured on PDA monthly. All chemicals were analytical grade obtained from local distributors.

2.2 Preparation of Monascus-fermented durian seeds

Monascus-fermented durian seeds were prepared according to our previous research (Srianta, Novita and Kusumawati, 2012). Durian seeds were prepared by

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boiling, peeling, cutting and sterilization. After that, the 50 g of sterilized durian seeds cut were inoculated with 7 -days *Monascus purpureus* starter with a total spore of about 10^5 spores/mL. Incubation was carried out at room temperature (± 30°C) for 14 days, then dried at 45°C for 24 hours. The dried MFDS was ground to obtain powder form. The MFDS was used as an ingredient in bread formulation.

2.3 Bread formulation and processing

Four bread formulas were: 1) control, consist of 200 g of wheat flour, 10 g of sugar, 8 g of margarine, 2 g of salt, 0.6 g of bread improver, 3 g of baker yeast and 124 g of water; 2) MFDS, consist of those of control ingredients with MFDS incorporating at 0.15 g; 3) RB, consist of those of control ingredients with RB incorporating at 20 g; and 4) MFDS+RB, consist of those of control ingredients with MFDS and RB incorporating at 0.15 g and 20 g.

The ingredients were mixed in a mixer (Phillips HR 1559 model) until it becomes a viscoelastic dough and then, fermented at 30°C for 30 mins. The dough was rolled, rounded and placed in a baking dish, and baked in an oven (Gas Bakery Oven RFL-12C model) at 180°C for 30 mins.

2.4 Evaluation of bread characteristics

2.4.1 Physicochemical analysis

The physical properties analysis of the bread: specific loaf volume according to AACC (2000), color by using color reader (Konica Minolta CR-10, Konica Minolta Optics, Inc., Japan) and texture profiles including hardness, cohesiveness and springiness by using texture analyzer with cylinder probe P36R (TA-XT plus, Exponent Lite software). The chemical analysis of moisture, ash, protein, and crude fiber contents analysis refer to the AOAC method (AOAC 925.10, AOAC 923.03, AOAC 984.13 and AOAC 978.10 respectively). Total phenolic content analysis was conducted according to Lee *et al*. (2008).

2.4.2 Sensory evaluation

Sensory evaluation of the bread was conducted by using the hedonic method (Stone and Sidel, 2004). A 7-point scoring was used with 1 representing extremely dislike and 7 representing extremely like. Forty untrained panelists participated in the sensory evaluation and had no previous or present taste or smell disorders. Bread samples were labeled with three-digit codes and randomly presented to avoid bias of order of presentation. The panelists scored for colour, texture, aroma, taste and overall preferences of the bread from the four formulas. The study was in accordance with the Declaration of Helsinki (Anon., 2017).

2.5 Statistical analysis

The experiments were conducted triplicate. The obtained data were subjected to analysis of variance (ANOVA) with α = 5% and followed by the Duncan Multiple Range Test (DMRT) with α = 5%. SPSS (version 19.0) were used in the analysis.

3. Results and discussion

3.1 Physicochemical characteristics

Bread made from four different formulas were visually different in their height and colour (Figure 1). Incorporating RB alone or combination with MFDS into the formula affected the specific loaf volume, colour, hardness, cohesiveness and springiness (Table 1), ash, protein, crude fiber and total phenolic content (Table 2) of the bread significantly ($p<0.05$). These results indicated that existence of rice bran in the formula contributed significantly in the colour, structure and texture properties of the bread. Specific loaf volume of bread with RB and MFDS-RB incorporation were higher than those of control and with MFDS ($p<0.05$). This results may be related to the fiber content in rice bran which has high water absorption capacity, as reported by Rafe *et al.* (2017). These results reflected that rice bran reduced the fermentation and proofing rates of dough, which related to the water availability for yeast activity. In the breadmaking, proteins in wheat flour need water to form gluten, which then contributed to form the viscoelastic matrix that can stretch properly by CO_2 during fermentation and proofing. The high fiber content in the bread dough with RB incorporation can reduce water availability in the system for the gluten formation, which causes the dough unable to stretch properly by CO_2. Durian seed contains high amount of gum with high water absorption capacity of 1112.15% (Cornelia *et al.*, 2015). However, the MFDS incorporation does not affect significantly on the specific loaf volume, may be due to the MFDS incorporated in low amount.

