

EFFECT OF DRYING TIME ON QUALITY OF MOZAMBIQUE TILAPIA FISH (*Oreochromis mossambicus*) AND ROUND SARDINELLA (*Sardinella aurita*) FLOUR

Slamet Widodo¹, and Saifuddin Sirajudin²

¹Universitas Negeri Makassar

²Hasanuddin University

taufiqnurramadhan@yahoo.com

ABSTRACT

This study assessed the quality tilapia and Sardinella fish based on drying time (5,6 and 7 hours) to get the best flour in term of color, flavor, texture as material to develop nutritious biscuit. The aim of the study was to know the effect of drying time on quality of the fish flour. Method used in this study was drying with temperature of 65°C during 5, 6, 7 hours. Data was collected by sensory evaluation of 16 trained panelists in term of color (whitish), flavor (fragrant), texture (grainy). Data analysis used mean and ANOVA test. The result of the study showed that mean value for color 5, 6, 7 hours was 5.6/white with little dark, 5.4/white little dark, 4.7/dark little white for the tilapia fish flour, 5.7/white little dark, 5.5/white little dark, 4.9/dark little white for Sardinella fish, respectively. ANOVA test showed significant difference ($p < 0.05$) term of color. Mean value for flavor of tilapia fish flour for 5, 6, 7 hours was 5.6, 5.4, 4.7, while for Sardinella fish was 5.7, 5.5, 4.9, respectively, with category of little bit good. ANOVA test showed no difference. Mean value for texture of tilapia fish flour for 5, 6, 7 hours was 5.6, 5.4, 4.7, while Sardinella fish was 5.7, 5.5, 4.9, respectively, with category of little bit fine. ANOVA test showed no difference in term of texture. As conclusion, drying time for 5, 6, 7 hours caused no difference in flavor and texture, but difference color with little bit good quality.

Keywords: Flour quality, fish flour, drying time

INTRODUCTION

Growing global population increases need of meat and fish as protein sources. The population is now aware of many benefits of eating fish, namely accelerating physical growth, supporting brain development, preventing cholesterol/heart disease and other benefit for health. Fish contains 16-24% of protein, 0.2-2.2% of fat, carbohydrate, mineral and vitamin. All type of fish is the relatively cheap animal protein sources compared to others. As food, fish is identified as having potential. Beside providing high amount of animal protein, fish also provides unsaturated fatty acid as well as various types of vitamin and mineral which is essential for the body.

Existing type of fish is freshwater fish and marine fish. Freshwater fish lives inside pond, lake and river. One of the freshwater fishes is Mozambique tilapia fish (*Oreochromis mossambicus*). Marine fish lives in the sea with example of round Sardinella fish (*Sardinella aurita*). Both

types of the fish is easily found, abundant and cheap but easily deteriorated. Fish is food source that is easily damaged so that special treatment is needed to maintain the quality. One of the methods is by heat treatment or commonly known as heating. There are two types of heating, namely dry heat and moist heat. Dry heat is non water heating, such as frying and roasting, while moist heat is water heating, such as boiling and steaming.

Mozambique tilapia and round Sardinella fish are type of fish with high nutrient content, particularly protein, calcium, zink, iodine, but dangerous for eating since they contain many bones. Therefore, specific treatment is needed to prevent the bone of causing injury to the consumer. The examples of treatment are drying, frying until done and pressure cooking. The other alternatives are by converting into flour so that it can be the substitute for various kind of food.

Fish flour is produced from all parts of the fish, namely head, meat, tail, bone

and innards. Since the demand for fish flour is relatively high lately, the flour is made from side products of fish which are previously discarded. This may in general affect the composition and quality of fish flour (Senapati, et al., 2016). Good quality fish flour can be seen from its white color, good flavor and fine texture. This good quality of fish flour can improve economic value of the fish and enhance the diversity in food stuff which further improve public health.

Making process of fish flour can be done by using sunlight and artificial drying. Both methods have their own strengths and weaknesses. Drying using sunlight prevents use of fuel which cost money but it needs long time and cannot be consumed directly. On the other hand, using artificial drying needs money but can be directly consumed since it is already done.

Artificial drying needs different time according to the size of the fish. Therefore, this study was aimed to know the effect of drying time on quality of Mozambique tilapia fish and round Sardinella fish flour. This study used round Sardinella and tilapia fish which contain protein, calcium, zink, iodine needed for growth, development and intelligence of children potential food diversification in terms of biscuit added by the produced fish flour.

METHODS

Time and Place

This study was conducted in December 2016-January 2017 located in cullinary laboratory in Makassar National University.

