The Effect of Addition of Nilem Fish Protein Concentrate Flour on the Proximate Characteristics of Mochi Cake

Junianto[1], Kintan Prameswari Finef[1*], Izza Mahdiana Apriliani[1] and Iis Rostini[1]

[1]*Department of Fisheries, Faculty of Fisheries and Marine Science, Padjadjaran University, Sumedang Regency, West Java, Indonesia.*

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Original Research Article

ABSTRACT

Nilem fish (*Osteochilus hasselti*) is a type of freshwater fish that is widely farmed in West Java. Another application of nilem fish is made into fish protein concentrate (FPC) flour. The addition of fish protein concentrate flour to the mochi cake can affect the proximate characteristics. This study aims to determine the proximate characteristics of mochi cake added by nilem fish protein concentrate flour. This research was conducted from August 2019 - January 2020 at the Laboratory of Fisheries Product Processing, Faculty of Fisheries and Marine Sciences, and the Chemical Research and Services Laboratory, Basic Science Service Center (PPBS), Padjadjaran University. The method used in this research was experimental with two treatments, that were the addition of 0% and 4.5% nilem fish protein concentrates from white glutinous rice flour was used. The parameters observed were proximate characteristics including carbohydrate, water, protein, fat, and ash content. The results showed that mochi cake with the addition of 4.5% of nilem fish protein concentrate had proximate characteristics namely carbohydrate content 59.57%, water content 29.93%, protein content 8.71%, fat content 1.41%, and ash content 0.38%.

Corresponding author: Email: kfinef@gmail.com;

1. INTRODUCTION

Consumed fish is one kind of a food consumed by people as a source of animal protein, one example is nilem fish. Nilem fish (*Osteochilus hasselti*) is a type of freshwater fish that is widely farmed in West Java [1]. People, in general, consume nilem fish in the form of fried, jerked, smoked, and pindang. Less diverse serving form of nilem fish can make consumers bored. Nilem fish also have many fishbones that make consumers choose not to consume them. Another form of nilem fish is made into fish protein concentrate (FPC) flour.

The water and fat are removed on the process of making fish protein concentrate, that is why FPC has a high protein concentration [2]. The application of fish protein concentrate is very large because it is made in the flour form. Fish protein concentrate flour can be applied to a variety of processed foods, especially low-protein food products [3]. Less content of water and fat on fish protein concentrate flour makes it as has a long shelf life. Utilization of fish protein concentrate flour in food can attract public interest because it has a high protein content. Increasing the nutritional value of food products can be done by fortification of food ingredients, such as fortification of proteins, vitamins, and minerals [4].

Mochi cake is one of the cake type originating from East Asia, especially China and Japan [5]. Mochi cake is a type of semi-wet cake that has a sweet taste and chewy texture due to the gelatinization process from raw materials [6]. Mochi cake is developed as one of the typical foods from Sukabumi, Indonesia. Various variants of mochi cake can be made such as dough, filling, and flavors. The basic ingredient used in making mochi cakes is glutinous rice flour so the carbohydrate content is high, which is around 75% but the protein content is low. Enrichment of animal protein in mochi cakes can be done by adding fish protein concentrate flour to making the dough. The addition of fish protein concentrate flour to the mochi cake can affect the proximate characteristics. Proximate characteristics test on food done to analyze or figure out the nutrition components on it. Not much research on mochi cake and nilem fish protein concentrate flour has been conducted till date. Based on this, it is necessary to research the effect of adding nilem fish protein concentrate flour to the proximate characteristics of Mochi cake.

2. MATERIALS AND METHODS

2.1 Time and Place

This research was conducted from August 2019 - January 2020 at the Laboratory of Fisheries Product Processing, Faculty of Fisheries and Marine Sciences, and the Chemical Research and Services Laboratory, Basic Science Service Center (PPBS), Padjadjaran University.

2.2 Materials and Tools

The tools used in this research were steaming pots, teflon, 10 and 50 ml measuring cups, calico cloth, jars, sieves, thermometers, digital scales, food processors, blenders, stainless steel bowl, ovens, and gas stoves. The materials used in this research were nilem fish size 150-250 g tail^{-1} from Majalaya, NaCl, N-Hexane solvent, water, Sodium bicarbonate ($NaHCO_3$), white glutinous rice flour, white sugar, peanuts, and tapioca flour.

