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Innovation of Indonesian Healthy Snacks Based on Purple Sweet Potatoes

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ABSTRACT

This study pointed out the innovation on Indonesian healthy snacks i.e. *senteling* and *onde-onde* made of purple sweet potatoes. The scope was focused on the quality assurance of those two snacks on two aspects of quality i.e. sensory quality and acceptability. This study used a purposive sampling technique. Different compositions of purple sweet potatoes were used for both snacks prepared in this study. In the case of *sentiling,* a composition of steamed purple sweet potatoes of 40-80 wt% (with a 20wt% increment) was used. In the case of *onde-onde,* a composition of purple sweet potatoes flour of 10-22 wt% (with a 6wt% increment) was used. The prepared snacks were examined through sequent sensory and acceptability tests involving eight panellists and 50 respondents, respectively. A single classification of variance analysis followed by Duncan test was used in the data analysis. The results revealed that sensory quality in *senteling* and *onde-onde* was almost the same, i.e. 5.5-7.4 and 5.3-7.2, respectively. The variations in acceptability of the two products differed greatly, 3.5-7.7 for *senteling* and 4.9-6.9 for *onde-onde*. The sensory quality was different for *senteling* in the overall aspect and elasticity, while in the case of *onde-onde,* it was different in the aspect of color, aroma, and flavor. The difference in acceptability in the case of *senteling* was observed in all aspects, whereas that difference was only observed in color and aroma aspects in the case of *onde-onde*. The best *senteling* in term of sensory quality and acceptability was obtained by the addition of 40 wt% of steamed purple sweet potatoes, while the best *onde-onde* was that with 16 wt% of purple sweet potatoes flour.

Keywords: innovation; healthy snacks; sweet purple potatoes.

1. INTRODUCTION

Sweet potatoes contain 76.4 g of carbohydrates in 100 g of sweet potatoes. The carbohydrates are in the form of a low glycaemic index (LGI) in the level of 54. Sweet potatoes are rich of fibre for human body. Purple sweet potatoes have a high content of anthocyanin antioxidant and vitamin A in the level of 7700 mg. Anthocyanin was reported as an active material and could act as an antioxidant, antihypertension, preventive substance for liver disfunction, coronary heart, cancer, and degenerative disease (Hasim & Yusuf, 2008). Anthocyanin could help the human body to avoid the growth of tumour cell and minimize the chances of heart attack (Lingga, 2012). Sweet potatoes also contain oligosaccharides, such as raffinose. This substance is acting as probiotics containing vitamin E and low fat (Bangun, 2005).

The use of purple sweet potato in food manufacturing was through steaming the sweet purple potato and the preparation of the flour. In this study, the steamed purple sweet potatoes were used as an ingredient for *senteling* and purple sweet potato flour was for *onde-onde*.

2. METHODS

Indonesian purple sweet potatoes used in this study were obtained from Gunungpati Semarang, Central Java with a purple skin and flesh. The composition of the steamed purple sweet potatoes of 40-80 wt% with a 20wt% increment was used in the preparation of *senteling*. The samples of the prepared *senteling* were called as PUU40, PUU60, and PUU80 which corresponded to the addition of the steamed purple sweet potatoes of 40, 60, and 80wt%, respectively. In the case of *onde-onde*, a different amount of the substitution of purple sweet potato flour of 10-22 wt% (with a 6wt% increment) was used. The samples of the prepared *onde-onde* were further called as TUU10, TUU16, and TUU22 corresponding to the weight of purple sweet potatoes flour of 10, 16, and 22 wt%, respectively. The sensory quality and acceptability of the prepared *senteling* and *onde-onde* in this study were examined by involving 8 panellist and 50 respondents, respectively. The difference of the treatment during the preparation of the snacks in this study was tested using Anova and Duncan tests.

3. RESULTS AND DISCUSSION

The result of the sensory test is presented in Table 1. It clearly showed that the amount of added steamed purple sweet potatoes in the prepared *senteling* gave a significant effect on its sensory quality. A significant difference on all sensory aspects of the prepared *senteling* was observed. Specifically, the different elasticity of PUU 40 compared to that of PUU60 and PUU80 was also observed. The sensory quality of the products was in the range of 5.5 – 7.4, as is shown in **Table 1**.

Table 1. The average and statistical analysis of *senteling*'s sensory quality.