Tools and Materials

Tools used in this study were cutting board, knife, pressure cooker, oven, flour grinder, strainer (70 mesh). Basic materials of round Sardinella and tilapia fish were obtained from fish auction in

Makassar and brought to laboratory immediately to be processed into fish flour.

Stages

The first stage of this study was to clean the fish from dirt, separate the head, gill, innards, tail and fin. This cleaning stage was aimed to omit unused elements with very poor nutrient content which can reduce the quality of the material. The second stage was steaming using 85°C temperature for 60 minutes. This steaming was aimed to maintain natural flavor of the food by transferring the heat by convection from hot fume to the food. The third stage was mincing the fish with aim to accelerate drying process of the fish. The fourth process was drying using 70°C temperature during 5, 6 and 7 hours. The fifth process was straining. This process was aimed to produce homogenous flour particle which was used for biscuit making. The straining used 70 mesh strainer (equivalent with wheat flour particle).

This study was the experiment of drying tilapia and round Sardinella fish with various drying time to produce flour. This study used non factorial random assignment. There were 3 treatments, namely tilapia fish for 5 hours (IM5), 6 hours (IM6), 7 hours (IM7) and round Sardinella fish for 5 hours (IS5), 6 hours (IS6), 7 hours (IS7) with 3 repetition. Parameter for fish flour quality was color, flavor, texture, yield and hedonic sensory evaluation by panelist.

Data collection and analysis.

Data was collected from the responses of 16 trained panelist on color, flavor and texture of the fish flour by using hedonic sensory evaluation. The colors of the fish flour were: 1 (white), 2 (white with little dark), 3 (white with more dark), 4 (dark with little white), 5 (dark), 6 (very dark), and 7 (strongly very dark). The flavor were: 1 (very good), 2 (good), 3

(little bit good), 4 (fair/no flavor), 5 (little bit bad), 6 (bad), and 7 (very bad). The textures were: 1 (very fine), 2 (fine), 3 (little bit fine), 4 (fair), 5 (little bit grainy), 6 (grainy), and 7 (very grainy). The statistical analyses were mean and ANOVA (Widodo, Riyadi, Tanziha, & Astawan, 2015).

RESULTS AND DISCUSSION

Variable in this study was effect of drying time on quality of tilapia and Sardinella fish flour. The results were presented below:

Characteristics of round Sardinella (*sardenilla*) and tilapia (*Oreochromis mossambicus*) fish flour and the yields

Characteristic of all produced Sardinella and tilapia fish was light brown in terms of color. This was due to basic color of fish and heating process of carbohydrate resulting in light brown color. The flavor of the fish was little bit good, while the texture was fine. This was due to grinding and straining process using 70 mesh strainer.

Yield was the important parameter to know economic value and effectiveness of the process of the product. Yield calculation was based on ratio between final weight and initial weight. More the yield of a product, higher the economic value and the effectiveness of the process

(Putranto, Asikin, 2015). The details on yield of the fish flour were presented in Figure 1.

The result of ANOVA test showed that there was significant ($p < 0.05$) difference among the treatments. The difference in the yield reduction was based on linear equation, which showed that the yield was more in tilapia fish (-0.5x) than Sardinella fish (-0.3x). This result was higher than the fish bone yield in the previous study (Trilaksani et al. 2006), which was 28.85% and almost similar with other study (Apprilliani, 2010) which was 8.85% More yield did not directly reflect higher calcium content, but it was also determined by other factors like low protein content in the material (Putranto, Asikin. 2015)

This yield reduction of tilapia and Sardinella fish when converted into flour was due to reduction in unused head, gill, fin and tail as well as water lost inside the fish due to drying. Based on this result, drying process for 5 hours with 70°C produced more flour, both in tilapia and Sardinella fish. This was in line with the previous study (Tsironi & Taoukis, 2014) mentioning that drying time affect the yields produced. This yield reduction may be caused by more non mineral component (water, protein and fat) in the material lost as more drying time (Freitas & Costa, 2006: Trilaksani et al. 2006).

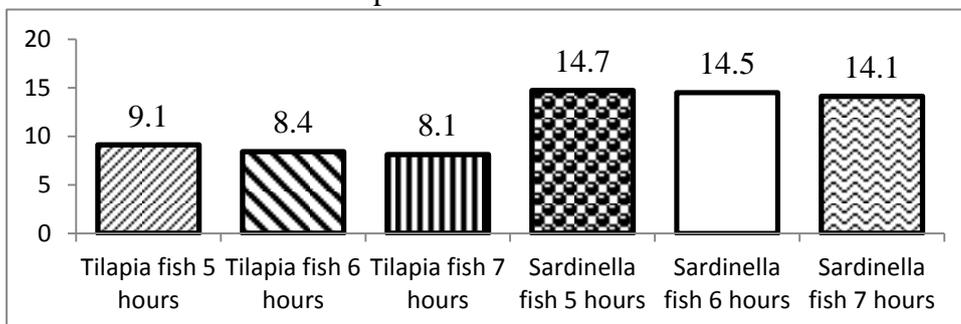


Figure 1. The value of the yield of tilapia fish and sardinella

Drying time of round Sardinella (*sardenilla*) and Mozambique tilapia (*Oreochromis mossambicus*) fish