2.3 Procedure of Making Mochi Cake

The procedure of making mochi cakes refer to Lungga et al. (2016) [5] which was modified by adding of nilem fish protein concentrate. The first step is making nilem fish protein concentrate flour. The second step is making mochi cake dough. White glutinous rice flour and white sugar are mixed on stainless steel bowl. Nilem fish protein concentrate flour is added according to treatment. All materials are mixed with water little by little to prevent clot until the mixture is homogeneous. The steaming pots are heated until the water is boiling (100°C), then the mixture is steamed for 10 minutes. The mixture is taken away and stirred for 1-2 minutes, then steamed again for 20 minutes until cooked. Dough that has been cooked is put on a base that has been sprinkled with roasted tapioca flour and then flattened and cooled at room temperature. The third step is making mochi cake filling. Roast the peanuts and removed the seed coat, then refined with a blender. Peanuts that have been refined, mixed with sugar and then add water so that become denser. The last step is the mochi cake forming. Mochi cake dough is cut and filling put into the dough. Mochi

cake is formed into a round shape and coated with roasted tapioca flour. The formulation of mochi cake [5] with the addition of nilem fish protein concentrate flour is shown in Table 1.

2.4 Research Method

The method used in this research is experimental with two treatments. The treatments in this research are: 1) Treatment A: 0% addition of nilem FPC and 2) Treatment B: 4.5% addition of nilem FPC, from the white glutinous rice flour used. Proximate characteristics analyzed in this study are carbohydrate content using by difference method [7], water content using gravimetric method [8], protein content using Kjeldahl method [9], fat content using soxhlet method [10], and ash content using gravimetric method [11]. Proximate characteristics were analyzed at Chemical Research and Services Laboratory, Basic Science Service Center (PPBS), Padjadjaran University.

2.5 Data Analysis

Data from the testing of the proximate characteristics were analyzed descriptive-comparative. Descriptive analysis is generally carried out to systematically describe the facts and characteristics of the object or subject that being studied appropriately. Comparative analysis is compared one or more variables in two or more different samples, or at different times [12].

3. RESULTS AND DISCUSSION

3.1 Carbohydrate Content of Mochi Cake

Carbohydrates are a component of food which are the main source of energy and dietary fiber that affects the body's physiological processes. Carbohydrates have important functional properties in food processing and play a role in determining the rheological characteristics of various types of food ingredients or products [7]. The results of the mochi cake carbohydrate test are shown in Table 2.

Test results on mochi cake showed that the carbohydrate content in treatment B, which is mochi cake with the 4.5% addition of nilem fish protein concentrate, has carbohydrate content 59.57%, that percentage lower compared to treatment A (without the addition of nilem fish protein concentrate) with carbohydrates content 60.20%. Carbohydrate content in mochi cake is high and more than 50% because the main ingredient is glutinous rice flour [13,14]. Carbohydrate by difference method depends on the deduction factor like water, protein, fat, and ash content. High or low carbohydrate content of a product depends on the proportion of the nutritional content of the product. The lower the water, protein, fat, and ash content, make the carbohydrate content higher, and vice versa [15]. Based on this, the addition of fish protein concentrate flour can produce mochi cake with lower carbohydrate content because the protein and ashes content are increasing.

3.2 Water Content of Mochi Cake

Water content has an important role in determining the durability of food because it can affect physical properties, chemical, microbiological and enzymatic changes [16]. The lower the water content of a product, the higher the durability of a product. The results of mochi cake water content test are shown in Table 3.

Test results on mochi cake showed that the water content in treatment B, which is mochi cake with the 4.5% addition of nilem fish protein concentrate, has water content 29.93%, that

Table 1. The formulation of mochi cake with addition of nilem fish protein concentrate flour

Ingredients	A (0%)	B (4.5%)
Mochi Cake Dough		
White glutinous rice flour (g)	100	100
White sugar (g)	60	60
Water (ml)	100	100
Nilem fish protein concentrate flour (g)	0	4.5
Mochi Cake Filling		
Peanuts (g)	50	50
White Sugar (g)	20	20
Water (ml)	5	5

percentage lower compared to treatment A (without the addition of the nilem fish protein concentrate) with water content 33.70%. Glutinous rice starch has a high amylopectin content. Amylopectin has characteristics that are difficult to absorb water but when the water has been absorbed, water will be trapped and difficult to release [17].

Table 2. Carbohydrate content in mochi cake with nilem FPC

Treatment	Carbohydrate content (%)
A (0%)	60.20
B (4.5%)	59.57

Table 3. Water content in mochi cake with nilem FPC

Treatment	Water content (%)
A (0%)	33.70
B (4.5%)	29.93

The test results above are different from the research of Andriaryanto et al. (2015) [13], where water content increased with the addition of snakehead fish protein concentrate flour to mochi (M0 = 31.20%; M1 = 33.84%; M2 = 37.62%) because an increase of adding snakehead fish protein concentrate flour, more water is added in ingredients. However, the results of this research showed that the treatment B mochi cake had lower water content compared to treatment A because the fish protein concentrate amount was higher while the other ingredients were the same. The higher protein content also results in the water content of the treatment B mochi cake being lower because the high protein can bind the water in the foodstuff caused by the presence of hydrophilic and charged particles [18].

