Vol. 7 no. 1, June 2023, pp. 24-36
DOI: 10.26877/jiphp.v7vi1.15441

JURNAL ILMU PANGAN DAN HASIL PERTANIAN

ISSN 2581-088X (Print)
ISSN 2581-110X(Online)

Physical and Sensory Properties of Instant Tiwul from Cassava Flour and Mocaf with Addition of Yellow Pumpkin Flour

Atika Yahdiyani Ikhsani[1)*], Bambang Dwi Wijatniko[2)], Ika Qurroatul Afifah[3)]
[1)] Department of Chemistry, Faculty of Science and Technology. Islamic State University (UIN) Sunan Kalijaga Yogyakarta, email: atika.ikhsani@uin-suka.ac.id
[2)] Department of Food and Agricultural Product Technology, Faculty of Agricultural Technology, Gadjah Mada University Yogyakarta, email: nicodw92@gmail.com
[3)] Department of Chemistry, Faculty of Science and Technology. Islamic State University (UIN) Sunan Kalijaga Yogyakarta, email: ika.afifah@uin-suka.ac.id
* Penulis Korespondensi: E-mail: atika.ikhsani@uin-suka.ac.id

ABSTRACT

Instant tiwul is commonly made from cassava flour which product specification was characterized by its properties. However, some sensory attributes of instant tiwul were not desirable. In addition, the nutritional quality of instant tiwul needs to be improved by the addition of micronutrients. The substitution of cassava flour with mocaf flour and supplemented with yellow pumpkin flour is expected to improve the physical and sensory quality of the product, as adding nutritional value of instant tiwul that enriched with vitamin A. This study was conducted in a group-randomized trial with the substitution of yellow pumpkin flour with variation of 0, 10, 20% to cassava flour and mocaf flour. Physical properties (water content, water absorption, color) and sensory properties (acceptance test) were evaluated. The result indicated that the addition of yellow pumpkin flour lowered the water content on instan tiwul from both cassava flour and mocaf flour. The addition of yellow pumpkin flour significantly increased the water absorption of instant tiwul from cassava flour, however it reduced on mocaf flour formula. Water absorption of instant tiwul from mocaf with 0% yellow pumpkin flour is the highest with 45,27%. There is significant change on L, a and b parameter of instant tiwul color with addition of yellow pumpkin flour. Sensory evaluation suggested that there is significant change on acceptance of aroma, taste, texture, and overall likeness from instant tiwul made from mocaf flour with addition of yellow pumpkin flour, however cassava flour with addition of yellow pumpkin flour showed least significant change on sensory properties.

Keywords: *Casava; Flour; Instan; Mocaf; Tiwul; Yellow Pumpkin*

ABSTRAK

Tiwul instan umumnya terbuat dari tepung singkong yang spesifikasi produknya ditentukan oleh khasiatnya. Namun, beberapa atribut sensorik tiwul instan tidak diinginkan. Selain itu kualitas gizi tiwul instan perlu ditingkatkan dengan penambahan zat gizi mikro. Substitusi tepung singkong dengan tepung mocaf dan suplementasi dengan tepung labu kuning diharapkan dapat meningkatkan kualitas fisik dan sensori produk, sebagai penambah nilai gizi tiwul instan yang diperkaya vitamin A. Penelitian ini dilakukan secara acak kelompok. Percobaan dilakukan dengan substitusi tepung labu kuning dengan variasi 0,10,20% pada tepung singkong dan tepung mocaf. Analisis dilakukan terhadap sifat fisik (kadar air, daya serap air, warna) dan sifat sensoris (uji penerimaan). Hasil penelitian menunjukkan bahwa penambahan tepung labu kuning menurunkan kadar air pada tiwul instan baik dari tepung singkong maupun tepung mocaf. Penambahan tepung labu kuning secara nyata meningkatkan daya serap air tiwul instan dari tepung singkong, namun menurunkan formula tepung mocaf. Daya serap air tiwul instan dari mocaf dengan tepung labu kuning 0% paling tinggi sebesar 45,27%. Terdapat perubahan yang signifikan pada parameter L,

