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RED TILAPIA'S BONE FLOUR FORTIFICATION AS A SOURCE OF CALCIUM ON STICK SNACKS PREFERENCE LEVEL

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ABSTRACT

This aim of this research was to determine the percentage of red tilapia bone flour as a source of calcium in the most liked stick snacks which resulted in the expectation of increased calcium intake in consumers. Research was carried out from July to August 2018 at the Fisheries Product Processing Laboratory, Faculty of Fisheries and Marine Sciences, Universitas Padjadjaran. and chemical tests were conducted at the Ruminant Animal Nutrition and Animal Food Chemistry Laboratory, Faculty of Animal Husbandry, Universitas Padjadjaran. The method used in this research was an experimental with 4 treatments, which were the addition of red tilapia bone flour to wheat flour among the treatments were 0%, 5%, 10% and 15%, involving 20 semi panelists as replication. The measurement parameter were the hedonic test (level of preference) based on organoleptic characteristics which included appearance, aroma, texture and taste and also chemical tests (water content and calcium content) on the stick snack. Based on the research results, it can be concluded that all treatments were accepted by the panelists, but the 10% red tilapia's bone flour treatment was the most liked treatment by the panelists with the median value that featured appearance, aroma and the taste was 7 and the texture was 8, water content value was 2.5% and calcium content value was 0.36%.

INTRODUCTION

Stick snack is a type of snack that is popular with the locals, where the processing is done by frying. Stick snacks have a savory taste and a crunchy texture. Many stick products have circulated in the market with consumers of various age (Pratiwi 2013). Sticks are a flour-based snack which is high in carbohydrates but low in calcium (Putri 2015), with a level of 66.03% and 0.086%, respectively (Handayani and Kartikawati 2015).

Calcium is essential for the body, it helps metabolism and the bones and teeth formation. The human body has different level of calcium requirements depending on the age and sex. Children need 600 mg of calcium per day whilst adults need 800 to 1000 mg per day LIPI Food and Nutrition Works (2004) *in* Syadeto et al. (2017), yet the average Indonesian only consume 254 mg of calcium per day (Salaman et al. 2015). One of the common impact of calcium deficiency is osteoporosis, a disease that is characterized by the loss of bone density (Kompas 2012).

In order to fulfill the calcium needs, the fortified red tilapia bone flour could be used in products such as stick snacks. The red tilapia bone is easy to get because it is an aquaculture commodity that has high economic value (Mansyur & Mangampa 2011). Currently, the fish bone waste in the fishing industry are not utilized properly (Rohmah et al. 2015). The utilization of red tilapia bones for calcium fortification in stick snacks, in addition to increase calcium intake, could also reduce environmental pollution.

The red tilapia bone flour fortification could increase the nutritional value of stick snacks. But, by adding red tilapia bone flour to the snack, the degree of consumer preference could also be affected. Based on these, it is necessary to conduct a study on the red tilapia bone flour fortification of stick snacks.

METHOD OF RESEARCH

Place and Time of Research

This research was carried out from July to August 2018. The creation of red tilapia bone flour, stick snacks, and organoleptic testing were conducted at the Fisheries Product Processing Laboratory, Faculty of Fisheries and Marine Sciences, Universitas Padjadjaran. The calcium and water level testing were conducted at the Ruminant Animal Nutrition and Animal Food Chemistry Laboratory, Faculty of Animal Husbandry, Universitas Padjadjaran.

Tools and Materials

The tools used in this research are 0.1 g precision digital scales, cutting board, plastic bag, knife, blender, sieve, stopwatch, oven, measuring cup, ampia, spoon, basin, cooking set, assessment sheet hedonic test, plate, glass. The materials used in this research are red tilapia bone waste, wheat flour, tapioca flour, baking powder, salt, coconut milk, butter, cooking oil, egg.

Method

This research consists of two stages : red tilapia bone flour making and stick snacks making. Red tilapia bone flour making according to Asni (2004) which has been modified. The fish bone are washed and steamed at temperature 100°C for 10 minutes. The fish bones are washed again and boiled at temperature 100°C for 30 minutes, then cut to a size of 5 cm and put into a pressure cooker with high heat, after the presto rings, then use low heat for 2 hours. The Fish bone pieces are dried using an oven at 100°C for 60 minutes, then mashed using a blender and then sieved using a 100 mesh sieve, so that the fish bone flour is homogeneous. The next stage is stick snacks making with the addition of the red tilapia bone flour.

The method used in this research was an experimental with 4 treatments, which were the addition of red tilapia bone flour to wheat flour among the treatments were 0%, 5%, 10% and 15%. In order to identify the level of preference for stick snacks, 20 semi panelists as replication. The measurement parameter were the hedonic test (level of preference) based on organoleptic characteristics which included appearance, aroma, texture and taste. As for chemical tests (water content and calcium content) in 0% stick snacks treatment (control) and the most liked stick snacks. The data analysis of water and calcium content used descriptive methods. In the organoleptic tests, data analysis used non-parametric statistics in the form of Friedman test. if there are significant differences in each treatment, multiple comparison tests will follow. The best treatment was determined using the Bayes test.

