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Physical analyze and hedonic quality of ilabulo crackers skipjack (*Katsuwonus pelamis*) fortified nano calcium bone

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Abstract. Ilabulo crackers of skipjack fish (*Katsuwonus pelamis*) is one of the traditional food diversification products. The aim of this research in Indonesia was to analyze the physical and hedonic quality of Ilabulo Skipjack Fish Crackers fortified nano calcium bone on a different formula. Physical testing using TA-XT2i and hedonic quality using Kruskall Wallis non-parameter analyze and using SPSS 16 software. The data was using analysis of variance and a significant effect was continued by Duncan test. The results of this research showed physical analyze about the crispness that formulation B higher 17875.7/gf than formulation A 14366.2/gf, formulation C 10142.8/gf and formulation D 4884/gf. All results within different formulas obtained were significantly different. The hedonic quality of formulation A was chosen with the criteria of complete appearance, flat surface, neutral texture, brownish yellow color, slightly fishy and rather savory.

Keywords: crackers. formulation. hedonic quality, organoleptic. physical analyze

1. Introduction

Ilabulo crackers made from skipjack fish (*Katsuwonus pelamis*) have been fortified with nano calcium flour from skipjack fish bone waste. Skipjack fish bone waste when preparing fish meat can be used as bone flour containing calcium. Calcium levels produced in ilabulo crackers of skipjack fish from nano calcium fortification results of skipjack fish bone were 29351.363 ppm higher than the fortification of skipjack fish bone was 16432.131 ppm.

The aim of this paper was to analyze the physical texture and hedonic quality of ilabulo crackers of skipjack fortified nano calcium bone. Diversification of ilabulo crackers of skipjack products that are crispy intact and have nutritional content. especially calcium in the form of nano calcium fortifies from the waste of skipjack fish bones are easily absorbed by the human body.

2. Related works

Generally, calcium consumed by humans contained in food in the form of micro calcium which is still not optimally absorbed by the body so that it still causes calcium deficiency which affects various complaints on the bones, teeth, blood, nerves and body metabolism [1]. The size reduction technology is nanotechnology by producing very small calcium sizes (10 - 1000 nm). Nano calcium can be absorbed directly by the body more optimally and more efficiently compared to the usual calcium consumed by the community [2]. The bioavailability of vannamei shrimp shells (*Litopenaeus vannamei*) is quite high at 63.3% [3]. The 20% fortification of catfish (*Pangasius* sp.) Bone as much as 20% in catfish ilabulo

produces hedonic organoleptic values ranging from like-neutral [4]. Ilabulo products of half wet catfish and chewiness texture but do not last long so that diversification is made into crispy and long-lasting crackers by replacing the raw material of catfish as freshwater fish with a pelagic fish are easily obtained and economically valuable a skipjack fish. The skipjack fish waste produced when making the preparation is made into nano calcium flour as a more optimal fulfillment of calcium intake.

3. Materials and Methods

Figure 1 shows a flow chart ilabulo crackers of skipjack fortified nano calcium bone. The details of materials and methodology are explained.

3.1. The materials

The material used skipjack fish. nano calcium skipjack fish bone, wheat flour, sago flour, spices and coconut milk. The tools used scoresheet SNI 01-2346-2006 about hedonic quality test [5] and the physical used TA-XT2i texture analyzer.

3.2. Preparation

Preparation of skipjack fish included weeding, evisceration and fillet making. Making fish meat based on the method [6] concerning the making of fish pulp, namely fish fillets washed using cold water temperature 5-10°C at three minutes.

3.3. Fish bone flour

Fish bones were boiled at 80°C for 30 minutes, washed and autoclaved at 121°C 1 atm for 30 minutes. The size of 5-10 cm was reduced and dried at 100°C for 60 minutes using an oven. based on the method of [7] modification [4].

3.4. Precipitation method of nano calcium

Precipitation of nano calcium used the modified method [1] with 48 hours of shrimp shell immersion time then nano calcium yield was calculated (%), nano calcium size with SEM, white degree, pH value. Mineral content was measured by AAS and spectrophotometer [8].

3.5. Crackers formulation

The crackers formulation consisted of crushed meat of skipjack fish. nano calcium of skipjack fish bones, wheat flour, sago flour, spices and coconut milk. The mixture was mixed with coconut milk and homogenized for 20 minutes and allowed to stand for two hours until the mixture expands. The mixture was mixed and added water and homogenized for 20 minutes. The dough was flattened with one or two millimeters, thickness and baked in an oven to 25 minutes at 110°C [9].

