Journal of Bio & Geo Material and Energy (BiGME)
Volume 2 No. 1, March 2022
P-ISSN: 2808-1560 E-ISSN: 2808-1404

The Effect of Different Concentration of Yellow Yam Flour (*Dioscorea alata*) on The Characteristic of Wet Noodles

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Article info:

Submitted : January 2022
Accepted: February 2022
Published: March 2022

Abstract :
Yellow yam (*Dioscorea alata*) tuber contains carbohydrates mainly starch which can be processed into noodles. This study aimed to determine the effect of yellow yam flour concentration on fiber content and organoleptic properties of wet noodle. The experiment used completely randomized design with a 5 levels of yellow yam flour concentration 0%, 10%, 20%, 30% and 40% with 4 repetition. The data were analyzed using ANOVA and followed DNMRT when necessary. The result showed that the concentration of yam flour has a significant effect on the water content, elasticity and sensory properties of wet noodles but has no effect on the fiber content and cooking loss. Wet noodles with the best characteristics can be made using a concentration of 10% yam flour with a water content of 59.83%, elasticity 25.75%, crude fiber content 0.27%, cooking loss 1.72, texture 3.65 (rather chewy), flavor 3.90 (rather like), and the overall acceptance 4.25 (like).

Keywords : Wet Noodles; Yam; Flour

1. Introduction

Yam (Dioscorea alata) is a starchy staple food crop that is very important in tropical and sub-tropical agriculture because it exhibits a strong growth cycle. The composition of yam tubers (Dioscorea alata) varies greatly depending on the variety, generally yam tubers have a high starch content of 25%, vitamin C varies between 5-15 mg/100g, the protein content of yam tubers is 2% (Yuniar 2010), crude fiber 4.76 in 100 grams (Richana, 2004). Apart from crude fiber, yam also has 16.66% dietary fiber (Harijono, 2013) and 1.52mg/g inulin (Winarti, 2013).

Yam is a group of carbohydrate-producing plants that have an important role in Indonesia but not many people know their benefits (Rostiawati, 1990). One use of yam is to make it into flour. Yam flour can be used as an alternative food substitute for wheat, but yam does not contain gluten like wheat flour.
Indonesia is not a wheat producing country, to reduce imports of wheat flour it is necessary to look for materials that can be used as substitutes for wheat (Setiawan, 2011). The high starch content in yam tubers allows it to be developed as a raw material for the local food industry (Nadia et al, 2011). However, yam tubers do not contain gluten like wheat flour. This is still a problem that cannot be resolved so wheat imports cannot be avoided. Gluten is the main protein in wheat flour consisting of gliadin (20-25%) and glutenin (35-40%). The presence of gluten affects the texture and development of a product.

One food product made from wheat flour is wet noodles. Many commercially available noodles are made from wheat flour, but according to Muhandri (2012), noodles can be made from starchy ingredients. The high starch content in yellow yam flour is one of the potentials for yellow yam flour to be processed into wet noodles. Apart from reducing dependence on wheat flour, wet noodles from yam flour are expected to have added value, namely higher fiber content than ordinary wet noodles.

Permatasari (2009) succeeded in making wet noodles with a raw material ratio of 20% taro flour and 80% wheat flour, while according to Astina (2007), wet noodles can be made with the addition of 30% carrots. The addition of 30% carrots had a significant effect on water content, protein content, beta-carotene,

ash content, and organoleptic values of noodle texture and color. According to Franceca (2014), making wet noodles with the addition of 10% -40% purple yam flour has an effect on increasing the water content, crude fiber content and inulin content but reduces the elasticity of the noodles and affects the color change. The aim of this research was to determine the effect of yellow yam flour concentration on fiber content, physical and sensory properties of wet noodles.

2. Research Methods

Materials and Tools

This research used yellow yam tubers, wheat flour, table salt, kie stones, eggs, water and vegetable oil. Yellow yam tubers were obtained from Tri Mulya village, Rantau Rasau District, East Tenjung Jabung Regency. The materials used for analysis are acetone, H_2SO_4, and NaOH. The tools used in this research were stainless steel knives, pasta makers. The tools used for analysis are an oven, desiccator, filter paper, ruler, Buchner funnel, vacuum pump, porcelain cup, and furnace.

Research Design

This research used a Completely Randomized Design (CRD) with 5 treatment levels and 4 replications. The treatments given were yellow yam flour concentrations of 0%, 10%, 20%, 30% and 40%. The observation data were analyzed using ANOVA, then if they were significantly different, it was continued with the DNMRT (Duncan's New Multiple Range) test at the 5% level.

Preparation of Yellow Yam Flour

The research began by processing yellow yam tubers into flour (Karleen, 2010). First, the yam tubers are peeled, washed, sliced 0.5 cm thick, steamed for 7 minutes, baked in the oven at 60oC until they can be broken, ground using a grinder and sifted. Sieving was carried out using a 60 mesh sieve.