RESULT AND DISCUSSION

Appearance

Appearance is an important organoleptic parameter because it is the first thing that the consumers see. Consumers generally pick foods that have an attractive appearance (Soekarto 1985). The appearance results are shown in Table 1.

Table 1. The Stick Snacks Appearance Mean in Each Treatment

Red Tilapia Bone Flour (%)	Median	Appearance Mean
0	7	7,2a
5	7	7,2a
10	7	7,5a
15	7	6,8a

Explanation : The mean followed by the same letter (a) showed that there are no significant differences according to the multiple comparison test at 95% confidence interval.

Based on the results above, all of the treatment was still favored by the panelists, with a median value of 7 which was in the "liked" category. The mean of stick snacks appearance ranges between 6.8 and 7.5.

The 10% treatment has the highest mean of 7.5. Despite of this, the overall results of statistic tests showed that all treatments were not significantly different, which means that the red tilapia bone flour fortification did not give a noticeable difference in appearance based on the panelists judgement of the yellow-brownish stick snacks. This could be caused by the clear white color of the red tilapia bone flour. This confirms Baskoro's research (2008) that also showed that the color of the flour is clear white. The color or appearance tends to be the same in each treatment and are still favored by panelists.

The yellow-brownish of the stick could be caused by the maillard reaction occurred in the frying process. The maillard reaction occurs between carbohydrates, especially the reducing sugar that has a primary amine acid groups, founded in the ingredients which will produce a brown color component called melanoidin (Winarno 1997).

Aroma

The taste of food mostly depends on its aroma. Aroma is a gas molecule that is inhaled by the nose, which from it one could determine whether the food is delicious or not. The aroma mostly related to the smell sense. (Winarno 1997). The aroma results are shown in Table 2.

Table 2. The Stick Snacks Aroma Mean in Each Treatment

Red Tilapia Bone Flour (%)	Median	Aroma Mean
0	7	7,5a
5	7	7,1a
10	7	7,3a
15	7	6,9a

Explanation : The mean followed by the same letter (a) showed that there are no significant differences according to the multiple comparison test at 95% confidence interval.

Based on the results above, all of the treatment was still favored by the panelists, with a median value of 7 which was in the "liked" category. The mean of stick snacks aroma ranges between 6.9 and 7.5.

The control has the highest mean of 7.5. Despite of this, the overall results of statistic tests showed that all treatments were not significantly different, which means that the red tilapia bone flour fortification did not give a noticeable difference in aroma. Stick snacks have a distinct aroma and the panelists did not notice the fishbone aroma. This is because the red tilapia bone flour has a fresh and fishy aroma that is not too noticeable (Baskoro 2008).

Texture

The texture of an ingredient will affect the taste that is caused by said food ingredients. In previous studies, it was found that the changes in texture or viscosity of ingredients can change the taste because it can affect the speed of arousal arising from the olfactory receptor cells and the salivary glands (Winarno 1997). The texture results are shown in Table 3.

Table 3. The Stick Snacks Texture Mean in Each Treatment

Red Tilapia Bone Flour (%)	Median	Texture Mean
0	7	7,2a
5	7	7,3a
10	8	7,5a
15	5	5,8a

Explanation : The mean followed by the same letter (a) showed that there are no significant differences according to the multiple comparison test at 95% confidence interval.

Based on the results above, all of the treatment was still accepted by the panelists, with the median ranging between 5 to 8 which were in the "neither liked or disliked to liked" category. The 10% treatment has the highest mean with a value of 7.5, and the 15% treatment has the lowest mean with a value of 5.8.

The results showed that the red tilapia bone flour fortification on stick snacks affected the preference level of texture parameter. The 0% and 5% treatment did not significantly affect the 10% and 15% treatment, but the 10% treatment was significantly different from the 15% treatment. The 10% treatment is the most liked treatment by the panelists because of the crunchy and easy-to-bite texture, while the 15% treatment resulted in a harder texture than other treatments, shown when bitten and chewed.

The addition of red tilapia bone flour by 10% could increase the preference of stick snacks. But, further addition such as the 15% treatment, will reduce the preference of stick snacks. This is caused by the gluten reduction due to the high content of calcium and phosphorus, thus the structure of the dough built by the gluten is less compact, which in turn causes the texture to harden. (Rochima et al. 2015). Though the 15% treatment reduces the stick snack preference because of its less crunchy texture, all of the treatments is still accepted by the panelists.

Taste

Taste is a parameter that is assessed using the taste sense (tongue). Taste is an important factor to determine whether a product is accepted or not by the consumer. Consumer's preference for the taste of a product is also determined by an interest in the color and aroma of said product. The odor captured by the nasal olfactory cells, and the color captured by the eye can stimulate the taste buds and tongue (Winarno 1997). The taste results are shown in Table 4.

