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Analysis Preference between Dried Catfish Noodles and Yellow Pumkin Flour Substitution

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ABSTRACT

Background: Dry noodles are products made from wheat flour which are dried to a maximum moisture content of 10%. This study investigated on analysis preference between dried catfish noodles and yellow flour and determined the protein and water content.

Methods: In an experimental completely randomized design using 3 treatments with different pumpkin flour substitutions, namely 5%, 7.5% and 10%, analysis preference between dried catfish noodles and yellow flour and a protein and water content analysis were undertaken according to the terms of the dry noodle quality requirements (SNI 8217-2015). The appearance, color, aroma, texture, flavor, overall appearance were also compared between dried catfish noodles and yellow flour.

Results: The 10% pumpkin flour substitution showed the highest value for appearance, color, aroma, texture and overall acceptance; whereas the flavor was dominated by 5% pumpkin flour substitution. The test for the highest protein content and the lowest water content was in 7.5% pumpkin flour substitution. The higher the water content, the lower was the protein content. Based on the proximate test, protein content of dried catfish noodles ranged 12.95-15.47%; and the water content of dried catfish noodles ranged 9.49-12.60%.

Conclusion: The 5% pumpkin flour substitution was preferably organoleptic, but the best water content was in 7.5% pumpkin flour substitution in accordance with the quality requirements for dry noodles (SNI 8217-2015). It is necessary to test acceptability of the product with variations in noodle processing techniques and differences in cooking recipes. Therefore, these finding can help the health authorities in nutritional plans.

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Introduction

Kampar regency is one of the regencies in Riau Province with the third largest freshwater fishery production in Indonesia. One of its main products is catfish with an annual production of 500 thousand tons (1). Catfish is an alternative that can be used as a substitute in local food-based food processing. The addition of catfish in dried catfish noodle products has increased the protein content of dry noodles (2). Dried noodles are dry food products

made from wheat flour with the addition of other food ingredients and permitted food additives, have a unique shape of noodles, and have a moisture content of 8-10%.

In the study of the effect of adding three types of fish, namely catfish, tilapia and cork, it showed that the panelists' preference for taste in catfish was higher than the other two types of fish and controls. Likewise in the protein analysis test, dried catfish noodles had the highest protein content (2). An intervention giving catfish wet noodles to school-aged children with malnutrition status showed an increase in body weight (p=0.001) and also an increase in calorie and protein intake (3). One of the efforts to overcome this is utilizing other local foods with good nutritional potential and bioactive components that have not been used optimally. Pumpkin (*Cucurbita moschata*) is a local food commodity that its utilization is still very limited. Pumpkin can last up to six months or more, depending on how it is stored. Although pumpkin has a long shelf life, storage in the form of fresh fruit is less efficient; because it requires a large space and is less practical in its use (4). To overcome, this can be done by processing pumpkin into flour. Processing fresh pumpkins into flour could reduce the water content by more than 78.2% (5).

The drying temperature factor will affect the characteristics of the produced pumpkin flour. The higher the temperature, the lower the produced water content and this is very important to maintain the shelf life of the material (6). However, the use of pumpkin flour in the substitution of processed food must also be limited to 10% of the weight of the enriched material, because the high use of pumpkin flour in processed food will affect the texture and aroma of the resulting product (7). The use of pumpkin flour as a substitute for dry noodle management procedures can be used as an alternative to reduce the use of wheat flour. The purpose of the study was to determine the level of preference for dried catfish noodles with a pumpkin flour substitution and to determine the protein content and water content of the product.

Materials and Methods

The ingredients used in making dried fish noodles were high-protein flour, pumpkin flour, catfish, eggs, salt, garlic, water, and cooking oil. The type of catfish used in this study was the Jambal catfish (*Pangasius djambal*), while this type of fish is commonly found in Riau waters. The peeled and cleaned pumpkin went through a drying process at a temperature of 60°C for 24 hours; then mashed and sieved using an 80 mesh sieve. The process of making dried pumpkin flour substituted noodles consisted of the following steps (i) Fresh catfish were removed from the bones and head and then washed with running water to remove dirt/blood that was still attached to the catfish meat. (ii) To carry out the process of reducing the size to facilitate the process of crushing/refining the catfish meat. (iii) After the catfish meat was smooth, the dry ingredients such as flour, pumpkin flour, baking powder, and salt were mixed. (iv) Egg, garlic, and ash water and whiting were added to the mixture. (v) The entire mixture of ingredients was stirred for about 15 minutes until a homogeneous mixture was formed. (vi) The dough was put into a dough sheeter to form a slab and then printed with a pasta machine to form a spiral. (vii) The second steaming was carried out for 2 minutes at a temperature of 100°C and the steamed noodles were dried in an oven at 70°C for 8 hours to produce dried catfish noodles.

