Sensory Acceptance and Influence of Pumpkins (Cucurbita moschata) Flour in Making Crispy Noodles Toward Primary School Children of Bengkulu

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Sensory Acceptance and Influence of Pumpkins (Cucurbita moschata) Flour in Making Crispy Noodles Toward Primary School Children of Bengkulu

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ABSTRACT

Noodle is one of the popular foods and favoured in ASIA, including Indonesia. Thus, this research was conducted to determine the level of pumpkin concentration in substituting wheat flour as a natural food colorant in the manufacture of crispy noodles that can be accepted by consumers. It is experimental research. This research conducted the determination of pumpkin flour substitution on wheat flour, i.e., F0 (control, 0% substitution) F1 (20% pumpkin flour substitution), F2 (30% pumpkin flour substitution), and F3 (40% pumpkin flour substitution), and analysis of these substitutions toward organoleptic quality analysis in the development of crispy noodles. According to the results, at proximate composition determination, the water content of crispy pumpkin noodles of F0 has the lowest water content (2.46%), and F1 has the highest ash, protein, and starch contents (3.33%, 15.79%, and 37.42%, respectively). At the organoleptic properties assessed by the semi-trained panellist, the panellists seemed unable to distinguish the color or aroma of the crispy noodles significantly, with the excellent taste was F1 and texture was F2. So the F1 was chosen to go through the acceptability assessment on school children by comparing with F0. It was found that school children could not distinguish colors, flavors, aromas, and textures significantly between both F1 (selected product) and F0 (control). It revealed that pumpkin crispy noodles could be an alternative of healthy snacks with a 20% pumpkin flour substitution toward wheat flour that can improve the family economy. Further research suggested to find out regarding the benefits of crispy pumpkin noodles on the health of school children.

Keywords: school children, Pumpkin, dry noodles

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INTRODUCTION

Indonesia is one rich natural resource country. However, Indonesia is still facing public health and nutrition problems yet (Sipayung, 2014). Indonesia has at least 77 local food ingredients that contain carbohydrates almost the same as rice so it can be used as a substitute (Astuti.U.P, 2012). Utilization of local products is an effort in empowering local economic potential, while reducing dependence on functional food imports (Yusuf.B.,F.D.Lestary, 2017).

Bengkulu is very rich in staple food sources other than rice, such as sweet potatoes, cassava, arrowroot, and others. The availability of diverse local food sources in the region will be optimized through nutritional needs that can be met through both staple foods and snack foods (Astuti.U.P, 2012). One popular local food in Bengkulu is Pumpkin (*Cucurbita Moschata*). Pumpkin has an excellent biological potential because of the very diverse nutrient content (Yadav et al., 2010).

Pumpkin is a functional vegetable that is high in phenolic, vitamin flavonoids (vitamin A and vitamin C), amino acids, and carbohydrates (Muhieddine, 2019; Kaur et al., 2019). Pumpkin also contains high dietary fiber, β-carotene and phenolic compounds (Wahyono et al., 2020). Pumpkin is commonly used as a fruit, vegetable, and has therapeutic properties as well as medicine (Adam et al., 2001; Malik et al., 2010). Pumpkin is used in traditional medicine for several diseases such as antidiabetic, antihypertensive, antitumor, immunomodulation, antibacterial, antihypercholesterolemic, intestinal antiparasitic, anti-inflammatory, antalgic(Fu Caili, Shi Huan, 2006) Pumpkin pulp contains high antioxidants as an antidote to various types of cancer.(Dinu et al., 2016) The features of the Pumpkin, such as soft and easy to digest, also provide a quite high carotene (pro-vitamin A), which contribute to attractive colors into processed food. However, the Utilization of this staples has not been optimal and varied (Pendong, L.T ., O.Porajouw, 2017).

