Global Scientific JOURNALS

GSJ: Volume 8, Issue 4, April 2020, Online: ISSN 2320-9186
www.globalscientificjournal.com

MILKFISH BONE FLOUR FORTIFICATION AS A SOURCE OF CALCIUM ON DONUT PREFERENCE LEVEL

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Keywords
Donuts, fortification, milkfish bone flour, preference level

ABSTRACT

This research aims to determine the appropriate percentage of the addition of milkfish bone flour as a source of calcium to the donuts. The method used in this study was experimental with four fortified milkfish bone flour fortifications, namely treatment A (control), treatment B (2.5%), treatment C (5%), and treatment D (7.5%). The parameters observed consisted of chemical tests (calcium levels), physical tests (yield of milk bone meal, a yield of donuts, volume expanding donut), and hedonic tests (appearance, aroma, texture, taste). The results showed that milkfish bone flour fortification of 2.5% was the most preferred treatment. Based on the physical test of milkfish bone flour yield obtained is 39.85%, the expanding of donuts in the treatment of 2.5% respectively 50%, based on the chemical test donuts in the treatment of 2.5% have calcium levels 0.152%, based on the hedonic test obtained an average value of appearance 6.5, aroma 6.8, texture 7.0, and taste 8.2, and based on the Bayes test results obtained that the donuts with the addition of 2.5% milkfish bone flour obtained the highest alternative value of 8.13 and the most important criterion in the panelists' final decision in choosing donuts was the flavor with a weighting criteria of 0.566.

INTRODUCTION

Calcium is one type of mineral needed by the body to support growth, health, and strength of bones and teeth. Adequate calcium intake is very important to achieve optimal peak bone mass (Optimal Peak Bone Mass) and reduce the risk of fractures due to increasing age (Kalkwarf et al. 2003). The average calcium intake of Indonesian people is still relatively low, namely less than 300 mg/person/day, while the recommended one is 1000-1200 mg/person/day.
The milkfish (Chanos chanos Forskal) is one of the most popular fish that can be processed into presto milkfish, milkfish thorns, soft thorns, milkfish, milkfish nuggets, and others. Pamijiati (2009) states that milkfish are favored by most Indonesian people because they have high nutritional content and complete protein and are important for the body, but milkfish have a large number of fine thorns in the body.

The rest of the milkfish bone waste or waste in the processing of the milkfish extract can be used as raw material for the production of bone meal. According to Adawiyah and Selviastuti (2014), milkfish bone waste produced from several home industries of milkfish extracted in thorns in the city of Semarang reaches 15 kg/day or 5.4 tons/year. Milkfish bone waste can be used as an alternative source of calcium and phosphorus to provide a nutrient-rich food source. This is because the nutritional content of milkfish is not only in meat but also in the bones. Milkfish bones contain 4% calcium, 3% phosphorus and 32% protein (Sudoyo 2009). This allows the potential for milkfish as an alternative foodstuff that can be processed into milk bone flour and can be added to food products such as donuts.

Donuts are one type of bakery product made from wheat flour and have a texture like bread but have a frying process (Putri and Murtini 2017). Donuts are one of the foods that are very popular with the community and are very popular among all groups of children, adolescents, and adults because of their delicious taste and affordable prices.
Fortification is the addition of micro substances into certain foods to increase nutritional value. One of the addition of micro substances to food is calcium which is found in milkfish flour which is added to the material for making donuts. The addition of milkfish flour to the making of donuts as a source of calcium causes an influence on consumer acceptance such as appearance, aroma, texture, and taste.

MATERIALS AND METHODS

The study was conducted in November 2019 to January 2020. Making milkfish flour, making donuts, milk yield, and milk donation yield test, test expands the volume of donuts, hedonic test was carried out at the Laboratory of Fisheries Product Processing, Faculty of Fisheries and Marine Sciences, Padjadjaran University, and testing Calcium levels were carried out at the Laboratory of Agricultural Industrial Technology Service Test Laboratory, Padjadjaran University.