3.3 Protein Content of Mochi Cake

Protein is the main source of nutrition as a source of amino acids [19]. The results of mochi cake protein content test are shown in Table 4.

Table 4. Protein content in mochi cake with nilem FPC

Treatment	Protein content (%)
A (0%)	4.40
B (4.5%)	8.71

Test results on mochi cake showed that the protein content in treatment B, which is mochi cake with the 4.5% addition of nilem fish protein concentrate, has protein content 8.71%, that percentage higher compared to treatment A (without the addition of nilem fish protein concentrate) with protein content 4.40%. High or low measured protein values in a product can be influenced by the amount of water content lost from the material [20]. The measured protein content will be higher if the amount of water lost is greater [21]. High protein can bind water in food [18]. This can indicate that the protein content of mochi cake treatment B is higher than treatment A due to the addition of nilem fish protein concentrate flour and lower water content. Nilem fish protein concentrate flour also has high protein content because in the process the water and fat are removed, where the protein content is 93.77%. These results are the same as those of Andriaryanto et al. (2015) [13], where the addition of snakehead fish protein concentrate flour had an effect on the value of mochi protein content which increased along with the increase of snakehead fish protein concentrate.

3.4 Fat Content of Mochi Cake

Fat is one of the main nutritional components as an energy contributor for the body. Fat also has important functional properties in the food industry such as heat transfer when frying, softening products, build-up, and increasing product palatability [7]. The results of mochi cake fat content test are shown in Table 5.

Table 5. Fat content in mochi cake with nilem FPC

Treatment	Fat content (%)
A (0%)	1.58
B (4.5%)	1.41

Test results on mochi cake showed that the fat content in treatment B, which is mochi cake with the 4.5% addition of nilem fish protein concentrate, has fat content 1.41%, this percentage lower compared to treatment A (without the addition of nilem fish protein concentrate) with fat content 1.58%. The fat content decreases because the protein concentrate of nilem FPC flour used has a small fat content, which is 0.42%, while it has much protein content. Fish protein concentrate produced more amount of protein than its initial condition because it is concentrated [22]. The results of testing the fat content in each mochi cake did not much different.

3.5 Ash Content of Mochi Cake

Information on ash and mineral content in food is very important to evaluate the nutritional value of a food and to get minerals that are needed by the body [7]. The results of mochi cake ash content test are shown in Table 6.

Table 6. Ash content in mochi cake with nilem FPC

Treatment	Ash content (%)
A (0%)	0.20
B (4.5%)	0.38

Test results on mochi cake showed that ash content in treatment B, which is mochi cake with the 4.5% addition of nilem fish protein concentrate, has ash content 0.38%, this percentage higher compared to treatment A (without the addition of nilem fish protein concentrate) with ash content 0.20%. Nilem fish protein concentrate flour has mineral content, where the test results on the ash content test is 4.73%, so the addition of nilem fish protein concentrate flour will increase ash content in mochi cake. These results are the same as those of Andriaryanto et al. (2015) [13], where an increase in ash content along with increasing fish protein concentrate flour, i.e. mochi with the 0% addition of snakehead fish protein concentrate has 0.40% ash content and the treatment 4.5% has 0.98% ash content.

