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Effect of wheat flour replacement with durian seed flour on the quality of egg noodles

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Abstract The effect of partial replacement of wheat flour with durian seed flour (DSF) (0-50%w/w) on quality of egg noodles was investigated. Results showed that the addition of DSF led to increase its fat, fiber and ash contents, which the sample containing 50% DSF had the highest of all samples. Whereas the moisture and protein were decreased as the percentage of DSF was increased. In the hardness and adhesiveness, the noodle containing 50%DSF had the highest hardness and lowest adhesiveness, as same as the cooking time was increased as the DSF increased. The sensory evaluation demonstrated that noodles containing DSF received the high score at 10-20%. The average value showed no significant difference (p>0.05) on taste and overall when compared with control. This research shows that DSF can be a useful replacement of wheat flour for production of egg noodles.

Keywords: Durian, Durian seed flour, egg noodle

Introduction

Durian (*Durio zibethinus* Murr.) is a seasonal fruit grown in Southeast Asia, Malaysia, Indonesia, Thailand, and Philippines. Durian is normally eaten fresh. Only a third of durian is edible, whereas the seeds (20–25%) and the shell (30-40%) are usually discarded. The seed of ripe durian contains 51.1% water, 46.2% carbohydrate, 2.5% protein, and 0.2% fat (Malini *et al*., 2016). Durian seed is very nutritious and has high carbohydrate and fibre contents (Amin *et al*., 2007; Pertiwi *et al*., 2018). There were several studies on durian seeds, which that could be incorporated into various food products including cake, cookies, soup, tempura, meatball, thickening agent etc. (Amin *et al*., 2007); (Cornelia *et al*., 2015) ; (Malini *et al.*, 2016) ; (Pertiwi *et al.*, 2018).

Egg noodles are made of unleavened dough that is cooked in boiling water. Generally, egg noodles are made with eggs and wheat flour, or rice flour. Sometimes arrowroot or tapioca starches are added to enhance the texture and uniformity of the strands. There are many varieties of egg noodles, and the

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sizes vary from country to country. Egg noodles are typically long flat strips of dough (Kumar, 2011). Generally, Thailand noodles are long, wide, flat strips of dough. Nowadays, wheat consumption may cause allergy or gluten sensitivity in some group of people, leading to increasing demand of gluten-free products (Purwandari *et al.,* 2014). There were several studies have been done using different types of wheat flour, sorghum flour (Suhendro *et al*., 2000), corn starches (Tam *et al.*, 2004), Pseudo-cereals (amaranth, quinoa, and buckwheat) (Alvarez-Jubete *et al.*, 2010), breadfruit, konjac, or pumpkin flour (Purwandari *et al.,* 2014). However, the addition of different types of flour may be lead to lower noodle quality.

Therefore, the aim of this study was to evaluate the suitability of durian seed flour to replace wheat flour in egg noodle making and to determine the highest content of durian seed flour that provides an acceptable composite noodle.

Materials and methods

Preparation of durian seed flour (DSF)

Durian seeds were removed from Sunshine International Co, Ltd. (Chanthaburi, Thailand). The seeds were cleaned and rinsed with water. The brown spermoderm covering cotyledon was removed by soaking the seeds in solution of sodium hydroxide (5g/100ml) and citric acid (5g/100ml) each 2 min and washed with water (Kategunya and Sanguansri, 2011). The seeds were sliced (1-2 mm thickness) and tray dried at 60 ℃ until the moisture content was less than 13%. The dried seed pieces were grounded into powder form. Seed powder was passed through a sieve (100 mesh), packed in the plastic bag and stored at room temperature until further use.

Noodle preparation

Egg noodles containing levels of DSF were prepared according to the formulation in table 1. The dry materials were mixed for 1 min at speed 1 (KitchenAid, USA). Then, salt, water and egg were added to mixture and mixed until the dough became uniform (speed 5 for 5 min). Next, the dough was placed in the stainless steel container, sealed and stored at room temperature (28 $\pm$2 ℃) for 30 min. The dough was divided into small portions and sheeted using hand-operated by feeding the dough inside the rollers to make the consistent structure before cutting into noodle form. All samples were prepared with same size and length as the commercial noodle.

Table 1. Formulation of egg noodles with 0-50% DSF

Samples	Wheat flour (g)	DSF(g)	Egg(g)	Salt(g)	Water(g)
control	100	0	50	2	25
10%DSF	90	10	50	2	25
20%DSF	80	20	50	2	25
30%DSF	70	30	50	2	25
40%DSF	60	40	50	2	25
50%DSF	50	50	50	2	25

Proximate analysis

Samples were analyzed for moisture, protein, fat, ash, carbohydrate (AOAC, 2000): moisture by the oven method; protein by the Kjeldahl method (g/100 gNx6.25); crude fat by petroleum ether extraction method; ash by the muffle furnace method and carbohydrate were determined by difference.

Texture analysis

Samples were measured as hardness and adhesiveness on a texture analyzer (TA-XT2, Stable Micro Systems, USA.).The samples were measured with the speed of 2.00 mm/s and strain 50. The hardness (g) and adhesiveness (g.sec) of each sample were measured at least three times for each sample.