The tools used in making milkfish flour and donuts are gas stoves, digital scales with an accuracy of 0.001 grams, pans, cutting boards, and knives, plates or containers, presto, oven, blender, 100 mesh tyler sifter, measuring cup, basin, stopwatch, spoon, rolling pins, donut molds, non-stick pans, chopsticks, filters, plastic plates. The ingredients used in making milkfish flour and donuts are milkfish bone, milk bone flour, flour, margarine, milk powder, yeast, eggs, sugar, salt, water, cooking oil.

The method used is an experimental method that is making donuts with various additions to milkfish bone meal. The calculation method used is Friedman's non-parametric statistical method using four treatments with 20 semi-trained panelists as a test and continued with the Bayes test. The treatment of the addition of milk bone flour based on the weight of wheat flour used was: A (0%), B (2.5%), C (5%), and D (7.5%). Observations were carried out on the yield test (milk bone meal and donuts), physical tests namely the expanding donut volume, hedonic tests

(appearance, texture, aroma, and taste), and chemical tests namely calcium content.

RESULTS AND DISCUSSION

Milk Bone Flour Yield

Yield is the percentage ratio between the weight of the material that can be utilized (milk bone meal) and the total weight of the material (milk bone) (Nurfitriani 2018). The yield of milkfish flour is presented in Table 1.

Table 1. Milkfish Flour Yield

Milkfish	Wet bones	Bone meal
4.200 g	271 g	108 g
Yield (%)	2,71	39,85

Based on the results of milkfish meal yield, the initial weight of milkfish in the study was 271 grams, after the process of flouring was obtained as much as 108 grams of milkfish flour so that the milk fish meal yield was 39.85%. Based on the yield of Salitus research results (2017), the yield of milkfish flour produced is 38.57% and based on the yield of Nurfitriani's research (2018), the yield of red tilapia flour produced is 31.99%. The yield value does not differ much because the fish bones used are the bones of the same type of fish, namely milkfish and bones from red tilapia which are freshwater fish. The yield value produced can also be influenced by the sifting and drying process. According to Bakhtiar et al. (2019), the process of milkfish bone flour sifting and drying had an impact on the yield value of the milkfish flour produced.

Yield of Donuts

The yield of a donut is the percentage ratio between the weight of the dough and the weight of the donut. The yield of donuts is presented in Table 2.

Table 2. Yield of Donuts

Milkfish Bone Fortification (%)	Dough (g)	Donuts (g)	Yield of Donuts (%)
0	954	1025	107,44
2,5	967	1038	107,34
5	991	1062	107,16
7,5	1029	1101	106,99

The highest yield of donuts in the control treatment is 107.44% and the lowest in the treatment of adding 7.5% banding of milkfish is 106.99%. The yield of donuts decreases with the addition of milk bone flour which is added to the dough. This is due to the addition of a fishbone meal resulting in a decrease in water content because a bone meal is absorbing water so the divider for water content increases (Nurfitriani 2018). The yield value is also influenced by the amount of water that evaporates due to the frying process, thereby reducing the weight of the final product (Saputra 2008).

Volume Expanding Donut

Volume expanding donut is measured based on the percentage difference in the volume of donuts after frying and before frying. The results of observations of the average expanding donut volume are presented in Table 3.