Pumpkin can be stored in about 1 to 3 months after harvest. However, when after peeled, the squash is prone to loss of moisture, softening, discoloration, and microbial

decay. Squash characteristics are influenced by the varieties by referring to the physicochemical and sensory profiles of several indicators such as total titratable acidity, pH, dissolved solids, carotenoid content, cooking time, color, hardness, descriptive sensory analysis, preferences, and purchase intentions.(de Almeida et al., 2019) In extending the shelf life durability of squash, then conduct the drying and processing into powder with the right technology (Dirim and Çalışkan, 2012). Pumpkin flour can be used and developed into a variety of foods such as bread, soups, cakes, sauces, instant noodles, and as a natural coloring agent in pasta and flour mixes (Cumarasamy et al., 2002). This kind of flour may improve nutrition, color characteristics, and taste.(Fei Que, Linchun Mao, Xuehua Fang, 2008) One product that can be developed from this flour is noodles.

Noodle is one of snackable food preferred by schoolchildren due to its chewy texture, practical, and easy to serve (Ratnasari, 2012). Squash can be one of the ingredients to make a good quality noodle product, but it needs a texturing agent to make it even better. To get a firm, hard, chewy, and sticky texture of noodles by adding flour (Purwandari et al., 2014). The addition of pumpkin flour may shorten the cooking time of noodles due to the rise of water absorption when cooked.(Minarovičová et al., 2017) Thus, Pumpkin is perfect for noodle products development that rich in benefits and can be used as a functional food to improve nutrition in school-age children (Hussain Dar et al., 2017).

Yellow Pumpkin or also known as summer squash (*Cucurbita moschata)* has a bright color so that it can be applied in making noodles.(Aukkanit and Sirichokworrakit, 2017; Nanthachai et al., 2020) Color is the primary indicator that influences a child's interest in eating the noodles as a snack. Previous studies found that elementary school children prefer to eat snacks with attractive colors, including crispy noodles (Ferreira de Almeida et al., 2017). Noodles that have a bright color provide a higher appeal to the preferences of elementary school children (Annis, 2019).

Based on the existing potential, it is necessary to study the concentration of pumpkin substitution against wheat flour as a natural food colorant in the preparation of the crispy noodles that can still be accepted by consumers.

METHODOLOGY

Pumpkins flour

Pumpkin (*Cucurbita moschata)* was divided and cut into pieces, removed the skin and seeds, washed, then steamed until tender, crushed using a fork, for a smoother result, then continued using a mixer. The pumpkin flour was made from crushed Pumpkin by removing the water, drying in the oven for ± 60 minutes with a temperature of 200 ºC, and minimizing the particles using Draymil, then sift through an 80 mesh filter.

The process of making crispy pumpkin noodles

The raw materials used in this study consisted of wheat flour, pumpkin flour, salt, and water. The process of making instant noodles substituted by Pumpkin was modified from Aukkanit et al.(Aukkanit and Sirichokworrakit, 2017) All ingredients were mixed and stirred for 15-20 minutes. Let it rested for 20 minutes. Then the dough was pressed with a pressure roller. The dough was flattened with a thickness of 1 mm and cut to width and length of about 1 × 300 mm. The noodles were steamed for 1 minute at 100 ºC for pre-gelatinization of starch. The noodles were put into a square-shaped metal mold, roasted in at a temperature of 65-75 ºC for 2-3 minutes. The product was placed in 5 x 3 inches CPP (OPP + PE) plastic and stored at room temperature (30±2 ºC). Water, ash, protein and starch content were analyzed by AOAC method.(*Official Method of Analysis of AOAC International*, 2000)

Optimization of crispy pumpkin noodles

This research was conducted with a completely randomized design (CRD). Noodles were substituted with pumpkin flour at 0, 20, 30, and 40% with three replications. Sensory evaluation of dry noodles was held with a 5-point hedonic scaling with 40 semi-trained panelists and 30 primary school panelists. The hedonic scale used five categories ranged from "very dislike (1)" to "very like (5)". All cooked treatments were steamed at 100 ºC for 3 minutes. Then the noodles were dried using the oven for 2-3 hours. Each panelist was given 50 grams from each sample. 70 panelists evaluated the color, taste, texture, and aroma of crispy noodles

Statistical analysis

Data analysis was carried out in 3 stages. Chemical data were analyzed by one-way Analysis of Variance (ANOVA). Sensory evaluation data were analyzed by two-way ANOVA if there were differences, DMRT method applied as further analysis at a significant level of 0.05. The sensory preference level of the semi-trained panelists was carried out using the Friedman test. The evaluation of preference level by primary school panelists used the Mann-Whitney test.