Code of *senteling* sample	***Sentiling*'s sensory quality**					
	Overall*	**Colour**	**Aroma**	**Elasticity***	**Sweetness**	**Flavour**
PUU40	7.4^{a}	6.1	5.5	7.1^{a}	7.0	6.4
PUU60	5.9^{b}	6.5	5.8	5.6^{b}	7.3	6.7
PUU80	5.6^{b}	7.1	6.6	4.1^{c}	7.4	7.2

$^{*, a,b,c}$ = there was no difference or different if there was a significant difference

The colour of the *senteling* got darker by the addition of more steamed purple sweet potatoes. It indicated that purple colour from the steamed sweet potatoes used provided a stable colour in the prepared *senteling* regardless the treatment involved during the preparation. The anthocyanin content in cookies with purple sweet potatoes flour of 80 wt% was 28 mg/100g. This was not significantly different from the anthocyanin content in the purple sweet potatoes itself, i.e. 30 mg/100 g. The process of the manufacturing did not reduce the intensity of anthocyanin (Tuhumury et al., 2018) retained in the prepared *senteling*. The composition of

anthocyanin of the purple sweet potatoes was in the range of 110-210 mg/100 g sweet potatoes (Nintami & Rustanti, 2012), 83.78 mg/100 g in the form of cyanidin-3-caffeoyl-p-hydroxy benzoyl-sophoroside-5-glucoside (Huang et al., 2019). In a theoretical discussion, the use of 40-80% of purple sweet potatoes in the preparation of *senteling* (assuming that the anthocyanin content was 160 mg/100 g sweet potatoes) would allow a contribution of anthocyanin in the prepared *senteling* in the range of 64–128 mg/100 g. The anthocyanin has been proven to help the human's wellbeing. Anthocyanin contains a catechol structure that would carry an antimutagenic compound (Yoshimoto et al., 2001), free radical antidote, anti-carcinogen and antihypertension (Ahmed et al., 2010). The extract of anthocyanin in the purple sweet potatoes contained PSP-AE which was potential to weaken skin's oxidative stress and responded in inflammation due to UV-B (Zhi et al., 2019). Alkali-soluble sweet potato polysaccharides (ASPP) can be developed as a new agent of anti-inflammation (Chen et al., 2019).

The acceptability of purple sweet potato-containing sentiling got a lower score than its sensory quality, which was ranging from 3.5–7.5 (Table 2). The low score of the sensory quality of the prepared senteling mostly came from the elasticity aspect. The use of steamed purple potatoes gave more significant change in all aspects, i.e. overall, colour, elasticity, sweetness, and flavour aspects. The prepared senteling with the best quality in term of sensory quality and acceptability was that with 40 wt% of steamed purple sweet potatoes as a substitute ingredient.

In the case of the prepared *onde-onde,* the substitute of purple sweet potatoes flour was in the range of 10–22% (with 6 wt% increment) of the glutinous rice flour used. The substituted of purple sweet potatoes flour gave a significant change in the colour, aroma, and flavour of the prepared *onde-onde*. The average sensory quality of the *onde-onde* was in the range of 5.3–7.2 (**Table 3**).

Table 2. The average and the statistical analysis for *senteling*'s acceptability.

Code of *senteling's* sample	*Senteling*'s acceptability					
	Overall*	**Colour***	**Aroma***	**Elasticity***	**Sweetness***	**Flavour***
PUU40	7.5^{a}	5.4^{a}	5.6^{a}	6.5^{a}	7.0^{a}	6.9^{a}
PUU60	5.7^{b}	5.7^{a}	5.3^{ab}	4.3^{b}	6.1^{b}	6.2^{b}
PUU80	6.9^{b}	4.1^{b}	4.8^{b}	3.5^{c}	5.9^{b}	6.0^{b}

*, a,b,c = there was no difference or different if there was a significant difference

