Shrimp Paste Crackers as Potential Product Development for Small and Medium Enterprise (SMEs)

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Abstract. There are many Small and Medium Enterprises processed food in the marine and fisheries sector in Central Java Province area, such as Demak Regency, Semarang City, and Pekalongan Regency. However, some business actors have not dared to innovate their products. Shrimp paste is one of the marine products that is processed by fermentation. Generally, shrimp paste is made from shrimp or small fish and is used as a spice in chilli sauce. The addition of shrimp paste to crackers is intended to increase its utilization as a marine product in the product development of Small and Medium Enterprises. This study aimed to determine the effect of adding shrimp paste on its chemical properties (moisture, protein, and fat content) and consumer acceptance through sensory testing. The ratio of tapioca flour and shrimp paste used in this study were 100: 0, 100: 5, 100: 10, and 100: 15. The results of the sensory analysis showed that the formulation with a ratio 100:15 was the most preferred formulation by the panelists. Based on the results of chemical analysis, the moisture content of crackers before and after frying 100:15 formulation ratio was 8.84% ± 0.14 and 1.85% ± 0.26. Fat and protein contents at 100:15 formulation ratio were 43.63% ± 4.23 and 1.67% ± 0.12 while those in the control were 26.46% ± 3.67 and 0.63% ± 0.70. Sensory evaluation data showed that consumer could accept this shrimp paste cracker as a potential food product.

Keywords: Product Development, SMEs, Shrimp Paste, Shrimp Paste Crackers

1. Introduction

Indonesia is an island nation with abundant marine wealth which can be found in many places, including Semarang City, Demak Regency, and Pekalongan Regency. Of the 90 SMEs processed seafood in the three regions, there are 39 types of products produced. Salted fish (18%), presto milkfish (14%), and pindang fish (9%) are the three most manufactured products. Shrimp paste is already produced by 1% SMEs [1].

Shrimp paste is one of the processed of fishery products from rebon raw materials, fresh or dried shrimp or a mixture of both which are then fermented. There are three criteria for the form of shrimp paste products based on the Indonesian National Standard (SNI) 2716:2016 [2] namely 1) shrimp paste that has semi-solid characteristics, 2) concrete dry shrimp paste blocks that have dry features and solid block-shaped, and 3) dried shrimp paste powder and granules that have dry attributes in the form of powders and granules. The process of making shrimp paste includes sorting, drying, braking, fermentation, milling and fermentation [3].
In Indonesia, shrimp paste is quite popular as a seasoning or flavouring in many cuisine. Usually, some dishes are flavorful. Currently, shrimp paste has also been used in the manufacture of crackers. The use of shrimp paste in the manufacture of crackers is expected to improve the taste of crackers. Crackers have long been known to Indonesians as snacks that can increase appetite. Crackers are easy to obtain in restaurants, stalls, supermarkets, and restaurants. Many types of crackers have been made, from those made from tapioca flour, rice flour, or wheat flour [4]. The Indonesian Dictionary (KBBI) [5] says that crackers are food made from flour dough mixed with fish or shrimp, processed, and then cut thinly or can also be formed with mold and dried so that it is easy to fry.

In that case, shrimp paste crackers can be further developed by selling shrimp paste cracker products to increase the selling value of processed seafood products. In addition to being acceptable to the community, the addition of shrimp paste in the manufacture of shrimp paste crackers is also expected to meet the chemical and sensory characteristics desired by consumers.

2. Materials & Methods

2.1. Making shrimp paste crackers
The ratio of tapioca and shrimp paste flour used in the manufacture of crackers is T0 (100:0), T1 (100:5), T2 (100:10), and T3 (100:15). Tapioca flour is divided into two parts, i.e. the first part 1/4 and the second part 3/4 of the total flour. First of all, the shrimp paste is first smoothed by adding 75 ml of water then filtered. The first half flour of 1/4 is made into a gel by adding shrimp paste that has been added with water and then heated ± 1 minute 30 seconds. Once the gel dough is formed, add the tapioca flour of the second part 3/4 and water as much as 20 ml little by little. The dough is then kneaded until solid. The dough is steamed for 45 minutes, silenced in room temperature ± 1.5 hours and put in a chiller for ± 12-18 hours and sliced to a thickness of ±2.5 mm using a slicer and then dried with a Solar Tunnel Dryer (STD) for 6-8 hours. Crackers are deep-fried fat frying for 10 seconds at a temperature of 180 - 200 °C.

