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Article Note

Development of Mocaf-Wheat Noodle Product with the Addition of Catfish and Egg-White Flours as an Alternative for High-Animal-Protein Noodles

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Abstract

This study aimed to determine the best formula and chemical dan sensory properties of noodles made from mocaf-wheat flour supplemented with catfish and egg-white flours. The factorial randomized trial was used in this experiment. The treatment factors consisted of the types of supplementary flour i.e. catfish flour (T_1) and egg white flour (T_2). These supplementary flour was applied to the mocaf and wheat flour of 70:30 as follows 5, 10, 15, and 20% (w/w) and assigned as P_1, P_2, P_3, and P_4. Chemical properties (water content, total fat, total protein, carbohydrate, and ash contents) and sensory properties were then analyzed. Hedonic test was performed to determine the consumer's acceptance level of 15 semi-trained panelists. Result showed that the interaction between the two treatments had no significant effect on the five chemical variables, while combination of the two treatments only had a significant effect on the texture of mocaf-wheat noodles and had no significant effect on other variables. Noodle with the treatment of egg white flour supplementation had higher protein content compared to those of catfish flour. As more flour was supplemented, the higher protein content. As conclusion, the mocaf-wheat noodle product was able to be developed to produce high protein content of noodle.

Keywords : noodles, mocaf, catfish flour, egg-white flour

Introduction

Noodle is one of the forms of processed food sources of carbohydrates, which can be used as staple food. It is commonly consumed by most consumers, either as breakfast food or snack. Noodle is one of popular food for breakfast. Indonesia is the second largest market in the world after China with a continuous increase in noodle production (World Instan Noodles Association, 2014). Total noodle production in Indonesia – either instant, dry or fresh noodles – reached 1.6 million tons in 2008. The production reached 2.0 million tons in 2013 and 2.2 million tons in 2014. Based on the data of Indonesian Central Bureau of Statistics, 60% of 3.6 million tons wheat-flour produced annually are used to make noodles; i.e. 20% for instant noodles, 30% for fresh noodles, and 10% for dry noodles. The new method is necessary to overcome this issue to decrease the use of wheat flour in noodle production. For example, substitution wheat flour with flour from local foodstuffs.

Cassava is the largest commodity of carbohydrate sources in Indonesia, compared to other carbohydrate sources. It can be processed into several sources of industrial raw ingredients in food industries such as cassava flour, modified cassava flour (mocaf), tapioca flour, dried cassava, and other foodstuffs. Mocaf is the one that has great potential. The basic principle of mocaf production is by modifying cassava cells through fermentation using lactic acid bacteria (Subagio, 2006).

Many studies reveal that mocaf has similar characteritistics with wheat flour, i.e. has white color, soft, and no smell of cassava (Amri and Pratiwi, 2014; Sulistyo and Nakahara, 2013). Andriansyah*et al.* (2017), reported that mocaf made by autoclaving cooling cycle method was able to maintain the texture of processed products of noodle and spaghetti. Mocaf might produce various wheat-based products such as biscuits with high iron for children under five years (Agustia *et al.*, 2017). Instant tiwul may be made from mocaf (Agustia *et al.,* 2018) as well as brownies (Prayitnoet al., 2018), furthermore mocatilla chips could also be made from mocaf and maize (Asmoro *et al.*, 2017).

Since gelatinization does not occur in mocaf, mocaf cannot replace the role of wheat flour in noodle production. Thus, mocaf may serve only for substitution of wheat flour in noodle production. The results of chemical analysis and organoleptic test showed that substitution of wheat flour with mocaf could be done for the maximum of 15% (Subagio, 2006). Mocaf could substitute until 10% of the corn flour and tapioca in corn instant noodle resulting in a chewy texture and favorable to consumers (Indrianti *et al.,* 2013). Noodle might be made from various ingredients such assago starch (Agustia *et al.*, 2016) resulting high protein product (10.47% dry basis/db) and mung bean flour resulting 1.8% (db) protein (Yuliani*et al.,* 2015). In this study used fresh noodles that was made from mocaf-wheat noodles. According to SNI 01-2987-1992, fresh noodles were defined as food product made from wheat flour with or without the addition of other allowable ingredients and foodstuffs, and in the typical form of undried noodles. Various studies of mocaf noodle with the addition source of vegetable protein has been done such as utilization of porang (Konjac) flour in noodle as mocaf substitution (Faridah and Widjanarko, 2014) and corn subtitued-mocaf (Diniyah *et al.,* 2017).

