**Development of semoer jengki kamaboko from skipjack tuna fish for entrepreneurial products**

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**Abstract.** Entrepreneurs in the culinary field are becoming popular recently. Culinary products need to be developed with the right methods so that the public prefers them. This study aimed to find the recipe for semoer jengki kamaboko and determine these product's preference levels. This study used the Research and Development method with 4D procedures, namely define, design, develop, and disseminate. The control was semur jengkol from jengkol. The product was semoer jengki made from kamaboko. Kamaboko was made from 100% skipjack tuna fish fillets, egg whites, and cornstarch. Kamaboko was molded to resemble jengkol and then stewed. The semoer jengki kamaboko was then served with uduk rice, dried tempeh, fried rice noodle, sliced ​​omelet, and cucumber. The product was evaluated by sensory analysis by trained and semi-trained panelists. Thirty untrained panelists performed the 1-5 scale hedonic test. The data were then analyzed qualitatively and descriptively quantitatively. The hedonic test results showed that the semur jengkol's average preference was 3.7, and the semoer jengki kamaboko was 4.4. The t-test for color, odor, taste, and overall parameters showed that semur jengkol and semoer jengki Kamaboko were not significantly different. However, the semoer jengki kamaboko texture was preferred to the semur jengkol. This data showed that the semoer jengki kamaboko product was acceptable.

1. **Introduction**

The environment must support the willingness of vocational education graduates to become entrepreneurs. The stigma of entrepreneurship is sometimes negative because there are people who think that entrepreneurs are less educated. Some people also think that entrepreneurship is related to small enterprises whose main goal is to survive and not concern with economic growth [1]. The students spend less time discussing entrepreneurship as a solution to poverty [2]. Therefore, entrepreneurship education needs to be included in the vocational education curriculum to prepare graduates with entrepreneurial skills. Food security and nutrition are essential issues in Indonesia. Therefore, entrepreneurship in the food or culinary sector is the most popular entrepreneurial activity in Indonesia [3]. Entrepreneurship education in the food sector can be grown among the students through a course in food product development. Students are trained to develop new food products that are preferred by consumers.

Indonesia is the largest archipelago country in the world, which has 17,499 islands. Indonesia's total area is 7.81 million km2 consisting of 2.01 million km2 of land, 3.25 million km2 of oceans, and 2.55 million km2 of the Exclusive Economic Zone. Based on data from the Ministry of Marine, Affairs, and Fisheries, captured fisheries production in 2017 reached 23,186,442 tons, while aquaculture production reached 16,114,991 tons. The Indonesian people's fish consumption is far behind other nations with a much smaller potential for fishery resources.

Skipjack tuna fish is a protein source. It contains fat-soluble vitamins, namely vitamin A, D, E, and K, iron, vitamin B1 and C. Skipjack tuna fish also contain omega-3s. This fish is excellent for pregnant women to consume because it is beneficial for fetal growth.

Semur jengkol is a traditional dish from Betawi, Indonesia. Semur jengkol are served as a one-dish meal or a side dish. Semur jengkol is usually served as a side dish in uduk rice, consisting of uduk rice, semur jengkol, cucumber, sliced ​​omelet, dried tempeh, and served with prawn crackers as a compliment. The superiority of semur jengkol is its distinctive odor, distinctive texture. This product's disadvantage is that it can cause bad odor in the mouth, urine, and feces. The standard portion served as a one-dish meal is 120 grams.

Kamaboko is a fish meat product in the form of a gel, which is chewy and elastic [4]. This processed product originated in Japan [5]. Approximately 25% of the fish caught in Japan are processed into kamaboko [6]. Kamaboko is made from groundfish as the main ingredient, and other ingredients, such as starch, sugar, salt, and sodium glutamate. Fish meat used for surimi should not be washed because washing can remove sarcoplasmic proteins and increase myofibril proteins' concentration, which play an essential role in forming a gel. The next process is steaming, roasting, boiling, or frying. [7].

 Several studies have published kamaboko from various fish raw materials, such as tilapia, African catfish, walleye pollack [8], [9], silver carp [8], sardine [10], black rockfish [11], common carp [12], curisi fish [13], tuna fish [14], and yellow stripe trevally [15]. However, none reported the development of kamaboko from skipjack tuna fish.