Article Submitted May17th 2023 ***Article Revised June 20th 2023***
Article Accepted June 28th 2023

Vol. 7 no. 1, June 2023, pp. 24-36
DOI: 10.26877/jiphp.v7vi1.15441
JURNAL ILMU PANGAN DAN HASIL PERTANIAN
ISSN 2581-088X (Print)
ISSN 2581-110X(Online)

a dan b untuk warna tiwul instan dengan penambahan tepung labu kuning. Evaluasi sensori menunjukkan adanya perubahan yang signifikan pada penerimaan aroma, rasa, tekstur, dan kemiripan secara keseluruhan terhadap tiwul instan berbahan dasar tepung mocaf dengan penambahan tepung labu kuning, sedangkan tepung singkong dengan penambahan tepung labu kuning menunjukkan perubahan yang paling kecil pada sifat sensoriknya.

Kata kunci: Instan; Labu kuning; Mokaf; Singkong; Tepung; Tiwul;

INTRODUCTION

Cassava consists of high carbohydrate content which makes this food commodity as one of staple food to fulfill the diet daily (Waisundra, 2017). Cassava is rich with starch that can be converted into various food products derived from it, especially gluten free products (Dini et al., 2014). Cassava is commonly processed into starch or flour to serve as food ingredients that have longer shelf life compared to the fresh tuber. The utilization of starch and flour from cassava needs to be increased as a way to compensate the rising number of imported food ingredients that surprisingly being inundated the market, such as wheat flour (Aristizábal et al., 2017). Starch from cassava called cassava flour is commonly used as the basic ingredient to make tiwul, a traditional food product that is preserved from generation to generation. Tiwul is notably recognized as indigenous food from Yogyakarta and central Java. Tiwul can be incorporated with various side dishes or garnish that can increase the acceptance of the products. The common way people eat tiwul is adding the coconut shredded on the top of Tiwul. However, some sensory attributes of tiwul are not desired which might be because of low quality of cassava that is used for making tiwul (Herlina et al., 2021). Cassava with defects on the tuber and inappropriate fermentation process showing any indication for perished will produce tiwul with bitter taste, dark color, and unpreferred odor that promptly will lower the acceptance of the tiwul. It is important to emphasize the quality of cassava that is associated with the quality of tiwul (Yerizam et al., 2019).

Tiwul that readily cooked usually has short shelf life due to its high moisture content that might be susceptible to the food spoilage microorganism. However, the shelf of tiwul can be prolonged by evaporating the water in cooked tiwul to reduce the moisture content to increase its shelf life. Prior to serving for eating, instant tiwul can be rehydrated with hot water to recover its moisture to form the texture of cooked tiwul. The dehydration process enabled the retrogradation of starch molecules to reassociate into their initial form which affected on the textural properties. However, after rehydrating the tiwul, the gel structure will reform which brings the alteration on the opacity, color, and texture. The critical properties of instant tiwul relies on its ability to absorb the water to restructure its original form (cooked tiwul) to form physiochemical properties of cooked tiwul that is desirable by the consumer. In addition, the drying quality is determined by the moisture content of the product. It is important to reassure that the drying process creates a product with low moisture content that suggested good shelf life.

Sensory properties are essential to evaluate the acceptance of tiwul as it is affected by the ingredients. However, some sensory attributes in tiwul were not desired by the consumer that associated with the properties of cassava flour as main ingredient of tiwul. Substitution of cassava flour with other components such as mocaf (modified cassava flour) might alter the sensory properties that exerted a significant effect on the acceptance of tiwul. Mocaf is produced by fermentation of casava chips with lactic acid bacteria starter or by spontaneous fermentation and followed by drying and grinding. The Physiochemical properties of mocaf is stipulated different compared to cassava flour or cassava flour (Afifah and Ratnawati, 2017). The physiochemical of mocaf might be attributed in the formation of physical and sensory properties of tiwul which led to the improvement of the quality of the instant tiwul.

