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Characteristic of Shredded Made from Boiled Fish (*Euthynnus Affinis*) with Substitution of Okara

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ABSTRACT: Boiled fish is one of traditional fish process that people like due to the low price and high nutrient content. However, it has short shelf-life, salty taste and less appearance. Diversification product such as shredded is required to improve the quality of boiled fish. The purpose of this study was to improve the characteristics of shredded made from boiled fish with substitution of okara. Boiled fish was soaked at different water condition (cold and hot) and soaking time (10, 20, 30 and 40 minutes). The data indicated that hot water with soaking time 30 minutes showed higher decreasing salt contents compared with others. The resulting boiled fish was made with substitution of okara (0, 10, 20, 30, 40 and 50%). The results indicated that substitution 20% (w/w) okara showed better characteristic that others with water, protein, fat, ash content, TBA, soluble dietary fiber, insoluble dietary fiber values was 7.60%, 32.08%, 28.72%, 3.23%, 0.27 mg/kg, 1.39% and 7.67%, respectively. Moreover, sensory evaluation was proposed to measure the product's response by panelist and showed significant different in odor and texture characteristic.
Author Keywords: Boiled fish, Dietary fiber, Okara, Shredded

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INTRODUCTION

Fish production was abundant in Indonesia and it will be useless if just sold in raw fish or traditional process like boiled fish. Boiled fish is one of the traditional processed fish found in Indonesia. Little tuna (*Euthynus affinis*) commonly used as boiled fish due to rich in protein and high amount of unsaturated fatty acid [1]. Boiled fish has great demand for Indonesian due to high nutrient content and more economical compared to red meat. However, it has some problem such as high salt content, harmful substances such as microbial and chemical contaminants and short shelf-life [2].

High salt consumption is a major factor in the increase in blood pressure, risk of stroke, kidney, obesity and stomach cancer [3]. Reduction salt content in boiled fish can be conducted by soaked in water. Less of information and processing technology cause low product diversification of fish. To improve the quality of boiled fish, one of the way was shredded. Shredded is chopped and dried by the addition of seasoning. Types of processed shredded fish is one of the diversified businesses processing of fishery products. Compared to other traditional forms of processing, shredded fish has relatively long shelf-life, which is still acceptable in storage for 50 days at room temperature. However, shredded has low fiber, so it needs to add some fiber to improve its quality. The addition of fiber also can reduce salt content and improve the texture properties. One of fiber which add to shredded was okara. Okara or known as tofu by product is classified in the industrial waste of agricultural products, can also be used directly as food product, easily damaged, and ends up as animal feed [4]. However, it has insoluble fiber 50.77%, 4.71% soluble fiber, protein 28.52%, 9.84% fat, 3.61% ash and 2.56% carbohydrates [5].

Due to okara showed higher protein and fiber, it is potential to add in foods and increase their characteristics. Boiled fish is low shelf-life and consumption, so combination between okara and boiled fish to be a shredded is required to improve the characteristic of shredded.

MATERIALS AND METHODS

The boiled fish with the length approximately 30 cm and weight 300 gram and okara was obtained from traditional market in Malang, East Java, Indonesia. Boiled fish was soaked in cold and hot water for 10, 20, 30 and 40 minutes, respectively. Subsequently, the resulting boiled fish (soaked in hot water for 30 minutes) was cooked with substitution of okara (w/w) 0%, 10%, 20%, 30%, 40% and 50%. Prior to cook, okara was steamed for 30 minutes and kept at room temperature. The shredded were mixed with 5% onions, 8% garlic, 2% coriander, 15%

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brown sugar, 1% tamarind, 1% galangal, 50% coconut milk, lemongrass leave and stir-fried at 180 ^{0}C for 5 minutes. The formulation of shredded substituted by okara was resumed in Table 1. The water, protein, fat, ash contents, thiobarbituric acid (TBA), soluble dietary fiber, insoluble dietary fiber was determined according to [6] with slight modification. The sensory evaluation was conducted by panelists consist of 15 male and 15 female with ages between 20 to 50 years. They were selected from Fisheries and Marine Science Faculty and all had experience in sensory evaluation, not allergic to fish, consumption of boiled fish at least once per week and willingness to evaluate meat from boiled fish. Panelists were instructed to evaluate the color, salty taste of the products, odor, texture and hedonic test was performed. The experiments were conducted in triplicate and data were expressed as the mean ± standard deviation. The data was analyzed using SPSS 16.0 software (SPSS, Inc., Chicago, IL). Differences between means were analyzed by analysis of variance (ANOVA) test with least significant different test at the resulting *p*-value lower than 0.05 ($P<0.05$).

RESULTS AND DISCUSSION

We measured the salt contents of boiled fish and the data exhibited that soaked time for 30 minutes in hot water decreased the salt approximately 21.67 ± 1.95% were given in **Table 2** the differences of using water condition had effect for decreasing salt content. Decreasing of salt content in boiled fish due to hot water was capable to widen the meat's pores so the water entered and pulled the salt out from the meat faster. Although, soaked time 30 and 40 minutes did not showed significant different, soaked time 30 minutes selected due to time effectiveness. In addition, substitution of okara tends to decrease water and protein content but increase the fat content based on Table 3 the decreasing of water contents in shredded influenced by okara.

Okara had large pores and when it fried in hot oil, the water is easily removed and resulting low water content. On the other hand, during frying water loss as well as penetration of oil into food takes place [7]. Okara had low protein content, so when it substituted in shredded would decrease the protein content. Moreover, heat processing leads to reduction in protein value and total amino acid as described by [8]. Okara tends to increase the fat content due to the components of okara was capable to hold oil when pressed by spinner. Okara had high carbohydrate which indicated this component could absorb and hold oil in shredded. Moreover, the fat content influenced by water content due to water was removed and remained space which filled by the oil resulted increasing fat content. Ash content and TBA showed that there was no significant difference between the treatments. No significant different of TBA in treatments indicated that there was not oxidative damage in shredded. However, TBA could increase when storage days was longer and inappropriate storage condition would accelerate the lipid oxidation [9]. Hedonic test was conducted to measure the response of the product by panelist.