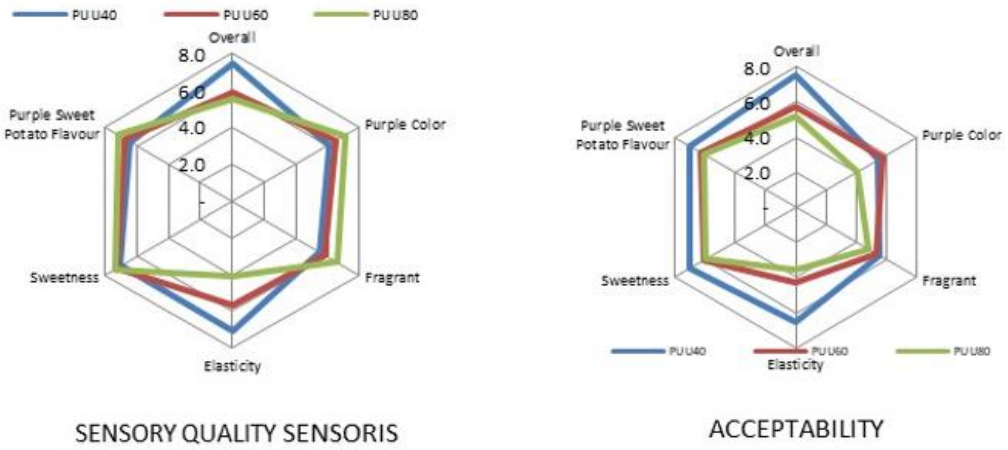

Figure 1. The sensory quality and acceptability rate of the prepared *senteling* using different composition of purple sweet potatoes.

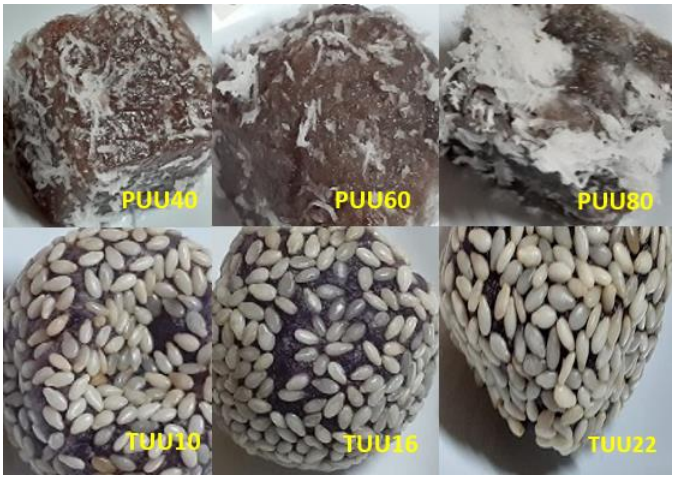

Figure 2. *Senteling* and *onde-onde* prepared with different composition of added purple sweet potatoes.

Table 3. The average and statistical analysis of *onde-onde*'s sensory quality.

***Onde-onde*'s sample code**	**The sensory quality of *onde-onde***					
	Overall	**Colour***	**Aroma***	**Elasticity**	**Sweetness**	**Flavour***
TUU10	6.3	5.3[a]	5.3[a]	5.6	5.9	5.4[a]
TUU16	7.2	6.6[b]	6.5[b]	6.0	6.6	6.6[ab]
TUU22	6.9	6.8[b]	6.6[b]	5.4	6.9	6.8[b]

*, a,b,c = there was no difference or different if there was a significant difference

Tabel 4. The average and statistical analysis of *onde-onde*'s acceptability test.

Code of onde-onde's sample	***Onde-onde's* acceptability**					
	Overall	**Colour***	**Aroma***	**Elasticity**	**Sweetness**	**Flavour**
TUU10	6.4	6.9[a]	4.9[a]	6.3	5.9[a]	5.4[a]
TUU16	6.9	6.3[b]	5.1[ab]	5.8	6.5[b]	6.4[b]
TUU22	6.6	5.9[b]	5.6[b]	5.6	6.5[b]	6.7[b]

*, a,b,c = there was no difference or different if there was a significant difference

Figure 3. The sensory quality and acceptability rate of the prepared *onde-onde* with adding different composition of purple sweet potatoes as a substitute.

The lowest and the highest score of the onde-onde's acceptability rate was 4.9 and 6.9, respectively (**Table 4**). The same trend was observed for the sensory quality of the prepared onde-onde, especially for the aspect of sweetness. The best onde-onde with the highest score of the sensory quality and the acceptability was obtained when adding the purple sweet potatoes of 16 wt% (**Figure 3**). This finding was similar to that reported earlier for Chinese steamed bread (CSB) with 5-10% PSP (Zhu & Sun, 2012). The anthocyanin contained in the purple sweet potatoes was c.a 27.7 mg/100 g (Ahmed et al., 2010). The theoretical measurement for onde-onde indicated that the content of anthocyanin was 2.77–6.09 mg/100 g.

The colour of the prepared *onde-onde* was lighter than that of the *senteling*. As in the previous research, purple sweet potatoes contain a high level of anthocyanin when steamed or fried (as chips) (Husna et al., 2013). The anthocyanin is normally in the form of peonidin and cyanidin which are stable and undegradable at higher temperatures of cooking. In fact, anthocyanin is polarized and easily soluble in a polarized solution (Winarti et al., 2008). At high temperatures, the stability and endurance of those substances would change resulting in the decomposition of the anthocyanin (Winarno, 2004). The stability of the anthocyanin is mostly influenced by lights, temperature, and pH (Yoshimoto et al., 2001).