Parameters

Parameters analyzed for the yellow yam flour include color, yield and water content. Parameters analyzed on noodles include water content (Sudarmadji, 1997), noodle elasticity test (Agusandi et al, 2013), fiber content (AOAC, 1984), cooking loss (Muhandri, 2012) and sensory tests on texture, flavor and overall acceptability (Soekarto, 1985).

3. Results and Discussion

Yam Flour and Wet Noodles

The resulting yam flour has an L* value of 81.67, an a* value of 4.33 and a b* value of 10 with the color name based on colorhexa being light grayish orange (Figure 1), a yield of 16.77%, a water content of 8.98% and a fineness of 60 mesh. The resulting color is the same as previously reported (Garjito et al., 2013) but different from that reported by Harijono (2011) who used the same method as this research. Yellow yam flour from this research has a slightly desaturated orange color with a water content of 6.09%.

The most apparent characteristic of wet noodles made with yellow yam flour are the color and length of the strings. The higher concentration of yellow yam flour, the darker the noodle and the harder to form long strings are.

Figure 1. Yellow Yam Flour

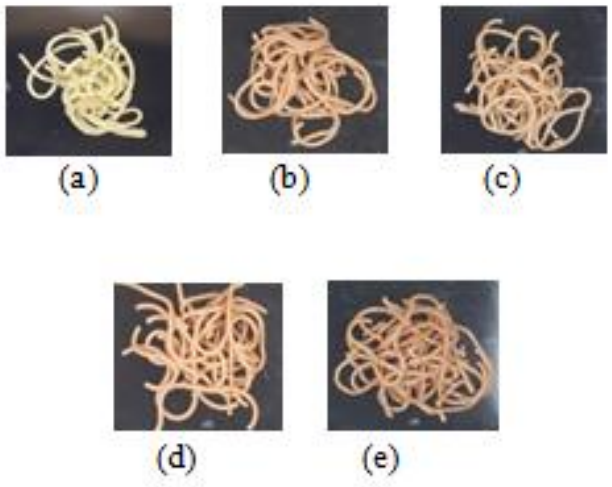

Figure 2. Wet noodles with different concentration of yellow yam flour: (a) = 0%, (b) = 10%, (c) = 20%, (d) = 30%, (e) = 40%

Physical Properties of Wet Noodle

The use of yellow yam flour has an influence on the elasticity of wet noodles (Table 1). Increasing concentration of yellow yam flour reduces gluten content of noodle dough. In noodles, a strong structural network is formed by wheat gluten. When pressure and crushing is applied to this gluten, it will create a strong bond (Muhandri, 2012). High gluten protein content is associated with increased elasticity of wet noodles. Gluten has viscoelastic properties so that noodles do not break easily during the molding and cooking process, which is formed by gluten which has elastic properties and gliadin which determines extensible properties (easy to stretch) (Retnaningsih, 2005).

Table 1. Physical properties of wet noodles at several concentrations of yellow yam flour

Yellow Yam Flour (%)	Elasticity	Cooking Loss	L*	a*	b*
0	27.50^{c}	1.31	93.67 c	-0.33 a	18.67
10	25.75^{c}	1.72	86.00 b	6.67 b	17.00
20	22.25^{b}	2.93	86.33 b	8.00 b	21.00
30	21.75^{b}	3.16	87.67 b	7.33 b	20.33
40	16.25^{a}	6.21	82.33 a	8.33 b	18.67

Note: Numbers followed by different letters on the same line are significantly different at the 5% level according to the DNMRT test.

Cooking loss of wet noodles was not influenced by the concentration of yellow yam flour. Wet noodles with a concentration of yellow yam flour from 0 to 40% produce noodles with cooking loss ranging from 1.31-6.21%. Cooking loss occurs due to the release of a small portion of starch from the noodle strands during cooking. The released starch is suspended in the cooking water and causes turbidity. High cooking loss is caused by less than optimal gelatinized starch matrix (Kurniawati, 2006). The dissolution of this starch component will be reduced if there is gluten in the wheat paste which can surround or trap the starch. The ability of the wheat tissue matrix to trap non-wheat flour is limited, so this causes noodles with a high level of substitution to easily fall apart when cooked and the cooking loss of the noodles is high (Muhandri, 2012).

The basic color of the wet noodles produced is slightly orange and is thought to be caused by the carotenoids found in the yam plant. Caratenoids are one of the important pigments that contribute orange, yellow and red colors to food and drinks (Andarwulan and Faradilla, 2012). The analysis results show that the concentration of yellow yam flour has a significant effect on the L* value (degree of brightness) of the

wet noodles produced. The higher the concentration of yellow yam flour reduces the brightness of the wet noodles.

The concentration of yellow yam flour has a significant effect on the a* value (degree of redness) of the wet noodles produced. The a* value of the resulting wet noodles tends to increase along with increasing concentration of yellow yam flour. This is related to the presence of caratenoid pigments in yellow yam flour. The caratenoid pigment causes the noodles to have a reddish color so that the more yellow yam flour that is substituted, the higher the a* value of the wet noodles. The results of analysis of variance showed that the concentration of yellow yam flour had no significant effect on the b* value (degree of yellowness).