The strength of the gel most determines the quality of kamaboko products. The main ingredient of kamaboko is fish surimi. This gel's strength is influenced by the freshness quality of the fish raw material, which is the largest component in the kamaboko formulation [5]. Kamaboko from marine fish has better gel strength than kamaboko from freshwater fish [8]. Fish meat used for surimi should not be washed because washing can remove sarcoplasmic proteins and increase myofibril proteins' concentration, which plays an essential role in forming a gel.

This article will describe the development of the semoer jengki product from kamaboko and the product acceptance test. Semoer jengki kamaboko acceptable to the panelists, can be developed into ready-to-sell products to strengthen entrepreneurial success.

1. **Methods**
	1. *Research Methods*

This study is a research and development (R & D) with a 4D design, namely define, design, develop, and disseminate [6]. At the define stage, a literacy study was carried out to obtain three kamaboko recipes and three semur jengkol recipes. Then the development of three kamaboko recipes was carried out at the design stage. Furthermore, at the development and disseminate stages, the best kamaboko formula was stewed by replacing jengkol with kamaboko. The product was named semoer jengki kamaboko. Semur jengkol and semoer jengki from kamaboko are served with uduk rice, dried tempeh, fried rice noodles, sliced omelet, and cucumber. Products were presented with garnish and plating and were packaged with packaging and packaging labels. Product evaluation at each stage was carried out by sensory testing. Trained panelists assessed products at the define, design, and development stages. Semi-trained panelists evaluated products at the define and design stages. Meanwhile, untrained panelists evaluated products at the disseminate stage.

* 1. *Materials*

The raw materials used to make semoer jengki products are skipjack tuna fish, corn starch Maizenaku, refined salt, leaves, and eggs. Skipjack tuna fish and eggs were purchased at the Lebeng market, Kesugihan Cilacap. Cornstarch and salt were bought from the bakery in the Lebeng market.

* 1. *Kamaboko Preparation*

Skipjack tuna fish was soaked in ice water for 10 minutes. The fish was then drained. Skipjack tuna fish was mixed with egg whites, cornstarch, sugar, pepper, salt and turmeric. The mixture was then mashed in a blender. The dough was molded using a mold. The dough was steamed in a steamer over high heat until well cooked.

* 1. *Stew Preparation*

Semur jengkol was prepared as follow. Garlic, shallots, ginger, salt and red chilies were mashed. The mashed ingredients was sauteed with cooking oil, until fragrant. Jengkol, water, and pepper were added to the frying pan. This mixture was cooked over low heat until the sauce thickened. Sweet soy sauce was added and then cooked briefly. Semoer jengki kamaboko was prepared with the same techniques as semur jengkol. However, the jengkol was replaced by kamaboko.

* 1. *Sensory Evaluation*

The sensory characteristics test at the define and design stage assessed color, odor, taste, and texture. This characteristic sensory test used a qualitative assessment. This test was carried out by one trained panelist and five semi-trained panelists. Samples at the define stage are three kamaboko recipe and three semur jengkol recipe. While the samples at the design stage were three kamaboko recipes from skipjack tuna fish.

The sensory test at the develop and disseminate stages was carried out based on the hedonic test. The hedonic test uses a scale of 1 - 5, where 1 is dislike extremely, 2 is dislike moderately, 3 is neither like nor dislike, 4 is like moderately, and 5 is like extremely. The hedonic test performed quantitatively, in which the panelists respond in the preference level to the sample characteristics. The panelists assessed semur jengkol and semoer jengki kamaboko. The development stage's hedonic test evaluated the shape, size, color, odor, taste, texture, overall, presentation, and packaging. This hedonic test was performed by one trained panelist and five semi-trained panelists. While the hedonic test at the disseminate stage evaluated the level of preference in aspects of taste, odor, taste, texture, and overall. Thirty untrained panelists evaluated the disseminate stage preference test.