Table 3. Average Expand Donut Volume

Milkfish Bone Fortification (%)	Volume A (ml)	Volume B (ml)	Expanding Volume (ml)
0	500	450	50
2,5	500	450	50
5	500	460	40
7,5	500	460	40

Based on the results of testing expands the volume donut, it is known that the highest expands the volume donut with milk bone fortification is 0% and 2.5% by 50 ml and the lowest level of expanding in milk bone fortification is 5% and 7.5% treatment by 40 ml. The treatment of milk bone fortification of 0%, 2.5%, 5%, and 7.5% which has a better expand rate of 2.5%. The 2.5% treatment has a good expand donut because of the addition of bone meal so that it does not cause donuts, while the 5% and 7.5% treatments have a expand volume donut that is lower than the 2.5% treatment due to the increasing bone meal so that it causes a little donut. The expand value tends to decrease with the increase in the amount of milkfish flour added. Decrease in the level of expanding volume donut due to particles or compounds contained in fishbone flour bind particles from wheat flour, so that when frying gluten cannot form a strong network to hold water vapor out of the dough, resulting in smaller or lower product expand power (De Man in Wardani 2012).

Appearance

Appearance is the first characteristic that is valued by consumers of a product in view using the sense of sight. The average hedonic test on appearance is presented in Table 4.

Table 4. Average Hedonic Test Appearance

Milkfish Bone Fortification (%)	Median	Average Appearance
0	7	6,5a
2,5	7	6,5a
5	7	7,1a
7,5	6	6,2a

Note: the average followed by the same letter shows no difference real according to the comparative test of 5%

Based on statistical tests on all treatments that milkfish bone fortification did not significantly affect the appearance of donuts. The appearance of donuts with 0% and 2.5% milk-white bone fortification is brownish-white due to the addition of a small amount of milk bone flour so that it is liked by panelists. Donuts with 5% milkfish flour fortification have the highest average appearance which is 7.1 so that it is most preferred by panelists because the brownish-yellow appearance resulting from the addition of milkfish flour is increased compared to the previous treatment. The appearance of donuts with 7.5% milkfish bone fortification is darker than the 5% treatment due to the addition of more milkfish flour than the previous treatment. The darker surface color of donuts in each treatment is influenced by the addition of brown milk bone flour with an increasing amount. The brown donut surface appearance is also caused by the Maillard reaction, which is a non-enzymatic reaction that is closely related to the reactions that occur from proteins and carbohydrate components, especially sugar derivation (Sun et al. 2006). Besides, the color of a product is also determined by the constituent materials (Marta'ati and Handajani 2015).

Aroma

The aroma is produced from volatile compounds found in the ingredients (Suprapto et al. 2012). The aroma of smell is very important in the food industry because it can quickly provide an assessment of the product you like or not. The average hedonic aroma test is presented in Table

5.

Table 5. Average Aroma Hedonic Test

Milkfish Bone Fortification (%)	Median	Average Aroma
0	7	6,6ab
2,5	7	6,8b
5	5	6,4a
7,5	5	5,6a

Note: the average followed by the same letter shows no difference real according to the comparative test of 5%

Based on statistical tests that milkfish bone fortification significantly affected the aroma of donuts. That is because milkfish flour has a distinctive fish aroma. Following the statement Darmawangsyah et al. (2016), the characteristic aroma of milkfish is that it smells of mud and soil attached to the bone meal of milkfish. The fortification of milkfish flour to the flavor of donuts at 2.5% treatment was significantly different from the treatment of 5% and 7.5%. Donuts with 2.5% milkfish flour fortification treatment have the highest average aroma value of 6.8 so that it is most preferred by panelists because it has a distinctive aroma of fish that is not too strong and still smells typical of donuts. Donuts with 5% milkfish flour fortification treatment and 7.5% decreased their favorite level, which is neutral/ordinary because it has a strong fish's distinctive aroma caused by the addition of increasing milk bone meal. This is consistent with the statement of Asikin et al. (2016), the higher the level of addition of fish bone meal, the lower the level of panelist preference for the aroma produced. The scent of a donut can also be determined by certain components that cause a characteristic odor, such as the type of material used, the frying medium (use of shortening), and the frying time (Suprapto et al. 2012).

Texture

The texture (Table 6) is one of the factors that determine the level of panelists' preference for food products. The texture is known through the human sense of touch (Ashari et al. 2016).