This study was experimental with a completely randomized design using 5 treatments, namely 3 treatments consisting of treatment A (5% pumpkin flour substitution), treatment B (7.5% pumpkin flour substitution), treatment C (10% pumpkin flour substitution), and 2 controls, namely, control 1 without the addition of fish and pumpkin flour substitution; while control 2 was without the addition of pumpkin flour. Based on a research, the addition of pumpkin flour with a concentration of 5% and 7.5% was the most preferred concentration by the panelists, while the 10% concentration had a texture that was not recognized by the panelists; while with a concentration above it was disliked by the panelists (5).

Our research has gone through our institutional ethical review (No. LB 02.03.6.09202, dated January 15, 2021). The variables observed in this study were the level of preference and analysis of nutritional content, namely protein and water content in dried catfish noodles with pumpkin flour substitution. Bivariate analysis was used to determine the effect of the level of preference for dried catfish noodles with pumpkin flour substitute on the level of preference for appearance, color, aroma, texture, taste, and overall acceptance. The normality of data was tested using Shapiro Wilk test with data normally distributed if p value was <0.05. Further tests were carried out using the ANOVA test with a 95% confidence interval (α=5%); while the data were normally distributed. If the data were not normally distributed, the Shapiro Wilk test was utilized with a 95% confidence interval (α=5%). If there was a significant difference between the five treatments, then Duncan's test was performed.

The protein content analysis method used the kjekdhal method. The working principle of the

Kjeldahl method was that proteins from organic components in the sample were destroyed using sulfuric acid and a catalyst. The water content analysis method was used to determine the initial moisture content and the critical water content of the product. The method used was the oven (AOAC-2005). The empty cup was dried in an oven at a temperature of 102-105°C for 60 minutes, then cooled in a desiccator. The cup was weighed until its weight was constant, then 2-5 g of the sample was placed into the cup. The sample was heated at 105°C for six hours, cooled in a desiccator and weighed to a constant.

Results

The hedonic test in this study was carried out by 60 untrained panelists using a score sheet consisted of an assessment of appearance, color, aroma, texture, taste and overall acceptability for each treatment (Table 1). The results of the normality test of Shapiro Wilk and the mean value of observations showed that the *p* value of the appearance and color of dried noodles was significant ($p<0.05$), indicating to a significant difference between each treatment with the addition of catfish and pumpkin flour for the appearance and color (Table 2).

The mean protein content of dried catfish noodles with pumpkin flour substitution ranged from 12.95% to 15.47%. The lowest value of dry noodle protein content was 5% pumpkin as treatment A (12.95%) According to SNI 8217-2015, the protein content of dry noodles with the dried method was at least 10%; revealing that dry noodles with the addition of pumpkin flour met SNI 8217-2015 (8) (Table 3). The average water content of dried catfish noodles substituted with pumpkin flour ranged from 9.49% to 12.60%. The lowest value of dry noodle moisture content was 7.5% pumpkin as treatment B (9.49%) and the highest was 5% pumpkin as treatment A (12.60%). According to the quality requirements of dry noodles (SNI 8217-2015), the water content in dried noodles was a maximum of 13%, and in this study, the test result was 9.49-12.60% (Table 4).

If the moisture content in dry noodles was more than 13%, it did not meet the requirements of dry noodles and was with a shorter shelf life and the processing was relatively more difficult to carry out (8, 9). Based on these findings, the dry catfish noodles substituted with pumpkin flour met the SNI requirements. In this study, the higher the protein consistency, the less the water content was. The use of heat in food processing reduced the percentage of water content and increased the percentage of protein content (10). The findings of this study are in line with researches on dried motan fish flour noodles which showed higher protein content in noodles with lower water content (11) (Table 3 and 4).

Based on the results of hedonic testing with five different treatments regarding appearance, color, aroma, texture, taste and overall acceptance of dried catfish noodles substituted with pumpkin, the data were not normally distributed, so the Shapiro Wilk test with a 95% confidence interval ($\alpha=5\%$) was replaced for one way ANOVA analysis. The performance was assessed using organoleptic test with a hedonic scale, while the hedonic scale ranged from an extreme good to an extreme bad scale. The results of the hedonic test for the appearance of the breakfast of A, B, and C by 60 panelists turned out to be the most favored by control 2 (182.81) and treatment C (164.53). The Shapiro Wilk test on appearance showed a *p* value of 0.002, that demonstrated a significant difference with a range value of 128.70-182.81.

Table 1: Shapiro Wilk analysis of results.