* 1. *Data Analysis Method*

The results of the sensory evaluation were then analyzed qualitatively and descriptively quantitatively. Qualitative data was data in the form of panelist comments about products. Quantitative data was in the form of a hedonic test scale. The hedonic test data at the disseminated stage was then carried out by a t-test to determine the difference between the two samples.

1. **Result and Discussion**

Semoer jengki kamaboko is a processed product made from skipjack tuna fish, which adopts a typical Betawi dishes, namely semur jengkol. This dish is a modification of the kamaboko. Kamaboko is made from skipjack tuna fish and molded with a shape resembling jengkol. The kamaboko is then processed using the stewing technique. The kamaboko was then presented with uduk rice, dried tempeh, fried rice noodles, sliced omelet, and cucumber. The stages of product development are described as follows.

* 1. *Define*

The literature study was carried out at the define stage to find three recipes for kamaboko and three recipes for semur jengkol. Table 1 displays the kamaboko formula. One trained panelist and five semi-trained panelists assessed the sensory characteristics of three kamaboko formulas. The sensory test results are shown in Table 2.

Table 2 shows that the formulas K1, K2, and K3 have a white color, savory taste, and a distinctive odor of fish. Odor and taste were considered to be the key factors affecting kamaboko's acceptability [8]. The characteristics of color was replaced by whiteness in some sensory analysis of kamaboko [8], [12], [15]. It can be concluded that the color of kamaboko should be white to meet the consumers' expectation. All of the formula shown in Table 2 resulted in kamaboko having white color. The textures of K2 and K3 are slightly soft, while K1 has better elasticity and is closer to the jengkol texture. Previous studies reported that the most acceptable kamaboko was the formula having a high breaking force. [8], [15]. The breaking force was correlated with the chewiness of the gel. Therefore, the K1 formula was selected as the best kamaboko formula.

**Table 1.** Kamaboko formula.

|  |  |  |  |
| --- | --- | --- | --- |
| Ingredients | K1 | K2 | K3 |
| Skipjack tuna fish fillet*,* g | 200.00 | 500.00 | 250.00 |
| Egg whites, grain | 1.00 | 1.00 | 1.00 |
| Corn starch, g | 20.00  | 30.00 | 20.00 |
| Sugar, g | 5.00 | 5.00 | 5.00 |
| Pepper, g | 5.00 | 5.00 | 5.00 |
| Salt g | 4.00 | 5.00 | 2.50 |
| Ginger water, g | - | 5.00 | 10.00 |
| Coriander, g | - | - | 1.25 |

**Table 2.** The Sensory evaluation results in the define stage for kamaboko products.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Formula | Color | Odor | Taste | Texture |
| K1 | White | Fish | Savory | Chewy |
| K2 | White | Fish | Savory | Slightly soft |
| K3 | White | Fish | Savory | Slightly soft |

The kamaboko elasticity was affected by the fish species [8], fish freshness, and processing technique [6]. The K1, K2, and K3 formula was processed using the same skipjack tuna fish and cooking technique. Therefore, the ingredient composition affected the difference in the sensory characteristic of the three formulas. The composition of skipjack tuna fish, egg white, and corn starch played an important role. Corn starch was a gelation agent. Previous studies also reported the use of gelation agents, such as zinc sulphate, zinc chloride [15], carrageenan [13], and sago starch [4].

A literature study was also carried out to find three recipes for semur jengkol from jengkol. Table 3 shows the semur jengkol formula. Whereas Table 4 shows the sensory test results of the semur jengkol.

**Table 3.** Semur jengkol formula.

|  |  |  |  |
| --- | --- | --- | --- |
| Ingredients | SJ1 | SJ2 | SJ3 |
| Jengkol, g | 300.00 | 500.00  | 100.00  |
| Water, g | 700.00  | 500.00 | 500.00 |
| Cooking oil, tbsp | 2.00  | 2.00  | 2.00  |
| Soysauce, tbsp | 5.00  | 5.00  | 3.00  |
| Shallot, grain | 3.00  | 3.00  | 3.00  |
| Garlic, grain | 2.00  | 5.00  | 2.00  |
| Red chilli, grain | 2.00  | - | 4.00  |
| Coriander, tsp | 1.00  | - | - |
| Candlenut, grain | 3.00  | 3.00  | - |
| Ginger, cm | 5.00  | - | 5.00 |
| Pepper, tsp | 0.25  | - | 1.00  |
| Salt, tsp | 1.00  | 2.00  | 1.00  |
| Cloves, grain | - | 2.00  | - |
| Cinnamon, cm | - | 3.00  | - |
| Palm sugar, g | - | 20.00  | - |
| Nutmeg, grain | - | 0.25  | - |