The color of wet noodles is mainly affected by carotenoids content of yellow yam flour. Caratenoids are one of the important pigments that contribute orange, yellow and red colors to food and drinks (Andarwulan and Faradilla, 2012). The results show that the concentration of yellow yam flour has a significant effect on the L* value (degree of brightness) of wet noodles. The higher the concentration of yellow yam flour reduces the brightness of the wet noodles (Figure 2).

Chemical Properties of Wet Noodles

Table 2 shows that the concentration of yellow yam flour has a significant effect on the water content of the wet noodles. The higher the concentration of yellow yam flour, the water content of the wet noodles increases. The total water content ranges from 59.82-62.48%, in accordance with SNI standards where the maximum water content for wet noodles is 65%.

The increase in water content with the addition of yellow yam flour is due to the ability of yellow yam flour to absorb water. The water absorption ability of yam flour is 2.51 g/g. Apart from that, yellow yam flour also has fiber which is able to bind water. Increasing the water content of wet noodles with the substitution of yellow yam flour is influenced by the high fiber content in yellow yam flour, namely 4.89% (Harijono, 2013). One of the fibers found in yellow yam flour is inulin. According to Fardiaz (1988) inulin is a hydrocolloid substance that has water binding properties. The water absorption capacity of inulin is caused by the free hydroxyl (OH) groups in inulin. The increase in water absorption capacity is due to the more free OH groups in the inulin molecule, making it easier to bind water (Winarti, 2013).

Table 2. Water and crude fiber content of wet noodles at several concentrations of yellow yam flour

Yellow Yam Flour (%)	Water content (%)	Fiber content (%)
0	59.82 ^{a}	0.20
10	59.83^{a}	0.27
20	60.36^{ab}	0.37
30	61.93^{bc}	0.41
40	62.48^{c}	0.41

Note: Numbers followed by different letters on the same line are significantly different at the 5% level according to the DNMRT test.

The concentration of yellow yam flour did not affect the crude fiber content of the wet noodles. The resulting wet noodles with the addition of yellow yam flour showed a total fiber content ranging from 0.20–0.41%. There is no difference in the crude fiber content of wet noodles because yellow yam flour has a low crude fiber content (Harijono, 2013). The high fiber content in yellow yam is dietary fiber, namely 16.66%. Yellow yams also contain water-soluble fiber, namely inulin, at 1.52 mg/gram (Winarti, 2013).

Sensory Properties of Wet Noodles

The texture score of wet noodles tends to decrease with increasing concentration of yellow yam flour (Table 3). Wet noodles with 0% yellow yam flour had the highest texture score of 4.15 (chewy) while wet noodles with 40% yellow yam flour had the lowest texture score of 2.40 (not chewy). This is again due to gluten content. Wheat flour contains gluten which plays a role in forming texture. It can absorb water and bind water, this causes the water holding capacity to be greater, so that during the heating (boiling) process a gelatinization process occurs which can give a chewy (elastic) texture to the wet noodles. The fiber in yellow

yam flour also affects the texture because more substitutions for yellow yam flour also cause the texture of the wet noodles to become rougher.

Table 3. Sensory properties of wet noodles at several concentrations of yellow yam flour

Yellow Yam Flour (%)	Texture*	Flavor **	Overall Acceptance**
0	4.15^{d}	4.05^{d}	4.30^{b}
10	3.65^{c}	3.90^{cd}	4.25^{b}
20	3.05^{b}	3.60^{bc}	3.55^{a}
30	3.20^{b}	3.25^{ab}	3.75^{a}
40	2.40^{a}	3.05^{a}	3.45^{a}

Note: Numbers followed by different letters on the same line are significantly different at the 5% level according to the DNMRT test.
Score:
* 5) very chewy, 4) chewy, 3) rather chewy, 2) not chewy, 1) very not chewy
** 5) like very much, 4) like, 3) rather like, 2) don't like, 1) really don't like

The flavor score of the wet noodles tends to decrease with increasing concentration of yellow yam flour (Table 3). It can be seen that wet noodles without yam flour have the highest score of 4.05 (like), while wet noodles with a concentration of 40% yam flour have the lowest flavor score of 3.05 (rather like). The flavor score of the wet noodles was significantly different at the 5% level according to the DNMRT.

The acceptance score of the wet noodles tends to decrease with increasing concentration of yellow yam flour (Table 3). The increase in the overall acceptance score (level of preference) for the wet noodle produced is in line with the increase in the texture score. It is assumed that the overall acceptance score (level of preference) for the wet noodles is based on the texture.

Conclusion

The concentration of yellow yam flour has a significant effect on the water content, elasticity and sensory properties of wet noodles but has no effect on the fiber content and cooking loss. Wet noodles with the best characteristics can be made using a concentration of 10% yellow yam flour with a water content of 59.83%, elasticity of 25.75%, fiber content of 0.27%, cooking loss of 1.72%, the color of the wet noodles is very soft orange, texture 3.65 (rather chewy), flavor 3.90 (rather like), and overall acceptance 4.25 (like).

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