Variable	n	Mean	*p*
Appearance	300	16.995	0.002
Color	300	26.444	0.000
Aroma	300	3.863	0.425
Texture	300	3.847	0.427
Taste	300	9.664	0.046
Overall acceptability	300	8.806	0.066

Table 2: Results of panelists' preference level for patin fish dried noodles.

Treatment	Parameters tested					
	Appearance	Color	Aroma	Texture	Taste	Overall acceptability
Control 1 (K1)	138.68	130.89	144.87	149.20	144.83	141.48
Control 2 (K2)	182.81	196.57	163.28	163.14	152.38	167.30
Treatment A (5% pumpkin)	137.79	139.86	144.61	150.22	172.13	156.51
Treatment B (7.5% pumpkin)	128.70	127.90	139.21	134.08	125.93	127.38
Treatment C (10% pumpkin)	164.53	157.28	160.53	155.86	157.23	159.83

Table 3: Protein content of different groups.

Sample	Protein content
Control 1 (K1)	14.79%
Control 2 (K2)	14.54%
Treatment A (5% pumpkin)	12.95%
Treatment B (7.5% pumpkin)	15.47%
Treatment C (10% pumpkin)	13.17%

Table 4: Water content of various groups.

Sampel	Water content
Control 1 (K1)	12.26%
Control 2 (K2)	12.13%
Treatment A (5% pumpkin)	12.60%
Treatment B (7.5% pumpkin)	9.49%
Treatment C (10% pumpkin)	12.04%

The best value for the color of dry noodles was shown in treatment C (157.28) and control 2 (196.57). Before boiling, control 2 produced a bright yellow color, while after boiling became a slightly dark color. Treatment C before boiling produced a dark yellow-orange color and after boiling became brownish yellow color. Panelists preferred dry noodles with the addition of 10% pumpkin flour; because the addition of more pumpkin flour produced colors that were more attractive to panelists. The higher water consistency, the less protein content was. This is due to reduced water content, while foodstuffs contain compounds such as proteins, carbohydrates, fats and minerals in higher concentrations (10).

Discussion

Color is very influential on food quality, as color is one of the assessment measures to determine the quality of foodstuffs. Winarno (2004) has demonstrated the food quality to be dependent on the color of foodstuffs, because the color appears first and is an important criterion to show the identity of a raw materials in food products (12). Color assessment of dry noodles as been tested in cooked noodle products and is strongly influenced by the browning reaction (13). The yellow color in dry noodles, apart from the pumpkin, also originates from the addition of fish in the manufacture of dry noodles and comes from the eggs and flour. The yellow color contained in pumpkins can be used as a natural dye in processed products such as wet noodles, while the orange color indicates that pumpkin contains an important antioxidant, beta carotene (14).

The egg yolk serves as a good color to the resulting noodles and is also used as an emulsifier because in the egg yolk there is lecithin, while lechitin can accelerate the hydration of water in flour to develop dough (15). An ingredient that is considered nutritious, delicious and has a good texture is not always liked by consumers if it has an unattractive color or gives the impression of deviating from the color it should be. According to Igfar (2012), a dark color is produced due to the substitution of pumpkin flour as pumpkin flour is yellow in color. It is necessary to mention that the protein combines with sugar/starch in a hot atmosphere and causes the product color to be darkened (16).

As Table 2 shows, the best value for the aroma of dry noodles was noticed in treatment C (10% pumpkin flour) (160.53) and control 2 (163.28) which demonstrated the panelists to prefer the aroma of dry noodles in comparison to other treatments. Before boiling, control 2 had a typical noodle aroma, and treatment C (10% pumpkin flour) had a pumpkin aroma. After boiling, control 2 produced a slightly fragrant aroma; while treatment C (10% pumpkin flour) produced a fragrant aroma. Aroma is an odor component caused by a product that is identified by the sense of smell (13). Pumpkin flour has a distinctive aroma and is different from the aroma of wheat flour, this causes the resulting aroma to be unique to pumpkin. The more pumpkin flour used, the more distinct the pumpkin's distinctive aroma will be (14).

Based on Table 2 findings, the best value for the dry noodle texture was illustrated in treatment C (10% pumpkin flour) (155.86) and control 2 (163.14) which made the panelists to prefer the dry noodle texture when compared to other treatments. Before boiling, control treatment 2 and treatment A had a crunchy texture. Meanwhile, after boiling, control 2 had a soft texture, while treatment A revealed a chewy texture. This is in accordance with the research of Biandari *et al*., (2018); a higher concentration of pumpkin flour can cause the hardness to increase as a result of poor development or decrease in the volume of the product; so that it becomes denser and feels harder, and the resulting product has fewer pores (17).