Cooking quality

Cooking time was determined by put strips into boiling water, and checked the disappearance of opaque at the center of the strip. The time of disappearance of opaque center was recorded as cooking time. Cooking loss was determined as the quantity of dry solid in cooking distilled water after cooking noodle strips according to their cooking time (Purwandari *et al.,* 2014).

Sensory evaluation

Sensory evaluation was based on taste, mouth feel, color, aroma, overall quality. Every attribute was assigned a suitable quantity on the nine-point hedonic scale from one (dislike extremely) to nine (link extremely) by 20 trained panelists.

Statistical analysis

A completely randomized design (CRD) was considered in the experiment and one way analysis of variance was carried out. Mean values were determined by Duncan's New Multiple's Range test.

Results

Proximate analysis

The proximate composition of all samples are shown in Table 2. The results shown that the addition of DSF effected increasing of fat, ash, and fiber contents, whereas moisture, protein, and carbohydrate decreased. The noodle containing 50% DSF had the highest fat, ash, fiber, and carbohydrate at 0.36, 1.23, 0.46, and 44.36%, respectively. There were not significantly different (p>0.05) with 40% DSF of noodle. For protein and moisture contents, the 10% DSF of noodle had highest contents at 12.50 and 57.54%, respectively, which that were not significantly different (p>0.05) with control.

Table 2. Composition of egg noodle fortified with different percentages of DSF

Samples	Composition (%)					
	Moisture	**Protein**	**Fat**	**Ash**	**Fiber**	**Carbohydrate**
control	57.58 ± 0.10^{a}	13.50 ± 0.13^{a}	0.14 ± 0.15^{c}	1.10 ± 0.17^{c}	0.40 ± 0.22^{b}	27.28 ± 0.24^{d}
10%DSF	57.54 ± 0.11^{a}	12.50 ± 0.15^{ab}	0.20 ± 0.18^{b}	1.11 ± 0.12^{c}	0.41 ± 0.12^{b}	28.24 ± 0.18^{d}
20%DSF	54.12 ± 0.19^{b}	11.85 ± 0.11^{b}	0.25 ± 0.09^{b}	1.15 ± 0.09^{b}	0.42 ± 0.21^{b}	32.21 ± 0.21^{c}
30%DSF	51.38 ± 0.20^{c}	11.54 ± 0.08^{bc}	0.28 ± 0.11^{b}	1.18 ± 0.10^{b}	0.42 ± 0.18^{b}	35.20 ± 0.17^{b}
40%DSF	48.40 ± 0.13^{d}	9.80 ± 0.19^{cd}	0.35 ± 0.15^{a}	1.21 ± 0.21^{a}	0.45 ± 0.20^{a}	39.78 ± 0.19^{a}
50%DSF	45.10 ± 0.19^{e}	8.50 ± 0.20^{d}	0.36 ± 0.12^{a}	1.23 ± 0.19^{a}	0.46 ± 0.09^{a}	44.36 ± 0.20^{a}

Mean Values ± standard deviation with different letter in the same column indicates statistical difference ($p \leq 0.05$)

Physical quality

Hardness and adhesiveness of noodle was affected by DSF contents (Table 3). The addition of DSF to the formulation of noodle led to increase the hardness and decrease the adhesiveness of noodles. The noodle containing 50% DSF had the highest hardness among all cooked (4526 g), the lowest adhesiveness decreased (29.62 g). Physical appearance of noodles showed in figure 1.

Cooking time

Cooking time was effected significantly by DSF contents (Table 3). The increasing of DSF in dough gave lower cooking time. The control had lowest cooking time (3.15 min), no significantly different (p>0.05) with 10 and 20% DSF, which the noodle containing 50% DSF had the highest cooking time (6.45 min), significantly different ($p \leq 0.05$) of all samples.

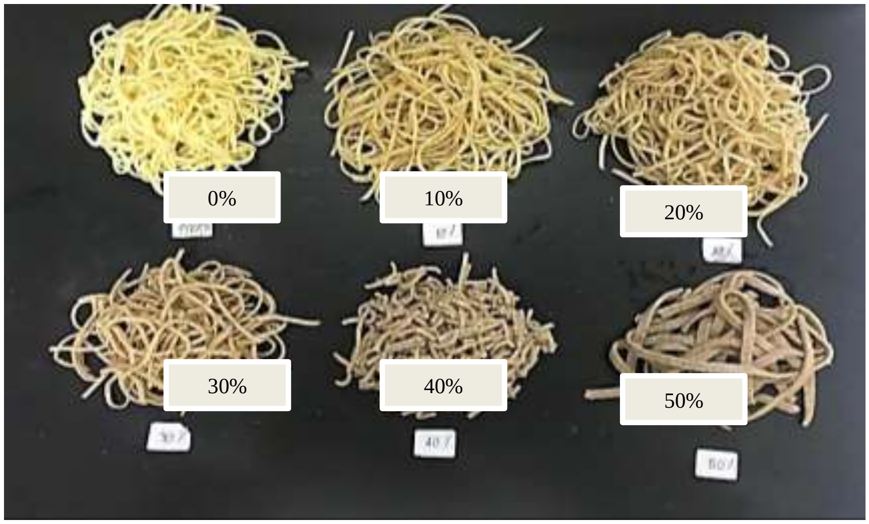

Figure 1. Physical appearance of noodles after cooking with different percentages of DSF