4. CONCLUSION

The results showed that carbohydrate content, water content and, fat content in mochi cake with 0% treatment were higher than 4.5% treatment, whereas protein content and ash content of mochi cake with 0% treatment was lower than 4.5% treatment, so the addition of nilem fish protein concentrate flour to mochi cake can increase protein content and ash content. Proximate characteristics of mochi cake by adding 4.5% nilem fish protein concentrate showed 59.57% carbohydrate content, 29.93% water content, 8.71% protein content, 1.41% fat content, and 0.38% ash content.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Tarigan N, Supriatna I, Setiadi MA, Affandi R. The effect of vitamin E supplement in the diet on gonad maturation of nilem (*Osteochilus hasselti*, CV). Jurnal Perikanan UGM. 2017;19(1):1-9.
2. Romadhoni AR, Afrianto E, Pratama RI, Grandiosa R. Extraction of snakehead fish [*Ophiocephalus striatus* (Bloch, 1793)] into fish protein concentrate as albumin source using various solvent. Aquatic Procedia. 2016;7:4-11.
3. Rieuwpassa FJ, Santoso J, Trilaksani W. Characterization of functional properties of fish protein concentrate of skipjack roe (*Katsuwonus pelamis*). Jurnal Ilmu dan Teknologi Kelautan Tropis. 2013;5(2):299-310.
4. Purwandani L, Indrastuti E, Ramadhia M. Fortifikasi tepung ikan lele (*Clarias gariepinus*) pada pembuatan snack dari pati jagung (*Zea mays*). Vokasi. Indonesian. 2013;9(2):175-179.
5. Lungga A, Karyatina M, Kurniawati L. Characteristics of mochi cake with red guava leaf extract (*Psidium guajava*) and ginger (*Zingiber officinale*). Jurnal Ilmiah Teknologi dan Industri Pangan UNISRI. 2016;1(1):29-34.
6. Sagala H, Ilza M, Sari I. The effect of spirulina sp flour fortification on the sensory-chemical characters of mochicake. Jurnal Online Mahasiswa UNRI. 2017;4(2):1-12.
7. Andarwulan N, Kusnandar F, Herawati D. Food analysis. Jakarta: Dian Rakyat; 2011.
8. [BSN] Badan Standarisasi Nasional. SNI 2354.2-2015, Cara uji kimia – Bagian 2: Pengujian Kadar air pada produk perikanan. Jakarta Indonesian; 2015.
    Accessed 4 December 2019.
    Available:http://sispk.bsn.go.id/SNI/Detail SNI / 10154
9. [BSN] Badan Standarisasi Nasional. SNI 01-2354.4-2006, Cara uji kimia – Bagian 4: Penentuan Kadar protein dengan metode total nitrogen pada produk perikanan. Jakarta. Indonesian; 2006
    Accessed 4 December 2019.
    Available:http://sispk.bsn.go.id/SNI/DetailS NI/7114
10. [BSN] Badan standarisasi nasional. SNI 01-2354.3-2017, Cara uji kimia – Bagian 3: Penentuan Kadar lemak total pada produk perikanan. Jakarta. Indonesian; 2017.

Accessed 4 December 2019.
Available:http://sispk.bsn.go.en/SNI/Detail SNI / 11103

11. [BSN] Badan Standarisasi Nasional. SNI 2354.1:2010, Cara uji kimia – Bagian 1: Penentuan Kadar abu dan abu tak larut dalam Asam pada produk perikanan. Jakarta. Indonesian; 2010.
Accessed 4 December 2019.
Available:http://sispk.bsn.go.id/SNI/DetailS NI/8486

12. Sugiyono. Research method: Quantitative, qualitative, and R&D. Bandung: Alfabeta; 2019.

13. Andriaryanto, Dewita, Syahrul. The assessment of mochi quality was fortified snakehead fish (*Channa striata*) protein concentrate. Jurnal Online Mahasiswa UNRI. 2015;2(1):1-9.

14. Nutritionix common food. Calories in mochi - 1 piece. US: Syndigo LLC; 2017.
Accessed 4 December 2019.
Available:https://www.nutritionix.com/i/nutritionix/mochi-1-piece/56c61c5dc5 bdcf727c1f7d58

15. Apriyani, Widiastuti I, Syafutri MI. Karakteristik fisik, kimia dan sensoris kerupuk keong mas (*Pomacea canaliculata*). Fishtec H: Jurnal Teknologi Hasil Perikanan. Indonesian. 2015;4(1):16-28.

16. Afriani RR, Kurniawati N, Rostini I. Penambahan konsentrat protein ikan nila terhadap karakteristik kimia dan organoleptik biskuit. Jurnal Perikanan Kelautan UNRI. Indonesian. 2016;7(1):6-13.

17. Sutedja AM, Trisnawati YC. Pemanfaatan tepung beras ketan hitam (*Oryza sativa glutinuosa* L.) pregelatinisasi pada produk flake. Prosiding Seminar Nasional PATPI. Indonesian. 2013;193-204.

18. Hayati W, Buchari D, Loekman S. Catfish (*Pangasius hypophthalmus*) Protein concentrate fortification in brownies cake. Jurnal Online Mahasiswa UNRI. 2014;1(1):1-8.

19. Natsir NA, Latifa S. Analisis kandungan protein total ikan kakap merah dan ikan kerapu bebek. Journal of Biology Science and Education. Indonesian. 2018;7(1):49-55.

20. Ramadhani A, Ilza M, Desmelati. Fortifikasi minyak ikan jambal siam (*Pangasius hypophthalmus*) dan Minyak Ikan Kerapu (*Chromileptes* sp) pada biskuit. Berkala Perikanan Terubuk. Indonesian. 2015; 43(2):77-88.

21. Annisa S, Darmanto YS, Amalia U. The Effect of various fish species on fish protein hydrolysate with the addition of papain enzyme. Saintek Perikanan. 2017; 13(1):24-30.

22. Listyarini S, Asriani, Santoso J. Konsentrat protein ikan lele dumbo (*Clarias gariepinus*) afkir dalam kerupuk melarat untuk mencapai sustainable development goals. Jurnal Matematika, Sains dan Teknologi. Indonesian. 2018;19(2):106-113.