Addition of various component in instant tiwul somehow will strongly affect the product specification which eventually associated with the consumer's acceptance. Besides its physiochemical properties that need to be improved, the nutritional quality of instant tiwul should be emphasized by addition of ingredient that might serve to the improvement of its nutritional quality. The usage of ingredients that contain micronutrients will lead to an increase in the nutrition content of instant tiwul. Materials such as pumpkin can be incorporated into instant tiwul since it is considered as source of beta-carotene which served as precursor for vitamin A (Staichok et al., 2016). In addition, in vivo study indicated that the constituent of pumpkin polysaccharides such as glucose, galactose,rhamnose, arabinose, xylose and glucuronic acid has better antioxidant activity (Chen et al., 2020). Pumpkin can be processed to be flour by drying and grinding method so that it can be mixed with cassava flour during the process of making tiwul. The substitution of cassava flour flour and mocaf flour with pumpkin flour is utilized to increase the beneficial nutritional value of instant tiwul (Anitha et al., 2020). In other hand, formulation of tiwul instant with cassava flour and mocaf with addition of pumpkin flour is expected to bring specific physical and sensory properties that correspond to the improvement of the acceptance of consumer. The objective of this study was to evaluate the physical and sensory properties of tiwul instant with substitution of pumpkin flour to cassava flour and mocaf.

MATERIAL AND METHOD

Materials

Materials used in the research were commercial cassava flour that is purchased from Harjodaksino traditional market in Surakarta. Mocaf and pumpkin flour was obtained from a local shop (Intisari) in Yogyakarta. Other ingredients used were commercial palm sugar. The equipment used in this research were cabinet drier, drying oven (memmert), desiccator, centrifuge, and experiment set for sensory analysis.

Preparation of Instant Tiwul

Instant tiwul was made from cassava flour, modified cassava flour (mocaf) which is substituted with pumpkin flour in a ratio of 100: 0, 90: 10, and 80: 20. Instant tiwul from cassava flour was prepared by mixing 100 gram of cassava flour with 0, 10% (10 gram) and 20% (20 gram) of pumpkin flour with the addition of 5-gram palm sugar. The mixture was added with 10 ml of hot water and mixed by kneading the dough thoroughly. Larger grains that appeared were mixed into the main dough so that there was no observed dry powder remained. The dough was then steamed for 20 minutes, followed by air drying (30 minutes) and evaporating the moisture by drying in the cabinet dryer at a temperature of 50^{o} C for 20 hours. Dried instant tiwul is packed in closed airtight plastic and keep in dry container prior use for analysis.

Analysis of Physical Properties

Physical properties of instant tiwul consist of water content, water absorption, and color. Moisture content analysis was performed by standard AOAC methods (Anonim, 1995). The color of instant tiwul was determined using L a b system with "Chromameter CR-400 Minolta. Water absorption was evaluated by determining the amount of water that is absorbed into the material by calculating the amount of water after centrifugation according to Ganjyal et al., (2006).

Sensory Analysis of Instant Tiwul

Sensory evaluation was performed according to Meilgard (1991) by determining the acceptance of tiwul instant by giving score that indicate likeness to the formula. The scoring system that is used in sensory analysis was from 1 (very dislike) to 7 (very like).

Data analysis

The statistical analysis was performed using ANOVA at the 5% test level. If there is a significant difference, then the analysis is continued by Duncan's test (Duncan Multiple Range Test/DMRT) at the 5% test level.