Table 3. Physical quality and cooking time of egg noodles with different percentages of DSF

Samples	Hardness(g)	Adhesiveness(g)	Cooking time(min)
control	3268±55.2^{d}	37.42±1.18^{a}	3.15±0.10^{d}
10%DSF	3362±70.8^{d}	35.18±2.03^{a}	3.30±0.53^{d}
20%DSF	3376±45.5^{d}	34.24±1.56^{b}	3.35±0.10^{d}
30%DSF	3684±64.0^{c}	32.85±2.01^{c}	4.10±0.50^{c}
40%DSF	4198±50.8^{b}	30.43±1.53^{d}	5.20±0.41^{b}
50%DSF	4526±20.4^{a}	29.62±2.10^{d}	6.45±0.15^{a}

Mean Values ± standard deviation with different letter in the same column indicates statistical difference ($p \leq 0.05$).

Table 4 Sensory evaluation of egg noodles with different percentages of DSF

Samples	Color	Aroma	Taste	Appearance	Mouth feel	Overall
control	7.03±1.18^{a}	6.83±1.10^{a}	7.19±1.56^{a}	6.96±1.21^{a}	6.61±1.10^{a}	7.41±1.42^{a}
10%DSF	6.90±2.14^{a}	6.64±1.08^{ab}	6.97±1.32^{a}	6.77±0.56^{a}	6.51±1.18^{a}	6.97±1.16^{ab}
20%DSF	6.61±1.45^{b}	6.48±1.15^{b}	6.70±0.98^{ab}	6.54±0.84^{b}	6.25±1.52^{b}	6.70±0.58^{ab}
30%DSF	5.90±1.51^{c}	5.67±0.90^{c}	6.51±0.85^{b}	5.90±0.93^{bc}	6.10±1.41^{bc}	6.51±0.74^{b}
40%DSF	4.93±2.21^{d}	4.80±0.57^{d}	5.48±1.24^{c}	5.45±1.10^{c}	5.15±1.12^{c}	5.54±0.52^{c}
50%DSF	4.70±2.60^{e}	4.67±0.86^{d}	5.06±1.11^{d}	4.87±1.09^{d}	5.09±0.98^{c}	5.03±0.54^{d}

Mean Values ± standard deviation with different letter in the same column indicates statistical difference ($p \leq 0.05$).

Sensory evaluation

Sensory evaluation showed that aroma, taste, and mouth-feel of noodle and was affected by treatments (Table 4). The panelist mostly was preferred the noodle fortified with 10 % DSF on all attributes. The average values were not significantly different (p>0.05) as compared to the control, and no significant different (p>0.05) with the noodle addition of 20% DSF on taste and overall. The addition of higher content of DSF (30-50%) to the noodle formulation that gave lower acceptance on all attributes, which that induced to increase the brown color and durian seed aroma in noodles.

Discussion

Gelatinization characteristic and granule swelling of the starch in the noodles were influenced by the amylopectin structure, starch composition, and starch granule size. Amylose content of DSF was still within the range of amylose content of common starch. Amylose in the flour was responsible for firm characteristic and induced gel formation while high amylopectin content was associated with sticky properties (Hakim *et al.*, 2013). The proximate contents of noodle were affected of the DSF addition. This could be explained by the addition of high amount DSF led to decreased water absorption capacity, this could be related to the interaction between DSF and water molecules decreased. The addition of DSF to the noodle formulation had effects to decreasing of protein, which might bind water molecules. The moisture within a starch-protein network can significantly affect the texture and overall quality of the products (Mirhosseini *et al*., 2015).

The presence of DSF could provide a stable polymeric network. This effect is similar to the products containing durian seed found and pumpkin flour, the cooked pasta containing 50% DSF had the highest hardness, this could be explained by the addition of hydrocolloids and polysaccharide of durian gum to the formulation of led to improve the cooking quality, uniformity and consistency (Mirhosseini *et al*., 2015). The coefficient of cooked noodles caused by cooking water absorption, this could be due to the granular and protein molecular size of DSF. Differences in water absorption might be related to differences in chemical and protein composition, degree of starch damage and gelatinization (Markowski *et al*., 2006), starch and protein have a great affinity for water which they absorb rapidly (Islas-Rubio *et al*., 2014).

The present study has shown that the physical quality, cooking time, sensory properties of noodle were affected by the concentration of the DSF added. The addition of DSF to the formulation of noodle had more hardness, cooking time and lower adhesiveness and sensory property of noodles. The noodle containing high DSF had much fat, ash, fiber, carbohydrate and low moisture and protein. The noodle with 10-20% DSF had most desirable overall acceptability. This research shows that DSF can be a useful replacement of wheat flour for commercial production of noodle.

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