Table 1. Formulation of shredded substituted by okara

Formulation	Treatments of substitution okara (w/w)					
	0	**10**	**20**	**30**	**40**	**50**
Boiled fish	100	90	80	70	60	50
Okara	0	10	20	30	40	50
Onions	5	5	5	5	5	5
Garlic	8	8	8	8	8	8
Coriander	2	2	2	2	2	2
Galangal	1	1	1	1	1	1
Tamarind	1	1	1	1	1	1
Brown sugar	15	15	15	15	15	15
Coconut milk	50	50	50	50	50	50
Lemongrass leave	1	1	1	1	1	1

Table 2. Decreasing salt contents after treatment water condition and soaked time

Treatments / Water condition	Soaked Time (minutes)	Decreasing Salt Contents (%)
Cold	10	1.74 ± 0.97^{a}
	20	10.25 ± 2.99^{b}
	30	13.12 ± 0.76^{bc}
	40	19.36 ± 3.23^{cd}
Hot	10	9.61 ± 2.29^{b}
	20	18.42 ± 4.81^{c}
	30	21.67 ± 1.95^{d}
	40	25.84 ± 2.80^{d}

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Table 3. Chemical characteristics of shredded substituted by okara

Substitution of okara (%)	Water (%)	Protein (%)	Fat (%)	Ash (%)	TBA (mg/kg)
0	10.63 ± 3.27^{ab}	36.91 ± 0.39^{c}	24.68 ± 1.26^{a}	3.85 ± 0.75^{a}	0.38 ± 0.27^{a}
10	12.81 ± 2.58^{b}	34.70 ± 1.05^{bc}	26.49 ± 3.36^{ab}	3.68 ± 0.50^{a}	0.24 ± 0.18^{a}
20	7.60 ± 1.48^{ab}	32.08 ± 1.72^{b}	28.72 ± 1.63^{abc}	3.23 ± 0.59^{a}	0.27 ± 0.24^{a}
30	7.22 ± 2.06^{ab}	28.72 ± 0.55^{a}	31.55 ± 3.17^{bcd}	3.36 ± 1.03^{a}	0.21 ± 0.15^{a}
40	8.31 ± 3.88^{ab}	25.81 ± 1.73^{a}	33.52 ± 1.52^{cd}	3.01 ± 0.85^{a}	0.51 ± 0.43^{a}
50	4.66 ± 1.45^{a}	26.87 ± 1.86^{a}	34.01 ± 1.98^{d}	2.66 ± 0.69^{a}	0.35 ± 0.31^{a}

Table 4. Sensory evaluations of shredded substituted by okara

Treatments of substitution okara (%)	Sensory evaluations			
	Color	Salty tastes	Odor	Texture
0	4.40 ± 0.48^{ab}	2.87 ± 0.12^{a}	3.58 ± 0.29^{ab}	4.07 ± 0.16^{bc}
10	4.05 ± 0.99^{ab}	2.97 ± 0.16^{a}	3.50 ± 0.20^{ab}	3.88 ± 0.16^{bc}
20	4.85 ± 0.87^{ab}	2.77 ± 0.04^{a}	3.90 ± 0.14^{b}	4.13 ± 0.17^{c}
30	3.37 ± 0.51^{a}	2.94 ± 0.28^{a}	3.45 ± 0.14^{ab}	3.57 ± 0.41^{b}
40	3.15 ± 0.77^{a}	2.55 ± 0.48^{a}	3.27 ± 3.45^{a}	3.02 ± 0.13^{a}
50	3.24 ± 1.00^{a}	2.30 ± 0.47^{a}	3.25 ± 0.30^{a}	2.88 ± 0.26^{a}

Shredded boiled fish with substitution of okara was served to panelist by random 6 alphabets (A to F) in one session in a taste panel including color, salty tastes, odor and texture using 7 point scale (1 is very dislike to 7 is very like). All of the sensory evaluation using p-value lower than 0.05 (*p<0.05)

Table 5. Nutrition composition of shredded with the best substitution of okara

Characteristics	Result
Water	7.60 ± 1.48
Protein	32.08 ± 1.72
Fat	28.72 ± 1.63
Ash	3.23 ± 0.59
Carbohydrate	26.90 ± 3.97
Salt	0.92
Total dietary fiber	9.06
- **Water soluble**	1.39
- **water insoluble**	7.67

According to Table 4 the result indicated that substitution of okara did not show significant different in color and salty tastes characteristic. However it showed significant different in odor and texture. Shredded fish with substitution okara is a relatively new product might be responsible for the insignificant difference in its acceptability. Basic tastes (sweet, sour, bitter, salt and umami) are one of the sensory evaluations of food, together with texture, pungency, aroma, appearance [10]. According to chemical characteristics and sensory evaluations, substitution 20% of okara or rasio boiled fish to okara was 80 to 20 was capable to increase the characteristic of shredded and nutrient composition can be seen in Table 5.

CONCLUSION

The soaked time 30 minutes in hot water can decrease the salt contents of boiled fish. Substitution of okara caused low water and protein content thus increase the fat content. The substitution of 20% okara improved the characteristic of shredded. Shredded can be considered as alternative way to increase the shelf-life of boiled fish. Nevertheless, variation of substitution and fish is necessary to improve the characteristic of shredded.

Competing interests

The authors declare that they have no competing interests.

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