RESULTS AND DISCUSSION

Water content of Instant Tiwul

The water content of instant tiwul is presented in Table 1. The water content of instant tiwul made from cassava flour tends to decrease as the percentage of pumpkin substitution increases. Meanwhile, in the mocaf group, the water content increased at the 10% substitution and then decreased at the 20% substitution. The largest water content is formula with cassava flour and 0% pumpkin flour with a water content of 5.31%. While the lowest water content is mocaf 80%: 20% pumpkin flour with a water content of 4.60%. This study showed the water content that is lower than instant tiwul that is reported by Hasan et al. (2011) with water content of 13.50%. However, a study by Agustia et al. (2018) also suggested that the water content of tiwul is in the range of 6.12% - 6.63%. The lower water content in this study is encouraged to prolong the shelf life of instant tiwul products when it is packaged with good packaging system. The moisture content of food must be maintained to avoid fungal spoilage for long-term storage (Abdullah et al., 2000). Moisture content affects the effectiveness of packaging and the shelf life of the material. The higher the water content, the more easily the material will be damaged.

The water content of instant tiwul has a relatively low water content which might be attributed due to the lower water content of the ingredients. This is supported by (Rukmini & Naufalin, 2015) which reported that the moisture content of instant tiwul is predominantly determined by the length and temperature of drying of cooked tiwul.

Vol. 7 no. 1, June 2023, pp. 24-36
DOI: 10.26877/jiphp.v7vi1.15441
JURNAL ILMU PANGAN DAN HASIL PERTANIAN
ISSN 2581-088X (Print)
ISSN 2581-110X(Online)

Table 1. Water Content of Instant Tiwul

Pumpkin Flour Substitution	Cassava Flour Instant Tiwul	Mocaf Instant Tiwul
0 %	5,31 ± 0,50^{a}	4,75 ± 0,06^{a}
10%	4,76 ± 0,18^{ab}	5,22 ± 0,14^{a}
20 %	4,65 ± 0,01^{b}	4,60 ± 0,13^{b}

The same notation in the same column shows no significant difference at the level of significance 5% (p <0.05)

Water Absorption of Instant Tiwul

Water absorption of instant tiwul from cassava and mocaf is presented at table 2.

Table 2. Water absorption of instan tiwul

Pumpkin Flour Substitution	Cassava Flour Instant Tiwul	Mocaf Instant Tiwul
0 %	25,58 ± 1,38^{a}	45,27 ± 0,30^{a}
10%	32,16 ± 0,70^{b}	34,67 ± 0,93^{b}
20 %	31,88 ± 2,04^{b}	33,40 ± 2,44^{b}

The same notation in the same column shows no significant difference at the level of significance 5% (p <0.05)

Table 2 indicated there was a significant effect of substitution of pumpkin flour to cassava flour and mocaf in instant tiwul. The cassava flour group suggested an increase in water absorption at the 10% substitution but decreased at the 20% substitution. Meanwhile, the modified cassava flour group showed water absorption that tended to decrease as the increase in the percentage of pumpkin flour. The highest water absorption of instant tiwul was observed in the composition 0% pumpkin flour at mocaf formula with the percentage of 45.27%. Water absorption of mocaf flour with pumpkin flour substitution decreased as the percentage of pumpkin flour increased.

The water absorption of the instant tiwul can be explained by the fiber content in the ingredients. Table 2 showed the water absorption of instant tiwul using modified cassava flour (mocaf) decreased with the higher substitution of pumpkin flour. The more substitution of pumpkin flour given would lower the water

Vol. 7 no. 1, June 2023, pp. 24-36
DOI: 10.26877/jiphp.v7vi1.15441
JURNAL ILMU PANGAN DAN HASIL PERTANIAN
ISSN 2581-088X (Print)
ISSN 2581-110X(Online)

absorption. Pumpkin is rich in carbohydrates and fiber which might contribute to the increment of water absorption in both cassava flour and mocaf group. According to Harijono et al. (2012), crude fiber attributed in a decrease in water absorption in starch granules. Limited water absorption in the starch granule resulted in the disruption of starch gelatinization process which lead to cause hard texture due to incomplete gelatinization.

