Puree sweet potato substitution in wet noodle processing

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Abstract. Wet noodles are generally made from flour and water or other additives. They are formed in a typical noodle and have been through the process of boiling or steaming. Wheat flour is derived from wheat which cannot grow well in Indonesia. One of the drawbacks of wheat flour that has less natural color. Sweet potato is one source of carbohydrates with cream, yellow, orange and purple flesh. The natural color in the sweet potato has a function as a good antioxidant to maintain body health. The disadvantage of sweet potato does not contain gluten, which functions as a form of elasticity in the noodles. Thus in this research, sweet potato puree substitution will be carried out in the processing of wet noodles. The method used is an experiment with a complete random design. The results showed that the maximum amount of sweet potato puree added was highly dependent on the amount of water content of the sweet potato puree. Orange sweet potato puree has a higher water content than yellow, cream and purple flesh sweet potatoes. Comparison of the amount of sweet potato puree with 1:1 flour, except for the orange flesh sweet potato 0.8:1. The time of kneading and the time of the attainment of a smooth noodle dough is highly depend on the water content of sweet potato puree. The higher water content, it leads to form a smooth mixture. The addition of sweet potato puree can extend the shelf life of wet noodles in the refrigerator temperature.

1. Introduction

Noodles are food ingredients from wheat flour, shaped like a rope, usually cooked by frying or boiling, given meat, shrimp, vegetables, herbs, and so on (Big Indonesian Dictionary). Wet noodles are freshly boiled noodles. The water content of wet noodles is higher than fresh noodles. Noodles are the second staple food after rice for most of Indonesians. Nowadays many noodles are added to other carbohydrate sources, such as potatoes [1], broken rice [2], buckwheat flour [3,4] oat flour, barley flour [5], sweet potato flour to increase the traction, diversity of noodles and reduce the amount of gluten [6]. The addition of food sources of carbohydrates that do not contain gluten, can affect the quality of noodles [7]. On the other hand, many gluten-free noodles were also performed. Gasparre and Rosell make gluten-free noodles from tiger nut flour with hydrocolloid [8]. Heo et al., applied gluten-free noodles from rice with Lentinus edodes mushroom gluc-glucon. One source of carbohydrates used for making noodles is sweet potato [9].

Central Bureau of Statistics, reported that the average productivity of sweet potato (Ipomoea batatas L) in Indonesia is 123.29 ku / ha, with a total production of 2,196,033 tons [10]. The average sweet potato productivity in West Java is 153.73 ku / ha, with a total production of 429,378 tons. Sweet potato
producing centers in West Java include Cilembu Sumedang, Bandung, Garut, Kuningan, and Ciamis. In addition to carbohydrates as its main ingredient, sweet potatoes contain vitamins, minerals, phytochemicals (antioxidants: β-carotene, anthocyanin) and fiber (pectin, cellulose, hemicellulose). Sweet potato is very potential to be used as a material for making flour, starch and functional food [11-14]. In 100 grams of sweet potato contains various nutrients that are needed by the body such as: (1) 123 calories, (2) 1.8 grams of protein, (3) 0.7 grams of fat, (4) 27.9 grams of carbohydrates, (5) 1.1 grams of minerals, (6) potassium 49 mgram, (7) vitamin A 7,700 SI and vitamin C 22 mgram. Sweet potatoes contain antioxidants that can prevent the formation of free radical cells (cancer) and beta-carotene, substances that are needed for eye health. Yellow and orange flesh sweet potato is a potential source of pro-vitamin A because of its β-carotene content as a sweet potato dye. Ejumula varieties grown in Uganda have β-carotene content of up to 325µg / g dry basis [15]. Ninety percent of the orange sweet potato carotenoids are trans-carotene [15,16].

Purple fleshy sweet potato contains a lot of anthocyanin. Anthocyanin is a dye in flowers, leaves, tubers, fruits and vegetables that gives the color ping, red, blue, purple which is influenced by pH. Anthocyanin is soluble in water, safe for consumption so it is widely used as a natural coloring for beverage products, fermented drinks, juices, fruit juices, even instant noodles. Anthocyanins have antioxidant activity [17-21].

Jung et al., reported that the cooking technique can reduce the amount of phenolic content by 7% for the oven, and almost 40% for the frying or stewing technique [22]. The greatest amount of total phenolics is reduced when it is processed by boiling [16]. Kim et al., reported that the average of anthocyanin was reduced by almost half when steamed and only slightly reduced when roasted [23]. Thus in this study the addition of purple, orange and yellow sweet potato puree will be carried out. The purpose of this study was the techniques for making sweet potato substitution puree noodles, so that the quality of the resulting wet noodles is relatively constant.

2. Materials and methods

2.1. Material
The ingredients used for the formulation of sweet potato substitution wet noodles are water, high protein flour, and steamed sweet potatoes. All materials are obtained from traditional markets in the city of Bandung.