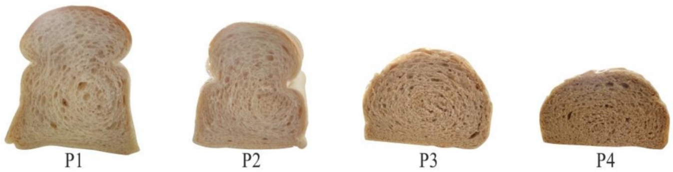

Figure 1. Picture of bread with MFDS and RB incorporation. P1: Control; P2: MFDS; P3: RB; and P4: MFDS+RB

Bread with RB and MFDS-RB incorporation was visually darker brown than those of bread with MFDS only. Colour measurement by using colour reader (Table 1) also show that L* of crumb of bread in which rice bran presence was higher than those of control and with MFDS alone. Sharma *et al.* (2004) also found the similar

Table 1. Physical characteristics of bread with MFDS and RB incorporation**

Bread formula	Specific volume (cm^3/g)	Colour			Texture profile		
		L*	a*	b*	Hardness (g)	Cohesiveness	Springiness (mm)
Control	5.45^b	75.54^b	0.41^a	11.18^a	128.89^a	0.80^b	0.91^b
MFDS	5.03^b	72.56^b	1.24^b	9.94^a	160.81^a	0.79^b	0.93^b
RB	3.78^a	66.57^a	3.82^c	18.18^b	643.54^b	0.65^a	0.81^a
MFDS+RB	3.91^a	68.4^a	4.31^c	18.43^b	784.46^b	0.64^a	0.78^a

* L = lightness, a = redness, b = yellowness
**Values are means ± standard deviations (n=3 for each group). Values in a column with the same letters are not significantly (p>0.05) different. The statistical significance was evaluated by one-way ANOVA followed by DMRT test (α = 0.05).

Table 2. Chemical composition of bread with MFDS and RB incorporation

Bread formula	Moisture (%)	Ash (%)	Protein (%)	Crude fiber (%)	Total phenolic (%)
Control	36.15^a	1.05^a	9.29^a	0.10^a	0.138^a
MFDS	37.24^a	1.06^a	8.83^a	0.12^a	0.168^{ab}
RB	37.35^a	1.50^b	8.57^a	0.24^{ab}	0.197^b
MFDS+RB	37.65^a	1.49^b	8.60^a	0.37^b	0.193^b

**Values are means ± standard deviations (n=3 for each group). Values in a column with the same letters are not significantly (p>0.05) different. The statistical significance was evaluated by one-way ANOVA followed by DMRT test (α = 0.05).

result that rice bran becomes darker after extrusion cooking, that occurred may be due to the browning reaction mainly Maillard during the heating process. The presence of high fiber and pheophytin in the rice bran may also contribute to the darker formation (Aung *et al*., 2014; Hussien *et al*., 2017). MFDS incorporation affected only on the redness value, higher red value is resulted by the MFDS presence. The MFDS contain red pigments produced during the Monascus solid state fermentation (Srianta *et al*., 2012).

Hardness, cohesiveness and springiness of bread with MFDS incorporation was not significantly different with the control (p>0.05), but those properties were significantly different with the bread with RB presence. Bread dough with RB incorporation increased the water absorption requirement. The high fiber content of the rice bran causes high water absorption capacity of the bread dough. The limited gluten formed in the dough, the heavy loaves bread obtained. This may be related to higher hardness values and lower cohesiveness and springiness values, which is in close agreement with Lima *et al.* (2002).

RB and MFDS+RB incorporation affected ash, crude fiber and total phenolic contents in the bread significantly (p<0.05). This results related to the chemical composition of rice bran that high contents in ash, fiber and phenolic compounds. MFDS contain phenolic compound (Srianta *et al*., 2014), but the bread with MFDS incorporation was not significantly different with the control (p>0.05). This may be due to the low level of MFDS incorporated into the bread dough.

3.2. Sensory characteristics

The overall preference scores of the bread with RB and MFDS+RB were significantly different with the control and with MFDS only (Table 3). Overall preference was determined on the basis of colour, aroma, texture and taste. Panelists gave lower scores to the bread's colour in which RB presence. Interestingly, there were no significant different of aroma and taste preferences among control, with MFDS incorporation and with RB incorporation.

Table 3. Sensory characteristics of bread with MFDS and RB incorporation

Bread formula	Preference				
	Colour	Aroma	Texture	Taste	Overall
Control	5.80^c	5.03^b	5.30^c	5.05^b	5.20^c
MFDS	6.08^c	4.48^{ab}	4.48^b	4.80^b	5.20^c
RB	3.80^b	4.80^b	5.13^c	4.48^b	4.48^b
MFDS+RB	2.53^a	4.05^a	3.35^a	3.15^a	3.88^a

**Values are means ± standard deviations (n=40 for each group). Values in a column with the same letters are not significantly (p>0.05) different. The statistical significance was evaluated by one-way ANOVA followed by DMRT test (α = 0.05).

4. Conclusion

Incorporating MFDS did not significantly affect almost all of the physicochemical and sensory characteristics of bread, whereas the incorporating RB affected significantly on those properties. The bread are being in further evaluation of the functional properties of anti-hypercholesterol and anti-hyperglycemia activities.

Acknowledgment

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