Table 1. Water, fat and total protein of catfish flour and egg-white flour

Ingredients	Water (%wb)	Fat (%db)	Protein (%db)	Ash (%db)	Carbohydrate (%db)
Catfish flour	6.73 ± 0.21	17.59 ± 0.16	66.25 ± 0.09	4.36 ± 1.52	4.86 ± 1.28
Egg-white flour	13.51 ± 0.23	1.66 ± 0.38	67.94 ± 0.88	6.24 ± 1.05	10.61 ± 2.11

Table 2. Concentration (%) of water, fat and total protein contents of treated product

	Water	Ash	Fat	Protein	Carbohydrate
Types of supplementary flour (T):					
Catfish flour	62.89^{b}	1.37^{b}	8.59	10.73^{b}	16.42
Egg-white flour	66.15^{a}	1.97^{a}	7.62	11.88^{a}	12.39
The proportion (P)					
5%	63.32^{bc}	1.64	7.32	9.17^{c}	18.55^{a}
10%	62.58^{c}	1.68	8.19	8.86^{c}	18.69^{a}
15%	66.74^{a}	1.61	8.91	12.94^{b}	9.09^{b}
20%	65.43^{ab}	1.75	7.99	14.24^{a}	10.58^{b}

Note: Values in the same column with the same superscript letters were not significantly different

Present study used catfish and egg-white flours as the sources of protein. The addition of animal-protein sources in the noodles produce energy-dense and high-protein noodles, in order to provide high carbohydrate and protein product. Catfish flour has several advantages compared to other sources of protein including a fairly high protein content (±20%) with a patterned amino acid arrangement (Asriani *et al.*, 2018)). Egg-white flour may also be used in manufacture to save the space and storage costs (Winarno and Koswara, 2002). Therefore, the objective of this study aimed at determine the chemical dan sensory properties of mocaf-wheat noodles that was supplemented with catfish flour and egg-white flour, in order to produce fresh noodles with high animal-protein content and favorable sensory properties. The use of mocaf and the addition of supplementary flours in fresh-noodle production may provide rich animal protein food, and may be used as the way to solve national problem such as malnutrition.

Materials and Methods

Materials

Mocaf was obtained from Annisa Female Farmer Group in Banjarnegara. Segitiga Biru® was used as wheat flour, while the eggs and catfish were obtained from traditional market in Purwokerto. Sodium tripolyphosphate (STPP), baking soda, and salt were purchased from modern bakery store in Purwokerto, Central Java. The extra tools for flour production and noodle production were also used.

Methods

This study was conducted in the Laboratory of Food Service and Laboratory of Agricultural Technology, General Soedirman University, Purwokerto. The study was conducted from May to September 2015. Factorial randomized design was chosen to analyze data with the following treatment: types of supplementary flour (T), and proportion of mocaf and wheat flour. Noodles without the addition of supplementary flours were used as control. Suplementary flour was done at 5, 10, 15, and 20% (w/w) and assigned as P_1, P_2, P_3, P_4, respectively. Catfish and egg white flour were used as supplementary flour.

Catfish flour production

Catfish fillets were washed properly, blanched for 15 minutes, and then dried using cabinet dryer at 55-60˚C for ±24 hours. The dried fillets were then finely ground and filtered using 60 mesh filter, packed and sealed until ready to use (Adeleke and Odedeji, 2010).

Egg-white production

White egg were separated from yolks and placed on the baking tray, then dried by using cabinet dryer at the temperature of 55-60˚C for ± 24 hours. Grounding and filtering using 60 mesh filter was then conducted and followed by packing and sealing until ready to use (Wulandari and Suryati, 2009).

Production of mocaf-wheat noodles supplemented with catfish and egg-white flours

Mocaf, wheat flour, and supplementary flours (catfish and egg-white flours) with the proportion according to the treatment were mixed thoroughly with 1% STPP, 3% salt, 1% baking soda, and 50% water. The flour mixture was kneaded until no longer sticky. The dough was pressed using noodle processor and boiled for one minute. The noodles were then drained (Murdiati *et al.*, 2015).

Chemical Analysis

Mocaf-wheat noodles were analyzed for water content (using oven method), ash content (gravimetric method), protein content (micro-Kjeldahl method), fat content (Soxhlet method), and carbohydrate by difference (Soedarmadji *et al.*, 1984).

Sensory Test Prosedure

Previous sensory test procedure as conducted by Setyaningsih *et al.* (2010) was performed to determine consumers' acceptance levels of texture, color, flavor and preference regarding mocaf-wheat noodles. The test on color, texture and flavor of mocaf-wheat noodles were performed by 15 semi-trained panelists without further processing. Score 1 to 4 was used to determine the likeness with the highest score was the best preference. Hedonic test was performed on processed noodles with similar ingredient.