Tamtarini & Yuwanti (2005) stipulated that crude fiber as a compound that is not soluble in water plays role to strengthen the matrices network that support the firmness of texture. The higher the crude fiber content will correspond to stronger texture that eventually cause the product to become hard. During the texture formation process, starch, fiber and protein components compete with each other to bind water (Paramita & Putri, 2015). The water absorption of food products also depends on the amount of carbohydrates in the material (Widaningrum et al., 2005). A plant generally contains amylose ranging from 11 to 37% of the total starch while amylopectin ranging from 65−85% (Abbas et al., 2020). Amylopectin is more soluble than amylose because of its branch and open structure so that water molecules can easily interact. In contrast, amylose tends to build intramolecular hydrogen hindering water access (Green, 1975). Mocaf has higher water absorption than cassava flour which might be associated with the fermentation process that alters the structure of starch granule. The addition of pumpkin flour to mocaf will decrease the water absorption due to the decrease of mocaf starch proportion, so it will lower the water absorption. The higher ability of mocaf to absorb the water will result in the improvement of gelatinization, pasting profile and texture of the product.

Color of Instant Tiwul

The color parameter of instant tiwul from cassava flour with the addition of pumpkin flour is presented at Table 3. Table 3 suggested there is no significant effect of adding pumpkin flour to the brightness (L value) of instant tiwul. The substitution of mocaf with 20% pumpkin flour has not yet caused diminishing the brightness of the product. According to Winarno (2004), the maillard reaction which resulted from the reactions between carbohydrates (especially simple sugars) with primary amine groups causes the product color to convert to brownish color. However, in this study, there is no observed significant effect. This might be

Vol. 7 no. 1, June 2023, pp. 24-36
DOI: 10.26877/jiphp.v7vi1.15441
JURNAL ILMU PANGAN DAN HASIL PERTANIAN
ISSN 2581-088X (Print)
ISSN 2581-110X(Online)

explained by the lower content of simple sugars in the cassava flour so that the Maillard reaction is limited.

Table 3. Color Parameter of Instant Tiwul from Cassava Flour Substituted with Pumpkin Flour

Proportion of pumpkin flour	Color Parameter		
	L	a	b
0%	61.16±0.74	6.45±0.30	22.37±1.17
10%	58.93±1.43	5.83±0.36	23.15±0.61
20%	60.05±0.70	6.33±0.10	26.26±0.54

The same notation in the same column shows no significant difference at the level of significance 5% ($p < 0.05$)

The a value indicated the color spectrum from green to red color. Negative a value indicated a green color while a positive value indicated a red color with a value range of -60 to +60 (Estiasih et al., 2016). The a value of instant tiwul substituted with pumpkin flour was highest in 0% pumpkin flour substitution, while the lowest a value for instant tiwul was in 10% pumpkin flour substitution. However, statistical analysis suggested that there was no significant effect of the percentage of the pumpkin flour addition on a value of instant tiwul.

The b value indicated the color spectrum from blue to yellow. Positive b value is between 0-60 for yellow and the negative b value is between 0-(-60) for blue (Estiasih et al., 2016). This study suggested that there was a significant effect of addition of pumpkin flour at different concentrations to the b value of instant. The addition of 20% pumpkin flour elicited color with bright yellow in compared to other pumpkin flour substitutions. Color parameter of instan tiwul from mocaf with the substitution of pumpkin flour is presented at Table 4.

Table 4 showed there is no significant effect of substitution of mocaf with pumpkin flour to the brightness level (L value) of instant tiwul. The a value of instant tiwul substituted with pumpkin flour showed no significant difference among all formula, as well as the b value. This result might be explained by the color parameter of mocaf and pumpkin flour is relatively similar which resulting in the insignificant change at the substitution of pumpkin flour at maximum 20%.