RESULTS AND DISCUSSION

Physical and chemical quality of crispy pumpkin noodles

The quality of pumpkin noodles in this study determined using a proximate analysis was performed on three treatment formulations (F1, F2, and F3) and one formulation control (F0) consisting of water, ash, protein, and starch. Based on the obtained results, dried squash noodles in 3 treatment formulas with squash substitution (F1, F2, and F3) had higher nutritional content compared to control formulas (F0). Proximate test results showed that the water, ash, protein, and starch content in the treatment formula (F1, F2, F3) were higher than the control formula (F0). This was influenced by the pumpkin flour substitution and the balance in the drying process, which initiates from the drying time and roasting process.

Ash content in the treatment formula was around 10.19 - 12.61%, higher than the control formula was 2.46%. The rapid drying process may cause the water in the material to be quickly evaporated.(Roongruangsri and Bronlund, 2016) Roongruangsri and Bronlund stated that the rapid drying process causes the water in the material is evaporated quickly. Drying at 60 ºC affects water content, water activity, color characteristics, total carotenoid content, bulk density, water-solubility, water absorption, and oil adsorption capacity. Ash content in the treatment formulas was around 1.82 - 3.33%, higher compared to the control formula (1.30%).(Aukkanit and Sirichokworrakit, 2017) This is consistent with previous research conducted by Aukkanit et al. (2017), who found that the substitution of pumpkin flour at 20 -30% had ash content of 1.86 - 2.05%. Protein levels in the treatment group were around 14.12 -15.79%, higher than controls (13.42%).(Aukkanit and Sirichokworrakit, 2017) This was different from the study of Aukkanit et al. (2017), who showed that protein content in 20 - 30% substitution had a protein content of around 7.81 – 7.96%. Starch content

in the treatment group was about 34.79 -37.42%, higher than control 33.05%.(Dewi, 2011) The carbohydrate and protein content does not significantly affect the taste and color of pumpkin noodles.

Sensory evaluation of crispy pumpkin noodles on semi-trained panelists

Table 2 shows that the acceptability tests of semi-trained panelists were assessed on color, taste, texture, and aroma. The substitution of pumpkin flour to wheat flour on dried noodles significantly influenced the sensory value ($p < 0.05$). Sensory evaluation results showed that the taste and texture had significant differences. The flavor in F1 has significant differences to F3, but there is no difference found toward F2.(Nanthachai N, Lichanporn I, Tanganurat P, 2020) The higher ratio of pumpkin flour against wheat flour will reduce the level of taste preference. The more pumpkin flour added to the noodle will lower the panelist's acceptability

Table 1: Nutritional value of crispy pumpkin noodles

Nutrient content	Formulation			
	F0	F1	F2	F3
Water (%)	2.46	12.18	12.61	10.19
Ash (%)	1.30	3.33	1.90	1.82
Protein (%)	13.42	15.79	14.32	14.12
Starch (%)	33.05	37.42	36.65	34.79

Table 2: Sensory evaluation of crispy pumpkin noodles

Parameters	Formulation			Acceptance level	P-value
	F1	F2	F3		
Color	3.55a	3.15b	3.12b	3.51	0.065
Taste	3.50ab	3.2bc	2.87c	3.35	0.024
Texture	2.92b	3.45a	2.82b	3.15	0.008
Aroma	2.82a	3.05a	3.17a	3.11	0.238

Note: Numbers followed by different letters on the same line indicate a significant difference

Figure 1. Dry noodles substituted with different levels of pumpkin flour F0 (0%), F1 (20%), F2 (30%), F3 (40%)