Table 3. Sensory properties of mocaf-wheat noodles

Treatment	Color	Texture	Flavor	Preference
T_1P_1	1.799 ± 0.49	2.512 ± 0.63[ab]	2.467 ± 0.43	2.422 ± 0.41
T_1P_2	1.823 ± 0.47	2.290 ± 0.47[ab]	2.357 ± 0.37	2.245 ± 0.39
T_1P_3	1.823 ± 0.53	2.178 ± 0.43[ab]	2.313 ± 0.45	2.289 ± 0.47
T_1P_4	2.044 ± 0.42	2.289 ± 0.64[ab]	2.333 ± 0.54	2.333 ± 0.61
T_2P_1	1.956 ± 0.42	2.667 ± 0.62[a]	2.489 ± 0.49	2.423 ± 0.46
T_2P_2	2.001 ± 0.39	2.444 ± 0.53[ab]	2.644 ± 0.41	2.578 ± 0.54
T_2P_3	1.821 ± 0.38	2.112 ± 0.49[b]	2.244 ± 0.54	2.245 ± 0.48
T_2P_4	1.956 ± 0.25	2.355 ± 0.54[ab]	2.4 ± 0.54	2.266 ± 0.55

Note: values in the same column with the same superscript letters were not significantly different ($p>0.05$). T_1=catfish flour; T_2=egg-white flour; P_1, P_2, P_3, P_4 was 5, 10, 15, 20% of supplementary flour

Data Analysis

The data were analyzed by using analysis of variance (ANOVA) or Fisher's exact test (F test) at 95% confidence level. If significant effects was detected, the analysis was continued with Duncan's multiple range test (DMRT) at a significance level of 5%.

Result and Discussion

Protein, Water, Fat, Carbohydrate, and Ash Content

Protein content of catfish flour and egg-white flour were 66.25% and 67.94% (db), respectively (Table 1) and may be used as supplementary flour according to the standard for making noodle by SNI 01-2987-1992, i.e. 8%. Table 2 showed that the types of supplementary flour had very significant effects on water and ash contents as well as on protein content, but no significant effects was detected on fat and carbohydrate contents. Table 2 also indicated no significant effect on the interaction between supplementary flour treatments and chemical variables.

Water content of the mocaf-wheat noodles supplemented with catfish flour was 62.89%, lower than the ones supplemented with egg-white flour (66.15%). It was due to the water content of egg-white flour (13.51%), which was higher than that of catfish flour (6.73%).

Types of supplementary flour had a significant effect on ash content. Ash content of the mocaf-wheat noodles supplemented with egg-white flour was 1.97%, higher than the ones supplemented with catfish flour (1.37%). It was due to the ash content of egg-white flour (6.24%), which was higher than that of catfish flour (4.36 %). Meanwhile, the proportion of mocaf-wheat and supplementary flours (P) and the interaction between the two treatments had no significant effects on the ash content of mocaf-wheat noodles. Based on this result, the higher the proportion of supplementary flour, the higher the ash content. The ash content of mocaf-wheat were 1.64 to 1.75%, as the addition of supplementary flour of 5 to 20%. This finding was in line with a study conducted by Omeire *et al.* (2015); in which the noodles made from wheat flour and cassava flour that were substituted with Bambara groundnuts had an ash content of about 1.8%.

Supplementary flour had a significant effect on protein content, however no significant interaction between the supplementary flour and protein content was detected. As provided data, the egg-white flour supplementation had higher protein content (11.88%) than the catfish flour (10.73%). This might be due to the high protein content ingredient (Aliya *et al.*, 2016). The protein content had met the national quality standard for minimum protein content at 8% (SNI 01-2987-1992).

No significant effects was detected on the fat content upon the supplementary flour application while no significant interaction was also detected on the supplementary flour and fat content. However, the values resulted wide range result starting from 6.43 to 11.39%. The high significancy effect of supplementary flour was found in the carbohydrate content. Meanwhile, the no significant interaction between supplementary flour and carbohydrate content was found. The higher the proportion of supplementary flour, the lower the carbohydrate content.

Sensory properties of mocaf-wheat noodles

Table 3 indicated that combination of the supplementary flour only had a significant effect on the texture. Result of color starting from 1.799 to 2.044, which showed brownish yellow color. Mocaf-wheat noodles supplemented with flours made from animal source of protein could provided brown color (Winarno, 2004). The highest value of texture (2.667) was found in 5% supplementary flour while the lowest value (2.112) was found in 15% supplementary flour.

Texture is important factors in the determination of product quality (Singham *et al.,* 2015). Texture sensing may be derived from touch and caught by skin surface (Nishinari *et al.,* 2013). However, the texture of food can usually be known through the fingertips (Setyaningsih *et al.*, 2010).

No significant interaction was found on the supplementary flour and flavor of mocaf-wheat noodles with the range of value from 2.244 to 2.644, which showed the flavor's criteria of rather tasty to tasty. The relatively low score was influenced by the addition of supplementary flours. Similar statistical result was also found in the interaction of supplementary flour and the panelist's preference of mocaf-wheat noodles. The values had range from 2.245 to 2.578, indicating the criteria for hedonic scale of like slightly to like. In general, the product was favored by the panelists.

Conclusion

The best treatment combination was obtained from the proportion of 70:30 mocaf-wheat flour and 20% egg-white flour, with a relatively high protein content (15.38% db). The noodles in this study had met the quality standards for fresh noodles (SNI 01-2987-1992).

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