Table 6. Average Texture Hedonic Test

Milkfish Bone Fortification (%)	Median	Average Texture
0	7	6,5a
2,5	7	7,0a
5	7	6,6a
7,5	7	7,6a

Note: the average followed by the same letter shows no difference real according to the comparative test of 5%

Based on statistical tests that milkfish bone fortification does not significantly affect donut texture. The texture of donuts with 7.5% milkfish bone fortification is still preferred or acceptable to panelists because it has the highest average value of 7.6. This is due to the amount of milkfish flour which is added to the 7.5% treatment, so it has a slightly rough and dry texture. The texture of the donuts tends to dry out more with increasing bone milk flour. This is because the texture of the donut is influenced by the amount of water, in making the donut dough it must be in the proportion of flour with additional ingredients of balanced milk bone flour. The same amount of water for each different concentration of bone meal results in a different level of violence (Salitus et al. 2017). Donuts with the addition of milk bone flour treatment of 0%, 2.5%, 5%, and 7.5% have an increasingly different texture but the texture of the donut is still preferred because it is seen from the median value of 7 which means like. These results are by the study (Wardani et al. 2012), based on the hedonic test (preference) for the texture of the fortification of tuna bone flour fortification 0%, 2.5%, 5%, and 7.5%, tend to be liked by panelists, where the texture is not too dense and still soft.

Taste

Taste is the most recent consideration factor for consumers in choosing food products (Bakhtiar et al. 2019). Panelist acceptance of a product is strongly influenced by the characteristics of taste, although other parameters are good if you have a taste that is not liked then the product will be rejected. The average hedonic test on the aroma is presented in Table 7.

Table 7. Average Hedonic Taste Test

Milkfish Bone Fortification (%)	Median	Average Taste
0	7	7,1ab
2,5	9	8,2b
5	7	6,6a
7,5	5	5,9a

Note: the average followed by the same letter shows no difference real according to the comparative test of 5%

Based on statistical tests that milkfish bone fortification significantly affected donut taste. That is because milkfish flour has a distinctive fish flavor. By the statement Darmawangsyah et al. (2016), the characteristic aroma of milkfish is that it smells of mud and soil attached to the bone meal of milkfish. Fortification of milkfish flour to the taste of donuts at 2.5% treatment was significantly different from the treatment of 5% and 7.5%. Donuts with 2.5% milkfish flour fortification treatment have the highest average flavor value of 8.2 so it is very preferred by panelists because it has a distinctive donut taste with a fishy flavor that is not too strong. The addition of milkfish flour in the treatment of 2.5% has not greatly influenced the taste of donuts because of the addition of a small amount of milkfish flour so that the distinctive taste of fish has not been too strong. Donuts with 7.5% milkfish flour fortification treatment with the lowest average value of 5.9 has a very strong taste of donuts with fish flavor due to the addition of increased milk bone flour which decreases the level of panelists' preference for donuts. This is by the statement (Bunta et al. 2013), where the more concentration of fishbone flour is added, the special taste of fishbone flour is increasingly felt so that the panelists' level of preference is decreased

Decision Making Using the Bayes Method

Decision making on the relative weight value of the criteria for appearance, aroma, texture, and taste of donuts is done by pairwise comparison. The matrix of valuation decisions using the Bayes method is presented in Table 8.

Table 8. Decision Making by Bayes Method

Milkfish Bone Fortification (%)	Median Value				Alternative Value
	Appearance	Aroma	Texture	Taste	
0	7	7	7	7	7
2.5	7	7	7	9	8.13
5	7	5	7	7	5.71
7.5	6	5	7	5	5.44
	0.141	0.144	0.148	0.566	

Data from the assessment using the Bayes method showed that taste was the most important criterion in the panelists' final decision in choosing donuts with a weight of 0.566, followed by texture with a weight of 0.148, aroma with a weight of 0.144 and appearance with a weight of 0.142. This shows the taste criteria are the main consideration in choosing a donut product. Taste assessment characteristics are very influential in the final decision of consumers to accept

and reject a product even though the other characteristics are good (Wardani et al. 2012).