Vol. 7 no. 1, June 2023, pp. 24-36
DOI: 10.26877/jiphp.v7vi1.15441

JURNAL ILMU PANGAN DAN HASIL PERTANIAN

ISSN 2581-088X (Print)
ISSN 2581-110X(Online)

Table 4. Color Parameter of Instan Tiwul from Mocaf Substituted with Pumpkin Flour

Proportion of pumpkin flour	Color Parameter		
	L	a	b
0%	60.95±1.81	5.42±0.46	18.31±0.66
10%	64.36±2.40	4.60±0.61	19.18±0.26
20%	62.30±0.12	4.88±0.58	19.66±0.61

The same notation in the same column shows no significant difference at the level of significance 5% ($p < 0.05$)

Acceptance of Instant Tiwul

The acceptance level of instant tiwul from cassava flour and mocaf with substitution of pumpkin flour is presented at Table 5 and 6.

Table 5. Acceptance Score of Instant Tiwul from Cassava Flour Substituted with Pumpkin Flour

Proportion of pumpkin flour	**Color**	**Aroma**	**Taste**	**Texture**	**Overall**
0%	4.76±1.39	5.12±1.42	5.12±0.92	4.96±0.97	5.16±0.85
10%	4.72±1.30	6.16±12.55	4.00±1.52	4.64±1.35	4.16±1.24
20%	5.40±1.41	3.40±1.63	3.20±1.44	4.12±1.50	4.80±6.05
p value	**0.152**	**0.412**	**0.000**	**0.102**	**0.612**

Substitution of cassava flour with pumpkin flour in instant tiwul showed no significant effect on taste, however it suggested significant effect on color, aroma, texture, and overall likeness. Substitution of cassava flour with more proportion of pumpkin flour tends to decrease the acceptance of consumer at aroma and taste. The acceptance score of color at 20% substitution of pumpkin flour showed highest value which might be attributed to the color formation that brings more likeness at the color formation. On the contrary, the color of instant tiwul which is evaluated in

Vol. 7 no. 1, June 2023, pp. 24-36
DOI: 10.26877/jiphp.v7vi1.15441
JURNAL ILMU PANGAN DAN HASIL PERTANIAN
ISSN 2581-088X (Print)
ISSN 2581-110X(Online)

the L a b system shows no significant effect on the proportion of pumpkin flour. This difference might be associated with the preference of the consumer in which tend to give high acceptance score on the color that attracted visually.

Table 6. Acceptance Score of Instant Tiwul from Mocaf Substituted with Pumpkin Flour

Proportion of pumpkin flour	**Color**	**Aroma**	**Taste**	**Texture**	**Overall**
0%	4..64±1.38	4.52±1.44	4.36±1.60	4.72±1.40	4.52±1.47
10%	4.80±1.25	3.92±1.80	4.48±1.58	4.84±1.40	4.64±1.46
20%	4.04±1.36	2.80±1.63	2.96±1.42	3.56±1.58	3.16±1.43
p value	**0.155**	**0.002**	**0.002**	**0.012**	**0.001**

The taste and aroma attribute of instant tiwul with substitution of 20% pumpkin flour showed the least acceptance which might correspond to the stronger taste of pumpkin flour which covers the original taste and aroma of the tiwul itself. The same finding was also observed at texture of instant tiwul with 20% pumpkin flour substitution that indicated the lowest acceptance score. It might be explained due to the texture formation from instant tiwul which strongly affected by the chemical properties of pumpkin flour as reported in the formulation of rice bread with addition of pumpkin flour (Dabash et al., 2017) In addition, pumpkin flour has more fiber content compared to cassava flour which contributes to the hardness properties of the product; hence the acceptance score was low (Radiani, et al., 2020).

The overall likeness of instant tiwul from mocaf flour suggested the lowest acceptance score on 20% pumpkin flour substitution which indicated a trend of decrease in the acceptance when the proportion of pumpkin flour is higher. In contrast with instant tiwul from cassava flour, substitution of pumpkin flour showed significant effect almost on all sensory attributes, except color. Overall sensory indicated that addition of pumpkin flour showed greater effect on sensory acceptance to instant tiwul form mocaf rather than casava flour. This result also stipulated that substitution of pumpkin flour was more suitable to instant tiwul derived from cassava flour, considering its rheological and physical properties.