2.2. Chemical Analyses
Moisture content, fat, and protein analyses utilized AOAC 2020 method [6].

2.3. Sensory Analyses
The rating method was used to determine the level of likeness for shrimp paste crackers. The favourite level score ranged from 1 to 5, score 1 was very dislike, score 2 dislike, score 3 neutral, score 4 like and score 5 very like. Sensory testing of shrimp paste crackers with rating method was conducted against 30 untrained panellists [7].

3. Results

Table 1. Chemical Analysis of Tapioca Flour and Shrimp Paste

| Properties (%) | Shrimp Paste | Tapioca Flour |
|----------------|-------------|---------------|
| Moisture content | 27.13±0.32 | 10.45±0.35 |
| Fat | 2.63±0.49 | 1.06±0.13 |
| Protein | 33.91±2.12 | 0.35±0.11 |

Description:
- All data presented is a mean ± deviation standard

Table 1 shows chemical analysis (moisture content, fat and protein) of tapioca flour and shrimp paste. Shrimp paste with the highest protein content at 33.91%. The result of the analysis of water content in shrimp paste were 27.13% and fat was 2.63%. It can also be seen that the result of the analysis of the water content of tapioca flour was 10.45%, fat was 1.06%, and tapioca flour protein was 0.35%.
Table 2. Chemical Analyses of Shrimp Paste Crackers

| Sample | Moisture content (%) Before Frying | Fat After Frying | Protein After Frying |
|--------|-----------------------------------|------------------|----------------------|
|        | Before Frying | After Frying    | Before Frying | After Frying |
| T0     | 9.62±0.31     | 2.93±0.22       | 26.46±3.67       | 0.63±0.07    |
| T1     | 8.40±0.31     | 2.27±0.51       | 35.85±5.61       | 1.10±0.07    |
| T2     | 8.31±0.38     | 1.75±0.26       | 39.89±6.11       | 1.34±0.09    |
| T3     | 8.84±0.14     | 1.85±0.26       | 43.63±4.23       | 1.67±0.12    |

Description:
- All data presented is a mean ± deviation standard
- Different superscript shows are real different (p<0.05)

Table 2 shows the chemical analysis of shrimp pastes crackers. Analysis of water content was conducted before frying and after frying, while fat and protein analysis was carried out on shrimp paste crackers after frying. The result of the analysis of water content of shrimp paste crackers before frying were the highest sample T3 and the lowest sample T1. The highest chemical analysis of shrimp paste crackers after frying was in sample T0 and the lowest was sample T3. The highest result of chemical analysis of shrimp paste cracker fat was T3 sample and the lowest was T0 sample. The highest result of the chemical analysis of shrimp paste cracker protein were T3 and T0.

Table 3. Sensory Analyses of Shrimp Paste Crackers

| Sample | Analyses                      | Colour                  | Aroma                  | Texture                | Taste                  | Overall                |
|--------|-------------------------------|-------------------------|------------------------|------------------------|------------------------|------------------------|
|        |                               | 3.50±1.17               | 3.03±0.89              | 2.83±1.12              | 1.93±0.74              | 2.37±0.67              |
| T1     |                               | 4.30±0.75               | 3.53±0.73              | 3.57±0.97              | 3.27±0.87              | 3.47±0.78              |
| T2     |                               | 3.43±0.97               | 3.73±0.78              | 4.00±1.08              | 3.90±1.03              | 4.00±0.69              |
| T3     |                               | 2.43±1.25               | 3.80±1.13              | 4.27±0.91              | 4.13±1.04              | 4.10±0.76              |

Description:
- All data presented is a mean ± deviation standard
- Different superscript shows are real different (p<0.05)

Table 3 shows the sensory analysis data of shrimp paste crackers. The attributes included colour, aroma, texture, taste, and overall.

4. Discussions

4.1. Moisture content

The moisture content in the sample of shrimp paste crackers before frying showed that T1 and T2 did not significantly differ, but have a significant difference of moisture content with T0 and T3. The moisture content of the shrimp paste crackers before frying in the T0 sample was 9.62% (Table 2). This happened due to no addition of shrimp paste in the T0 treatment. The ability of tapioca flour to bind water becomes more significant during the gelatinization process. In addition, [8] that during the drying process, there is a process of releasing water molecules by fat, protein, and ash in fish meat. The high salt content in shrimp paste causes a decrease in the amount of water present in the shrimp paste crackers because the salt is hygroscopic so that the absorption of water is increased by salt ions [9].
4.2. Fat

It was found that each treatment had a significant effect on the value of the fat levels of the estranged crackers. The T1 and T2 treatments were not different while T0 and T3 treatments had different fat levels with T1 and T2. Fat levels in shrimp paste crackers range from 24.93% to 41.81%. The high fat content in crackers is an influence of oil absorption during the frying process [10].