Based on the calculation by the Bayes method, the results obtained that the donuts with the addition of milkfish flour all treatments are still accepted or preferred by the panelists, but the 2.5% treatment gets a higher alternative value of 8.13 (preferred), then the 0% treatment gets an alternative value of 7 preferred), 5% treatment obtains an alternative value of 5.71 (neutral/ordinary), and 7.5% treatment obtains an alternative value of 5.44 (neutral/ordinary). Based on all parameters observed, the addition of 2.5% milkfish flour was preferred by panelists compared to other treatments

Calcium Donut Levels

The calcium content in the sample comes from the calcium contained in milk bone meal and milk. Calcium is the mineral most needed in the growth of bones and teeth (Asni in Nurfitriani 2018). The donuts tested in the study (Table 9) were donuts without milkfish bone fortification treatment (0%) and donuts that were most favored by panelists, namely by treatment of milkfish flour as much as 2.5%.

Table 9. Content of Calcium Donuts Fortification of Milkfish Flour

Milkfish Bone Fortification (%)	Calcium Content (%)
0	0.018
2.5	0.152

Based on the results of the test calcium levels of the addition of 0% milkfish flour containing 0.018% calcium while in the treatment of adding 2.5% milkfish flour contains 0.152% calcium. The addition of milkfish flour to donuts can increase the calcium content of donuts because the calcium content found in milk bone flour is mixed in the donut mixture. The higher the concentration of added milkfish flour the higher the calcium content produced (Salitus et al. 2017). The greater calcium content of donuts with the addition of milkfish flour is an advantage of the donut itself.

Overall Results of Donut Observation

The overall results of research conducted on the yield test (milk bone meal and donuts), the hedonic test (appearance, aroma, texture, and taste), physical test (expand) are presented in Table 10.

Table 10. Overall Results of Donut Observation

Observation	Average of Bonefish Flour Fortification			
	0%	**2.5%**	**5%**	**7.5%**
Appearance	6.5a	6.5a	**7.1a**	6.2a
Aroma	6,6ab	**6.8b**	6.4a	5.6a
Texture	6.5a	7.0a	6.6a	**7.6a**
Taste	7.1ab	**8.2b**	6.6a	5.9a
Alternative Value	7.0	**8.13**	6.71	5.44
Yield (%)	107.44	107.34	107.16	106.99
Expand (ml)	50	50	40	40
Calcium content (%)	0.018	0.152	-	-

Preference test results (hedonic) based on the parameters of appearance, aroma, texture, and taste of donuts with the addition of milk bone flour up to 7.5% are still accepted and preferred by panelists. Based on the Bayes test, the alternative value of the panelist preference level was the biggest value, which was 8.13 in the addition of milk bone flour by 2.5%. Based on the calculation of the yield of donuts given the addition of bone milk flour, the yield decreases from 0% to 7.5%. Physical test results for the expand of donuts given the addition of bone milk flour

decreased from 0% to 7.5% treatment. Based on the results of the calcium test on the treatment of adding 2.5% of milkfish flour has a higher calcium content compared to 0% treatment.

CONCLUSION

The results of the study based on the yield of milkfish flour obtained from the process of flouring was 39.85%, based on the panelist preference test on the appearance, aroma, texture, and taste of the donuts with the addition of milkfish flour treatment of all treatments is still preferred, the treatment of adding milk bone flour 2 5% is preferred compared to other treatments, based on the hedonic test the treatment of 2.5% has an average value of appearance 6.5, aroma 6.8, texture 7.0, and taste 8.2 while based on the Bayes test treatment 2.5% had an alternative value of 8.13 with a calcium content of 0.152%, a expand rate of 50 ml, and a yield of 107.34%.

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