CONCLUSION

Addition of yellow pumpkin flour affected physical properties by lowering the water content and water absorption of instant tiwul derived from mocaf flour. In contrast with mocaf flour, substitution of yellow pumpkin flour to cassava flour in instant tiwul increased water absorption of tiwul instant from cassava flour, even though the water content slightly decreased. Substitution of yellow pumpkin to instant tiwul at both casava and mocaf flour affected color properties as indicated by slight change on L, a and b parameter. Sensory evaluation showed that addition of yellow pumpkin flour greatly influences the acceptance of aroma, taste, texture, and overall likeness from instant tiwul made from mocaf, however cassava flour with addition of yellow pumpkin flour showed the least significant change on sensory properties.

REFERENCES

Abbas, H. M. K., Huang, H. X., Yang, Y. F., Xie, Y. H., Zou, J. F., Xue, S. D., Song, D. G., Wu, T. Q., Li, J. X., & Zhong, Y. J. (2020). Characterization of Starch in Cucurbita moschata Germplasms throughout Fruit Development. *Journal of Agricultural and Food Chemistry*. 68, 9690-9696. https://doi.org/10.1021/acs.jafc.0c03181

Abdullah, N., Nawawi, A., & Othman, I. (2000). Fungal spoilage of starch-based foods in relation to its water activity (a(w)). *Journal of Stored Products Research*. 36, 47-54. https://doi.org/10.1016/S0022-474X(99)00026-0

Afifah, N and Ratnawati, L.(2017). Quality assessment of dry noodles made from blend of mocaf flour, rice flour and corn flour. *IOP Conf. Ser.: Earth Environ. Sci.* 101 012021

Agustia, F. C., Rukmini, H. S., & Naufalin, R. (2018). Formulasi Tiwul Instan Tinggi Protein dari Tepung Ubi Kayu yang Disubstitusi Tepung Koro Pedang dan Susu Skim. *Jurnal Aplikasi Teknologi Pangan*. 7(1), 15-20. https://doi.org/10.17728/jatp.2132

Anitha, S., Ramya, H., and Ashwini, A. 2020. Effect of mixing pumpkin powder with wheat flour on physical, nutritional and sensory characteristics of cookies.

Vol. 7 no. 1, June 2023, pp. 24-36
DOI: 10.26877/jiphp.v7vi1.15441
JURNAL ILMU PANGAN DAN HASIL PERTANIAN
ISSN 2581-088X (Print)
ISSN 2581-110X(Online)

IJCS 2020; 8(4): 1030-1035

Aristizábal, J., José, A., and Bernardo, O. (2017). Refined cassava flour in bread making: a review. Ingeniería e Investigación vol. 37 no 1, april - 2017 (25-33)

Chen, L., Long, R., Huang, G., & Huang, H. (2020). Extraction and antioxidant activities in vivo of pumpkin polysaccharide. *Industrial Crops and Products*. 146 (112199) https://doi.org/10.1016/j.indcrop.2020.112199

Dabash, V., Iva, B., Marian, T., Michaela, Z., and Robert, G. (2017). The Effect of Added Pumpkin Flour on Sensory and Textural Quality of Rice Bread. Journal of Microbiology, Biotechnology and Food Sciences 6 (6) 1269-1271

Dini, C., Maria, C.,, Sonia, Z., and Maria, A. (2014). Cassava Flour and Starch as Differentiated Ingredientes for Gluten Free Products. Cassava: Nova Science Publihsers, Inc.

Estiasih, T., Harijono, Waziiroh, E., & Fibrianto, K. (2016). Kimia dan Fisik Pangan. Jakarta: Bumi Aksara.

F.G. Winarno. (2004). *Kimia Pangan dan Gizi*. Jakarta: PT. Gramedia Pustaka Utama.