In deep-fat frying, heat transfer occurs a combination of convection on hot oil and conduction to the inside of the shrimp paste cracker so that all surfaces get the same heat and tend to absorb more oil [11]. The evaporation process of water that occurs during frying is due to the temperature of the oil that acts as a medium in the frying pan. The oil has a higher boiling point of water so that the water inside the material evaporates [12].

4.3. Protein

The addition of shrimp paste in the manufacture of shrimp paste crackers contributes to the increase in protein levels of shrimp paste crackers. The increase in protein content in shrimp paste crackers comes from the high amount of protein in the shrimp paste which is 33.91%. Protein in shrimp paste comes from the raw material used, namely shrimp rebon.

Protein levels in the core crackers in this study were lower than the commercial cracker protein (shrimp crackers) [10] by 5.53% to 16.17%. That when the heating process occurs, the protein will decompose and cause a decrease in protein levels in the final product of the shrimp paste cracker [13]. In addition, the salt content of the shrimp paste can decrease protein soluble [14]. Water molecules bond strongly with salt, so there is an exciting competition between salt ions and protein molecules against water molecules [15].

4.4. Sensory

In general, the colour of the shrimp pastes crackers in this study is brownish yellow except for T0 because there was no addition of shrimp paste. Based on the results of the analysis, the highest acceptance could be found in formula T1 with an average rating of 4.30, indicating that the colour of the crackers was neither too white nor too brown. The likeness level on each product’s colour was significantly different. The more shrimp paste content, the lower the likeness level for colour. The reason might be because the addition of shrimp paste increase the brown colour. The difference in colour on the shrimp paste crackers can also be caused by the frying process. During the frying process, reactions in amino acid groups in proteins, peptides or amino acids with glycosyl hydroxyl groups are found in sugars [13].

The T0 formula differed noticeably to other formulas, while T1, T2 and T3 had no significant differences. The addition of shrimp paste affects the favourite level of shrimp paste crackers aroma. Another influential factor is the frying process because volatile compounds are formed by being degraded by heat. The distinctive aroma of shrimp paste crackers can be based on the protein content that decomposes into amino acids (glutamate acid), thus causing a distinctive aroma and taste [13]. Glutamate acid includes non-essential amino acids so that it can be self-produced by the human body. Glutamate acid contains glutamate ions that are able to simulate several types of nerves of the human tongue. High levels of glutamate acid found in shrimp paste have the potential to be a component in flavouring seasonings [16].

Shrimp paste addition increased the taste level of likeness, with no difference in formula T2 and T3. The increase in taste likeness assessment in shrimp paste crackers is due to the increasing number of shrimp paste added. According to [17], the addition of kalandue clam meat in each treatment can improve the taste of kalandue crackers. The savoury flavour of shrimp paste crackers can be attributed to the high protein fat content that produces a flavour that can be liked by panellists [18].

The food texture is closely related to the moisture content contained in foods. The expected texture of shrimp paste crackers is crispy. There were significant difference in level of likeness in texture between formulas but T2 and T3. This indicates that the addition of shrimp paste gives different values. The textures provided in T2 and T3 show no difference, both have the same level of coolness according
to the panellists. In accordance with [17] which shows that the texture of crackers produced in kalandue cracker research is rather rough and hollow. The core crackers made in this study are coarse and hollow textured. The frying process in the manufacture of shrimp paste crackers affects the resulting texture. This is due to changes in polymers in proteins, carbohydrates and fats [11].

The assessment of the overall attributes of shrimp paste crackers covers all aspects ranging from colour, the aroma of taste and texture. Crackers that have the taste, colour, aroma typical of raw materials and have the strong flavour, coolness and good texture are among the physical criteria favoured by consumers [17]. Overall, panellists preferred shrimp paste crackers on T3 formulations with 100% tapioca flour and 15% shrimp paste. T3 formulations are also preferred in aroma, texture and flavour attributes while in colour attributes panellists favour T1 formulations with the addition of 5% shrimp paste and 100% tapioca flour. Panellists prefer crackers with a colour level that is not too dark or bright. In the attributes of aroma and taste, panellists prefer formulations with the highest addition of shrimp paste which is 15%. This is because the aroma and taste inflicted on shrimp paste crackers are more dominant.

5. Conclusion

- The addition of shrimp paste up to 15% can increase moisture content of shrimp paste crackers before and after frying as well as the fat and protein content.
- The addition of shrimp paste in cracker darkens the colour. Nevertheless, the best formulation of shrimp paste crackers and favoured by panellists based on sensory analysis results, namely crackers with the addition of 15% shrimp paste and tapioca flour 100%.

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