Table 4 shows that the SJ1, SJ2, and SJ3 formulas had a distinctive jengkol odor, a savory taste, and soft and sticky textures. SJ1 and SJ2 had a light brown color, while SJ3 was brown. Therefore, the SJ3 formula was chosen to be the best recipe because it had better color than other reference recipes.

**Table 4.** The results of sensory evaluation in the define stage for semur jengkol.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Formula | Color | Odor | Taste | Texture |
| SJ1 | Light brown  | Jengkol | Savory | Soft and sticky |
| SJ2 | Light brown  | Jengkol | Savory | Soft and sticky |
| SJ3 | Brown | Jengkol | Savory | Soft and sticky |

* 1. *Design*

The semoer jengki kamaboko was a product innovation inspired by the combination of two cultures, namely, Betawi food culture and processed products from Japan. The kamaboko produced from the K1 formula were then modified to produce kamaboko with yellow color. The final product of semoer jengki kamaboko should be yellow to resemble the natural color of jengkol. The yellow color was produced by turmeric. Formulas K4, K5, and K6 have differences in the amount of turmeric used. Table 5 shows the complete formulas.

**Table 5.** Kamaboko formula from skipjack tuna fish.

|  |  |  |  |
| --- | --- | --- | --- |
| Ingredients  | K4 | K5 | K6 |
| Skipjack tuna fish fillet*,* g | 200 | 200 | 200 |
| Egg whites, grain | 1 | 1 | 1 |
| Corn starch, g | 20  | 20  | 20  |
| Sugar, g | 5 | 5 | 5 |
| Pepper, g | 5 | 5 | 5 |
| Salt, g | 4  | 4  | 4  |
| Turmeric, g | 10 | 20  | 30  |

**Table 6.** The sensory test results of the design stage for kamaboko.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Formula | Color | Odor | Taste | Texture |
| K4 | White | Fish | Savory | Chewy |
| K5 | White | Fish | Savory | Chewy |
| K6 | Pale yellow | Fish | Savory | Chewy |

One trained panelist and five semi-trained panelists tested the three formulas for sensory characteristics (Table 6). Formulas K4 and K5 produced white color, distinctive fish odor, savory taste, and chewy texture. Meanwhile, the K6 formula produced a pale yellow color, distinctive fish odor, savory taste, and chewy texture. The kamaboko would then be stewed. The desirable color of the stew was brown. Kamaboko K6 having pale yellow, was considered to be better color when the kamaboko was processed into stewing. Based on the results of the sensory test, the K6 formula was chosen as the best formula. K6 produces better colors than the other formulas.

* 1. *Develop*

Jengkol was processed into semur jengkol using the SJ3 formula. Meanwhile, the K6 kamaboko was then processed into semoer jengki kamaboko using the SJ3 formula. The jengkol ingredients in SJ3 were replaced with kamaboko from the K6 formula.

The semur jengkol and semoer jengki kamaboko were then served with uduk rice, dried tempeh, fried rice noodles, sliced omelet, and cucumber. The product presentation was accomplished by plating and garnishing. Both products were served using a dinner plate as a serving tool (Figure 1). For sales purposes, both products were packaged using attractive packaging and labels. Packaging functions to protect dishes from contamination, add aesthetic value, and make distribution easier. Two trained panelists carried out the hedonic test. The results of the sensory evaluation are shown in Table 7.