Green, M. M. (1975). Textbook errors, 123 which starch fraction is water-soluble, amylose or amylopectin? *Journal of Chemical Education*. 52(11), 729–730. https://doi.org/10.1021/ed052p729

Harijono, Susanto, W., & Ismet, F. (2012). Studi Penggunaan Proporsi Tepung (Sorgum Ketan Dengan Beras Ketan) Dan Tingkat Kepekatan Santan Yang Berbeda Terhadap Kualitas Kue Semprong. *Jurnal Teknologi Pertanian*. 16(1). Retrieved from https://jtp.ub.ac.id/index.php/jtp/article/view/114

Hasan, V., Astuti, S., & Susilawati. (2011). Indeks Glikemik Oyek dan Tiwul dari Umbi Garut (*Marantha arundinaceae* L.), Suweg (*Amorphallus campanullatus* BI) dan Singkong (*Manihot utilisima*). *Jurnal Teknologi Industri Dan Hasil Pertanian*. 16(1), 34–50 DOI:http://dx.doi.org/10.23960/jtihp.v16i1.34%20-%2050

Herlina, H., Triana, L., Nurhayati, N., Sulistiyani, S., Manik, N., Elok, S., and Siswoyo, S.(2021). Karakteristik Fisik, Kimia dan Organoleptik Tiwul Instan Protein Tinggi Bersubstitusi Tepung Koro Pedang (Canavalia ensiformis L.) agriTECH, 41 (4) 2021, 344-353

Meilgard, M. 1991. *Sensory Evaluation Techniques 3rd edition*. USA: CRC Press Inc.

Paramita, H. A., & Putri, W. D. R. (2015). Pengaruh Penambahan Tepung Bengkuang dan Lama Pengukusan terhadap Karakteristik Fisik, Kimia dan Organoleptik Flake Talas Effect of Addition Yam Flour and Steaming Duration on Phsyco-Chemical and Sensory Qualities of Taro Flakes. *Jurnal Pangan Dan Agroindustri*, *3*(3), 1071–1082. Retrieved from https://jpa.ub.ac.id/index.php/jpa/article/view/230/237

Radiani, A., Hudaida, S., and Bernatal, S. 2020. Formulasi Tepung Terigu, Mocaf Dan Pure Labu Kuning (Cucurbita Moschata) Terhadap Kadar Serat Kasar, Lemak, Dan Karakteristik Sensoris Bolu Kukus. Journal of Tropical Agrifood 2020; 2(1): 8-15

Rukmini, H. S., & Naufalin, R. (2015). FORMULASI TIWUL INSTAN TINGGI PROTEIN MELALUI PENAMBAHAN LEMBAGA SEREALIA DAN KONSENTRAT PROTEIN KEDELAI. *Jurnal Teknologi Industri Pertanian*. Retrieved from https://journal.ipb.ac.id/index.php/jurnaltin/article/view/11784

Staichok, A., Kamylla, R., Pamella, G., Lismaira, G., and Clarissa, D. 2016. Pumpkin Peel Flour (Cucurbita máxima L.) – Characterization and Technological Applicability. Journal of Food and Nutrition Research, 2016, Vol. 4, No. 5, 327-333

Tamtarini & Yuwanti, S. (2005). Pengaruh penambahan koro-koroan terhadap sifat fisik dan sensori flakes ubi jalar. *Jurnal Teknologi Pertanian*, 6(3), 187–192. Retrieved from https://www.e-jurnal.com/2014/06/pengaruh-penambahan-koro-koroan.html

Waisundra, V. (2017). Introductory Chapter: Cassava as a Staple Food. DOI DOI10.5772/intechopen.69424.

Widaningrum, Widowati, S., & Soekarto, S. T. (2005). Pengayaan Tepung Kedelai Pada Pembuatan Mie Basah Dengan Bahan Baku Tepung Terigu Yang Disubtitusi Tepung Garut. *Jurnal Pascapanen*. Retrieved from http://repository.pertanian.go.id/handle/123456789/11158

Yerizam, M., Suri, A., and Utari, O. 2020. Effect of Temperature and Starter Concentration on the Fermentation Process in Making MOCAF. *J. Phys.: Conf. Ser.* 1500 012050. **DOI** 10.1088/1742-6596/1500/1/012050