Table 4. The Stick Snacks Taste Mean in Each Treatment

Red Tilapia Bone Flour (%)	Median	Taste Mean
0	7	7,3a
5	7	7,4a
10	7	7,7a
15	5	5,5a

Explanation : The mean followed by the same letter (a) showed that there are no significant differences according to the multiple comparison test at 95% confidence interval.

Based on the results above, all of the treatment was still accepted by the panelists, with the median ranging between 5 to 7 which were in the "neither liked or disliked to liked" category. The 10% treatment has the highest mean with a value of 7.7, and the 15% treatment has the lowest mean with a value of 5.5.

The results showed that the red tilapia bone flour fortification on stick snacks affected the preference level of taste parameter. The 0%, 5%, 10% treatment did not significantly affect in between the treatments. But, the 15% treatment is significantly different from the other treatments. The 10% treatment is the most liked treatment by panelists because the treatment does not have a strong fish bone flour taste but still manage to have a savory taste that is typical of stick snacks. While the 15% treatment has a lower typical taste of stick snacks because the fishbone taste strenghtens, and tasted chalkier. This confirms Ngudiharjo (2011) study that showed the fortification of red tilapia bone flour gives fish flavor to dried noodle which in turn creates a new flavor of dried noodle products.

The 10% red tilapia bone flour could increase the preference for the stick snack. But, further addition, such as the 15% treatment, will reduce the preference. The high calcium and phosphorus content from the fish bone flour resulted in the after taste, i.e. the chalky taste. Therefore, further addition of the fishbone flour would resulted in the increase of the chalkier after taste (Kaya 2008). Despite of this, the flour fortification of stick snacks is still generally accepted by the panelists.

Decision making by bayes method

The calculation results in determining the best treatment using the Bayes method by considering the appearance, aroma, texture and taste criteria of red tilapia bone flour sticks snacks are shown in Table 5.

Table 5. Decision Matrix of Red Tilapia Bone Flour Stick Snacks Assessment with Bayes Method

Treatment (%)	Criteria				Alternative Value	Priority Value
	Appearance	Aroma	Texture	Taste		
0	7	7	7	7	7,07	0,26
5	7	7	7	7	7,07	0,26
10	7	7	8	7	7,29	0,27
15	7	7	5	5	5,53	0,21
Criteria Value	0,14	0,10	0,22	0,55	26,96	1,00

Based on Table 5, the highest number of criteria values is obtained in the taste parameter of 0.55, that means, taste parameter is the most important assessment or as a main consideration according to the panelists in choosing red tilapia bone flour stick snacks product. Based on the calculation of the bayes method, the results showed that stick snacks with the treatment of 10% red tilapia bone flour fortification was the most liked treatment by panelists compared to other treatments based on hedonic test because it had the highest alternative value and priority value was 7.29 and 0.270.27. Nevertheless, stick snacks with red tilapia bone flour fortification up to 15% treatment were still accepted by panelists.

Water Content

The control treatment water content is 4% whilst the most liked treatment, which is the 10% treatment, has a 2.5% water content. Both treatments fulfilled the quality requirements by SNI 01-2973-1992, which states that the water level should not exceed 5%.

The 10% treatment has a lower water level when compared to the control treatment. This is caused by the red tilapia bone flour capability of absorbing water in the dough. The calcium inside the flour naturally binds water, thus by adding more red tilapia bone flour, the independent water inside the snack will decrease. According to Linder (1992) in Syadeto (2017), this is caused by the addition of fish bone flour which signifies an addition of Ca^{++} particles that will bind OH^{-} particles which are a part of H_2O or water components which will reduce the water level.

This result confirms Hindasah (2015) study that showed the water absorption by fish bone flour could interfere with the absorption by starch due to the lower water resources. According to Pratama et al. (2014), the biscuit water level decreases along with the addition of fish bone flour.

Calcium Content

The control treatment calcium content is 0.21% whilst the 10% treatment is 0.36%, which means that the addition of red tilapia bone flour could increase the calcium level in stick snacks.

According to Widyakarya Pangan dan Gizi LIPI (2004) in Syadeto (2017), the average adult needs 800 mg to 1000 mg calcium per day. Therefore, in order to fulfill the calcium requirements, consuming 222.22 g to 277.77 g of stick snacks with fortified red tilapia bone flour per day could help to fulfill said needs.

Conclusion

Based on the results of the research, it can be concluded that the red tilapia bone flour fortification treatments is still accepted by panelists, with the most liked treatment is the 10% treatment, which has a preference level on appearance, aroma, and taste of 7 and 8 for texture. From the chemical test analysis, the the 10% treatment has a water content of 2.5% whilst the 0% (control) has a water level of 4%. As for the calcium content, the 10% treatment has a level of 0.36% whilst the control has a level of 0.21%.

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