**Figure 1.** Semoer jengki kamaboko (K6+SJ3).

Based on Table 7, panelists preferred semoer jengki kamaboko to semur jengkol in terms of shape and odor. The odor of jengkol is one of the things that causes consumers to dislike jengkol processed products. Kamaboko odor is an essential factor. Depending on the local culture, people might have different preferences for odor. The Japanese prefer marine fish kamaboko, while the Chinese prefer freshwater kamaboko [8]. Sensory evaluation showed that the bad odor in semur jengkol can be modified with replacing jengkol with kamaboko. The kamaboko, which was printed to resemble the jengkol shape, turned out to be preferred by the panelists to the original jengkol form. The level of acceptance for the panelists for the two products is at the same level, namely for the aspects of size, color, taste, texture, overall, presentation, and packaging

**Tabel 7.** Sensory evaluation of the product at the develop stage.

|  |  |  |
| --- | --- | --- |
| Sensory Characteristic | Semur Jengkol (SJ3) | Semoer Jengki Kamaboko (K6+SJ3) |
| Shape  | 4.0 | 4.5 |
| Size | 3.5 | 3.5 |
| Color | 3.5 | 3.5 |
| Odor | 4.0 | 4.5 |
| Taste | 4.0 | 4.0 |
| Texture | 4.0 | 4.0 |
| Overall | 4.0 | 4.0 |
| Presentation | 3.0 | 3.0 |
| Packaging | 3.0 | 3.0 |

* 1. *Disseminate*

Thirty untrained panelists performed hedonic tests on jengkol stew and semoer jengki kamaboko products. Table 8 shows the results of this evaluation. Differences between samples were tested by paired t-test.

**Table 8.** Result of sensory evaluation on the disseminate stage by untrained panelists.

|  |  |  |  |
| --- | --- | --- | --- |
| Sensory Characteristic | Semur Jengkol (SJ3) | Semoer Jengki Kamaboko (K6+SJ3) | P-value T-test |
| Color | 4.2a | 4.2a | 0.5000 |
| Odor | 3.7a | 4.1b | 0.0630 |
| Taste | 3.7a | 4.3b | 0.0060 |
| Texture | 3.7a | 4.3b | 0.0030 |
| Overall | 3.7a | 4.4b | 0.0055 |

Based on the hedonic test and t-test in Table 8, the semoer jengki kamaboko products were preferred (p≤0.05) than semur jengkol in terms of odor, taste, texture, and overall. The strength of the gel most determines the quality of kamaboko products. The main ingredient of kamaboko is fish surimi. This gel's strength is influenced by the freshness quality of the fish raw material, which is the largest component in the kamaboko formulation [5]. Kamaboko from marine fish has better gel strength than kamaboko from freshwater fish [8]. We developed kamaboko from marine fish so that the texture is preferred by the panelist.

The colors on the two products did not show any significant differences. The preference for panelists in the assessment was based on the preferences of each individual. The taste and odor of jengkol are very distinctive, so that the panelists tend to be less fond of it.

The panelists can accept the semoer jengki kamaboko. Therefore, entrepreneurs who are interested in developing semur jengkol products can diversify their products in the form of semoer jengki kamaboko. The acceptance of the semoer jengki kamaboko which was better than the original semur jengkol is expected to reduce marketing failure. Furthermore, the semoer jengki kamaboko's main ingredient is skipjack tuna fish, which has a high nutritional value. However, the use of fish products in Betawi dishes is still rare. Besides, this product is still not widely known by the public. This product needs further publication and large-scale dissemination. This product also undergoes repeated heat processing so that it is necessary to analyze its nutritional content.

1. **Conclusion**

Culinary product entrepreneurship is growing rapidly lately. Culinary product innovation needs to be performed. Product innovation needs to be tested for consumers' acceptance to determine the level of public acceptance for the innovation product. This study developed semoer jengki kamaboko. Kamaboko was made from skipjack tuna fish fillets. Kamaboko was then stewed to produce semoer jengki kamaboko. The jengkol ingredients in original jengkol stew was replaced with kamaboko. The original semur jengkol and semoer jengki kamaboko were then served with uduk rice, dried tempeh, fried rice noodles, sliced omelet, and cucumber. Semoer jengki kamaboko was preferred than semur jengkol in odor, taste, texture, and overall (p≤0.05). A proximate test on semoer jengki kamaboko needs to be accomplished to determine the nutritional content of this product.

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