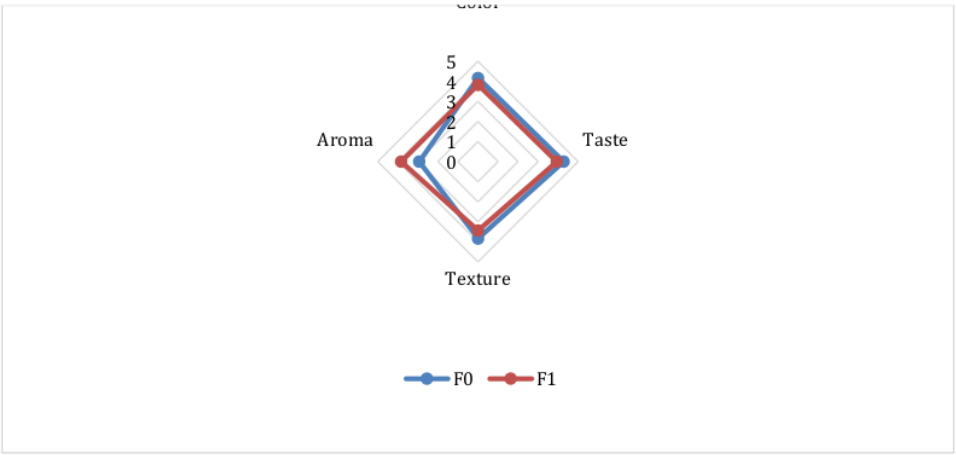

Figure 2: Sensory evaluation on panelists of primary school children

The texture in F1 and F2 are significantly different, but no significantly different from the F3 (Nanthachai et al., 2020; Purwandari et al., 2014). This occurred due to the higher the addition of squash flour will improve the hard texture, reduce elasticity, and the stickiness of the noodles (Laleg et al., 2017). Besides, the squash flour addition may affect the reduction of water absorption and softness of products.

However, the changes in aroma did not affect the acceptance of the panelists. Sensory evaluation results

show that in general, panelists prefer F1, which contained the lowest pumpkin flour of 20%. Based on the preference level in sequence, it can be seen that panelists liked the product in terms of color, taste, texture, and aroma. Color and flavor gained a higher average value than texture and aroma.

Sensory evaluation by primary school children

Figure 2 illustrates the sensory acceptance of color, taste, texture, and aroma assessed by not trained panelists based. The substitution of pumpkin flour on dried noodles was significantly affecting sensory acceptance ($p < 0.05$).

According to the Kruskal Wallis test on the color, taste, texture, and aroma of crispy pumpkin noodles and commercial crispy noodles, it was found no significant differences (P-value >0.05). Based on the average results, it was not really different in terms of color, taste, texture, and aroma of crispy pumpkin noodles against instant dry instant. Even though commercial crispy noodle was more preferred because it had a brighter red color and small shape like crispy noodles, so it was more attractive to primary school children (Annis, 2019). Colors charmed the children to consume the snacks. A brighter color is an indicator of high preference in consuming the crispy pumpkin noodles (Ferreira de Almeida et al., 2017). The addition of pumpkin flour shows that elementary school children cannot distinguish in sensory under the color, taste, texture, and aroma. The addition of 20% pumpkin flour to F1 was having sensory receptivity that was still accepted and preferred by primary school children

CONCLUSION

The most acceptable pumpkin (*Cucurbita moschata*) flour substitution in the crispy noodles by the target consumer is F1 (20% substitution). For the most preferred taste is F1 (20% substitution), and the most preferred texture is F2 (30% substitution). While the color and aroma appeared had no significant differences. The product F1 has the highest chemical properties on parameters of ash, protein, and starch, but water content gains the second-highest value, among other products. Primary school children could not significantly differentiate the best formulation according to the nutritional value (chemical properties) and the organoleptic results of the semi-trained panelists against the control formulation of commercial crispy noodles.

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CONFLICT OF INTEREST

All authors declare that there is no conflict of interest in this study.

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