4. CONCLUSIONS

Healthy sweet potato-based snacks, in the form of *senteling* and onde-*onde* showed good sensory quality and acceptability. The sensory quality of *senteling* and *onde-onde* was almost the same, 5.5-7.4 and 5.3-7.2, respectively. Acceptance variations in the two products differed greatly, i.e. 3.5-7.5 for *senteling* and 4.9-6.9 for *onde-onde*. The sensory quality was different in the case of *senteling* on the overall aspect and elasticity, while in the case of *onde-onde,* it was different on the aspect of color, aroma, and flavor. The difference in acceptability in *senteling* occurred in all aspects, while in the case of *onde-onde,* the difference was only in the color and aroma. The best products with the same results of the sensory quality and acceptability assessments achieved by *senteling* with the use of 40% steamed purple sweet potatoes and by *onde-onde* with the substitution of 20% purple sweet potato flour.

5. ACKNOWLEDGEMENT

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6. REFERENCES

Ahmed, M., Akter, M.S., Lee, J.C. & Eun, J.B. 2010. Encapsulation by spray drying of bioactive components, physicochemical and morphological properties from purple sweet potato. *LWT - Food Science and Technology*, *43*:1307-1312.

Bangun, A.P. 2005. *Segar dan bugar pada usia lanjut dengan jus buah & sayuran.* Agro Media Pustaka, Jakarta.

Chen, H., Sun, J., Liu, J., Gou, Y., Zhang, X., Wu, X., Sun, R., Tang, S., Kan, J., Qian, C., Zhang, N. & Jin, C. 2019. Structural characterization and anti-inflammatory activity of alkali-soluble polysaccharides from purple sweet potato. *International Journal of Biological Macromolecules*, 131: 484-494.

Hasim, A. & Yusuf, M. 2008. *Ubi jalar kaya antosianin pilinan pangan sehat*. Sinar Tani.

Huang, H., Xu, Q., Belwal, T., Li, L., Aalim, H., Wu, Q., Duan, Z., Zhang, X. & Luo, Z. 2019 Ultrasonic impact on viscosity and extraction efficiency of polyethylene glycol: A greener approach for anthocyanins recovery from purple sweet potato. *Food Chemistry*, *283*: 59-67.

Husna, N.E., Novita, M. & Rohaya, S. 2013. Kandungan antosianin dan aktivitas antioksidan ubi jalar ungu segar dan produk olahannya. *Agritech, 33*(3): 296-302.

Lingga, L. 2012. *The healing power of antioxidant*. Gramedia, Jakarta.

Nintami, A.L. & Rustanti, N. 2012. Kadar serat, aktivitas antioksidan, amilosa dan uji kesukaan mi basah dengan subtitusi tepung ubi jalar ungu (*Ipomoea batatas var Ayamurasaki*) bagi penderita diabetes melitus tipe–2. *Journal of Nutrition College*, 1: 382-287.

Tuhumury, H.C.D., Ega, L. & Keliobas, N. 2018. Pengaruh substitusi tepung ubi jalar ungu terhadap karakteristik kue kering. *Agritekno*, 7(1): 30-35.

Winarno. 2004. *Kimia pangan dan gizi*. Gramedia, Jakarta.

Winarti, S., Sarofa, U. & Anggraeni, D. 2008. Anggraeni. Ekstraksi dan stabilitas warna ubi jalar ungu (*Ipomoea batatas* L.,) sebagai pewarna alami. *Jurnal Teknik Kimia*, 3(1): 207-214.

Yoshimoto, M., Okuno, S., Yamaguchi, M. & Yamakawa, O. 2001. Antimutagenicity of deacylated anthocyaninsin purple-fleshed sweet potato. *Bioscience Biotechnology and Biochemistry,* 65(7): 1652-1655.

Zhi, Q., Lei, R., Li, F., Zhao, J., Yin, R. & Ming, J. 2019. The anthocyanin extracts from purple-fleshed sweet potato exhibited anti-photoaging effects on ultraviolent B-irradiated BALB/c-nu mouse skin. *Journal of Functional Foods,* 64:1-9.

Zhu F. & Sun, J. 2019. Physicochemical and sensory properties of steamed bread fortified with purple sweet potato flour. *Food Bioscience*, 30: 100411.