2.2. Tools
The tools used in this study include steamer, noodle maker, and other devices.

2.3. Analysis method
The product analysis method used is organoleptic test.

2.3.1. Organoleptic test for product development. The organoleptic nature of sweet potato substitution puree was analyzed using the Quantitative Descriptive Analysis (QDA) method. The panellists assessed the specific nature of the sample presented in small bowls in warm conditions. The assessment of sweet potato substitution puree noodles starts from appearance, color, taste, aroma, texture, and overall impression. Each time the panellists were given an observation sheet containing a 10 cm long unmarked straight line.

3. Results and discussion
Trial of making noodles is done by using two types of sweet potatoes, namely red-skinned sweet potato, orange flesh, and purplish red skin sweet potato, purple tuber meat. The trial begins with a recipe analysis of some recipes and how to make wet noodles. The recipe used as the initial recipe is the standard recipe that is present in all recipes for making wet noodles. The basic ingredients in making noodles are wheat flour and water or salt [24]. Some recipes add egg white to making noodles. in line
with the results of research Feng et al., that egg white protein, sodium alginate, xanthan and chitosan can provide good quality in making wet sweet potato vermicelli [25]. The process of making noodles includes mixing all ingredients, kneading until smooth, forming dough sheets, cutting and noodles ready to be processed. In general, making traditional noodles includes the stages of dough mixing, sheeting and cutting [24]. The process of making noodles can be seen in Figure 1, Figure 2 and Figure 3.

**Figure 1.** Original noodle making process A: Mix water and wheat flour, and form into baseballs, B: Rolling out the dough, C: The noodle sheet is allowed to stand until smooth, D: Cutting sheet noodle, E: Dusting, F: Wet noodle.

Figure 1 show the step of making original noodle. The first is mixing water and wheat flour, form into baseballs, resting, sheeting, cutting, and dusting. Figure 2 explains the process of making noodles with purple sweet potato substitution. Fresh purple sweet potato, washed, steamed, then skinned and mixed with flour. Then knead until smooth. Then flattened with a flattening machine, rested, then formed another sheet, rested, formed another sheet until the dough is completely smooth. After it is smooth, then the dough sheet is cut using a cutting machine. The quality of the noodles is largely determined by the eternal level of the dough. Storage of dough for purple sweet potato substitution is relatively longer compared to storage of original noodles. The original noodles are stored for 30 minutes, while the dough with purple sweet potato substitution for 2 times 30 minutes. Likewise, for storing the dough twice, the original noodles for just 15 minutes are already smooth, while the noodles with purple sweet potato substitution 3 times 15 minutes, then the dough can be formed.

**Figure 2.** Process of making purple sweet potato substitution noodles A: Mix steam purple sweet potato and wheat flour, B: Dough form into baseballs, C: Rolling out the dough, D: The noodle sheet is allowed to stand until smooth, E: cutting Sheet noodle, F: Dusting.
Figure 3 shows the process of making wet noodles with orange sweet potato substitution. The manufacturing process begins with washing fresh orange sweet potatoes, then steamed, then skinned and mixed with flour. Mix sweet potato flour mixture, then knead until smooth. After being smooth, the dough is flattened with a flattening machine, rested, then formed sheets, rested, formed another sheet until the dough is completely smooth. After smooth, the dough sheet is cut using a cutting machine. The quality of the noodles is largely determined by the eternal level of the dough. Storage of the dough for the substitution of orange meat sweet potato takes much longer than the storage of the original dough noodles and purple sweet potato substitution noodles. Noodles with orange flesh sweet potato substitution need the first storage time 4 times 30 minutes, while the dough with purple sweet potato substitution puree to 2 times 30 minutes, and the original 30 minutes. Likewise, for storing the dough twice, noodles with orange sweet potato substitution takes 4 times 15 minutes. Fresh noodles are then boiled to become wet noodles (Figure 4).

Figure 3. Process of making orange sweet potato substitution noodles A: Mix steam orange sweet potato and wheat flour, B: Dough form into baseballs, C: Rolling out the dough, D: The noodle sheet is allowed to stand until smooth, E: cutting Sheet noodle, F: Dusting.

Figure 4. Wet noodles, A: original, B: Purple sweet potato substitution, C: Orange sweet potato substitution.

The addition of pure sweet potato can extend the shelf life of fresh noodles in a refrigerator at 10°C in a closed container. The shelf life of 2 days’ original noodles, orange sweet potato substitution noodles for 1 week and purple sweet potato substitution noodles can be up to 2 weeks without mold. This is because purple sweet potato or orange sweet potato have antioxidant activity which can inhibit fungal growth as well [17-21]. Further research is needed to improve elasticity and shorten the processing time of noodles with sweet potato substitution.
4. Conclusion
The technique of making noodles with sweet potato substitution takes longer than the original noodles. The step of making wet noodle is mixing all ingredients, dough resting, sheeting, sheet resting, cutting and dusting. The time needed to make a smooth noodles mixture is directly proportional to the water content of the pure sweet potato. The higher the water content, the longer it will take to reach smooth. The addition of sweet potatoes can extend the shelf life of fresh noodles in the refrigerator.

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