The quality of fish flour made from Sardinella and tilapia fish was assessed by

16 trained panelists with occupation of lecturer in Culinary Art Major of Makassar National University. Sensory evaluation was conducted in sensory laboratory in Family Welfare Education, Makassar

National University. The result of the evaluation on color, flavor, texture and overall assessment was presented in Table 1.

Table 1. The mean quality of sardinella fish flour and the tilapia fish (*Oreochromis mossambicus*)

Indicator	IM5	IM6	IM7	IS5	IS6	IS7	p value
Color	5.6 ^b (white little dark)	5.4 ^b (white little dark)	4.7 ^a (dark little white)	5.7 ^c (white little dark)	5.5 ^b (white little dark)	4.9 ^a dark little white	0.000 ^{**})
Flavor	5.6 ^b (little bit good)	5.4 ^b (little bit good)	4.7 ^a (little good)	5.7 ^c (little bit good)	5.5 ^b (little bit good)	4.9 ^a (little good)	0.196
Texture	5.6 ^b (little bit fine)	5.4 ^b (little bit fine)	4.7 ^a (little fine)	5.7 ^c (little bit fine)	5.5 ^b (little bit fine)	4.9 ^a (little fine)	0.993
Over all	5.7 ^{cd} (rather good)	5.6 ^{bc} (rather good)	5.4 ^a (rather good)	5.8 ^d (rather good)	5.7 ^{cd} (rather good)	5.5 ^{bc} (rather good)	0.060

Note: ** = p < 0.01 : highly significant. Figures with a superscript in the same column shows no different

According to Table 1, only color which was different, while the flavor, texture and overall assessment was not different. This showed that *Sardinella* and tilapia fish when converted into flour had fixed quality which was not differed by drying time.

Color The result of ANOVA test on the color of *Sardinella* and tilapia fish showed significant difference based on drying time which meant that there was effect of drying time on the color of the fish flour. Duncan Test showed similar result with similar drying time on different material.

Color of the product was one of the factor affecting the quality of the fish flour prior to other determinants. This was directly related to preferred or unpreferred appearance by the consumer. Quality of a product usually affected by the material, processing method and presentation. Based on hedonic test, the color produced was pale white-white with little dark. This was due to caramelization process of carbohydrate inside the material and due to

protein. This was in line with study by Senapati et al. (2016) mentioning that in order to reduce browning, citric acid or pectin can be used to shorten heating process so that it can reduce browning reaction to heating.

Flavor In general, flavor smelled by nose was differentiated into good flavor, acidic smell, rancid smell and burning smell. Flavor of a food reflected the taste and assessment of the food. Hedonic sensory evaluation on tilapia and *Sardinella* fish showed that all flour was not different, which had little bit good flavor. ANOVA test showed that there was no difference on the flavor meaning that there was no effect of drying time on the flavor of the product. This was in line with previous studies (Nurdiani et al., 2015; Shaji & Hindumathy, 2013) mentioning that flavor was affected by heating amino acids inside the fish. Higher the amino acid content, better the flavor produced.

Texture Texture was one of the characteristics of the material sensed by sense of touch. Texture had important role

in acceptance of a food product. Hedonic sensory evaluation showed that the texture of tilapia and Sardinella fish was little bit fine. ANOVA test showed no difference meaning that there was no effect of drying time on the texture of the fish flour. Besides, this was also affected by use of 70 mesh strainer or wheat flour standard. Similar result was found by Nemati, et al (2016) which mentioned that smaller size of food material facilitates processing and absorption inside the human body.

Overall The overall assessment of the fish flour involved color, flavor and texture. ANOVA test showed no difference among all flour produced. Duncan Post Hoc test showed that the flour were not different, which were little bit good. This indicated that fish flour with drying time of 5, 6 and 7 hours had similar result. Therefore, based on consideration of cost and time efficiency, drying time of 5 hour was better than others.

The study had limitation since shelf life of the flour in various packaging as well as the nutrient content was not assessed.

CONCLUSION

Effect of drying time for 5, 6 and 7 hours on flavor and texture of tilapia and Sardinella fish was not different, except the color. The overall assessment of the flour was little bit good. With consideration of efficiency, the recommended drying time was 5 hours which further can be added to biscuit to improve the nutrition value of biscuit.

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