According to Silaban *et al*. (2017), protein plays a role in increasing the hard texture because the proteins found in fish are myosin and actomyosin. Proteins consisted of myosin and actomyosin in fish meat play an important role in clumping and gel formation, so that if the fish is processed; it would produce a dense structure (18). Differences in flour content in each treatment can affect the resulting texture. Pumpkin flour is hygroscopic or easily absorbs water and also contains pectin and fiber which can bind water better than wheat flour (5).

The best value for the dry noodle taste was shown in treatment A with the addition of 5% pumpkin flour making the panelists to prefer the dry

noodle taste compared to other treatments. Before boiling, treatment A had a slightly sweet savory taste. Meanwhile, after boiling, it showed a slightly sweet taste. Panelists liked the dry noodles with the addition of less pumpkin flour. Panelists preferred dry noodles with 5% pumpkin treatment, because the concentration of pumpkin added was less, and the higher concentration of pumpkin flour reduced the panelists' preference level. In the wet noodle study with the same percentage, addition of pumpkin flour showed the level of preference for taste to be with the highest value (5).

In general, there are five basic tastes, namely sweet, bitter, sour, salty and savory (umami). A product can be accepted by consumers if it has the desired taste. Therefore, taste is a sensory attribute that greatly determines the acceptance of panelists and consumers. The distinctive taste of dry noodles was due to the addition of fish in the dried noodles. Changes in taste in food were caused by the decomposition of proteins, fats, carbohydrates through chemical processes that occur due to enzymatic reactions (19). The mean protein content of dried catfish noodles with pumpkin flour substitution ranged from 12.95% to 15.47%. The lowest protein content value of dry noodles was treatment A (5% pumpkin flour) and the highest was treatment B (7.5% pumpkin flour). According to SNI 8217-2015, the protein content of noodles with the dried method was at least 10%. That is, dry noodles with the addition of pumpkin flour met SNI 8217-2015 (8).

The difference in protein content in the product was also influenced by the processing, namely at the time of steaming the fish and drying the dry noodles. The effect of heating on the components of fish meat was shown to cause changes in the physical and chemical composition of the fish meat. The effect of heating time needs to be considered on the nutritional components contained in fishery products. Several researchers showed that heating affected the water content, fat, protein and amino acids contents in the fish (12). The increase in protein content of dry noodles with the addition of pumpkin flour was thought to be due to the loss of carbohydrates and water content during noodle processing. According to Pratama (2014) findings, the measured high or low protein content was influenced by the amount of water lost from the material, while the measured protein value would be greater if the amount of water lost was greater (20).

Moisture content is one of the important quality parameters of dry noodles, which will affect its shelf life. Dried noodles that have a moisture content that exceeds the standard will have a shorter shelf life (21). The average water content of dried catfish noodles with the addition of pumpkin flour ranged from 9.49% to 12.60%. The lowest value of dry noodle moisture content was with addition of treatment B (7.5% pumpkin flour) and the highest was with treatment A (dry noodles with 5% pumpkin flour). Based on SNI 8217-2015, the water content in dried noodles has been a maximum of 13%, while in our study ranged from 9.49 to 12.60% (8). Based on these results, the dried catfish noodles substituted with pumpkin flour have met the requirements of SNI 8217-2015.

The water content of dry noodles was lower due to the oven processing time. The drying process was based on the occurrence of water evaporation (water absorption by air) as a result of the difference in water vapor content between the air and the product being dried. The results observed in this study were in line with researches on dried noodles from motan fish meal which showed higher protein content in noodles with lower water content (11). The use of heat in food processing can reduce the percentage of water content which causes the percentage of protein content to increase. The increase in the value of protein content is continued with the longer time used during the drying process up to 24 hours. This is because the longer the time and the higher the temperature used in drying, the more it causes an increase in protein content (22) revealing that the higher the water content, the lower the protein content that is due to reduced water content, and therefore, foodstuffs will contain compounds such as protein, carbohydrates, fats and minerals in higher concentrations (12).

Tests on water and protein content showed that dry noodles with pumpkin flour substitution of 7.5% (treatment B) resulted in the lowest water content and the highest protein content according to the terms of the dried noodle quality requirements (SNI 8217-2015) (8). In the hedonic test of treatment B, it did not show the highest content, but on the overall appearance; there was no effect for addition of catfish and pumpkin flour for overall acceptance, and this showed that dry noodles with 7.5% pumpkin flour substitution were accepted by panelist.

Conclusion

Treatment A as 5% pumpkin flour substitution was preferably organoleptic, but the best water content was in treatment B as 7.5% pumpkin flour substitution in accordance with the quality requirements for dry noodles (SNI 8217-2015). So it is necessary to test the acceptability of the product with variations in noodle processing techniques and variations in cooking recipes.

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Conflict of Interest

None declared.

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