3.6. Formulation and optimization of ilabulo skipjack fish crackers fortified nano calcium bone

Formulation and optimization of ilabulo crackers of skipjack fortified nano calcium bone. The formulation and optimization of ilabulo crackers of skipjack fortified nano calcium bone based on trial and error to obtain the best formulation by organoleptic tests of hedonic quality.

Table 1. Formulation of ilabulo crackers of skipjack.

Material	Treatment material composition			
	A	B	C	D (control)
Skipjack fish meat (g)	500	500	500	500
Nano calcium (g)	20	20	20	20
Wheat flour (g)	500	250	100	-
Sago flour (g)	50	50	50	50
Seasoning (g)	20	20	20	20
Sugar (g)	50	50	50	50
Salt (g)	10	10	10	10
Coconut oil (mL)	500	500	500	500
Cooking oil (mL)	50	50	50	50

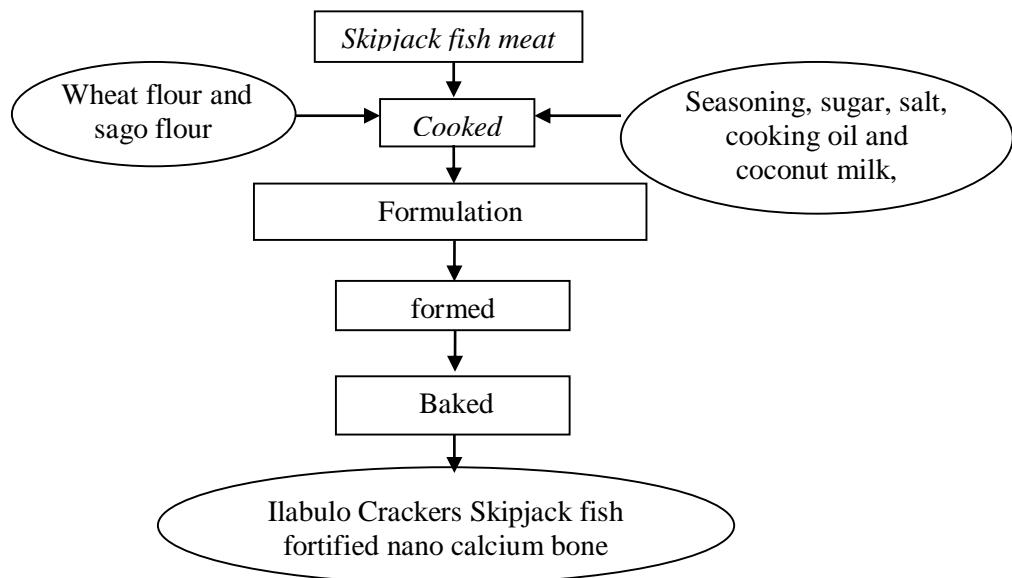


Figure 1. Flow chart ilabulo crackers of skipjack fortified nano calcium bone.

Physical analyze (*crispness*) Ilabulo Skipjack Fish Crackers fortified nano calcium bone using TA-XT2i texture analyzer [10]. The crisp value is calculated using the formula:

$$\text{Crispness (g cm)} = \text{gel force (gf)} \times \text{distance (cm)} \quad (1)$$

Ilabulo skipjack fish crackers fortified nano calcium bone were then performed for hedonic quality (SNI 01-2346-2006) based on Kruskal Wallis non-parametric statistics. Significantly different was used Duncan test. Hedonic quality analyze using SPSS 16 software.

4. Results and Discussion

4.1. Physical analyze of ilabulo skipjack fish crackers fortified nano calcium bone

The data physical analyze of ilabulo crackers of skipjack fortified nano calcium bone.

Table 2. The result physical analyze of ilabulo crackers of skipjack fortified nano calcium bone.

Replication	A (gf)	B (gf)	C (gf)	(control) (gf)
1	4746.7	5746.8	3355.3	1648
2	4959.7	5960.4	3382.8	1632
3	4659.8	6168.5	3404.7	1604
Average	14366.2	17875.7	10142.8	4884

The highest physical texture value an addition wheat flour 250 g was 17875.7/gf (B) and the lowest a control without nano calcium treatment and wheat flour which was 4884/gf. Physical analyze was the crispness of ilabulo crackers of skipjack fortified nano calcium bone was B formulation because the addition of wheat flour is not too much. Whereas in the control treatment the value a crispness ilabulo crackers were low because only addition of sago flour. The crispness of ilabulo crackers of skipjack fortified nano calcium bone is thought to be due to the different starch content in wheat flour and sago flour which also influences the crispness level of ilabulo crackers of skipjack fish fortified nano calcium bone.

The results of the analysis of variance data show that each formula had a significant effect and the results of Duncan's test further show that each formula is significantly different. The results analyze the hedonic quality of ilabulo crackers of skipjack fortified nano calcium bone.

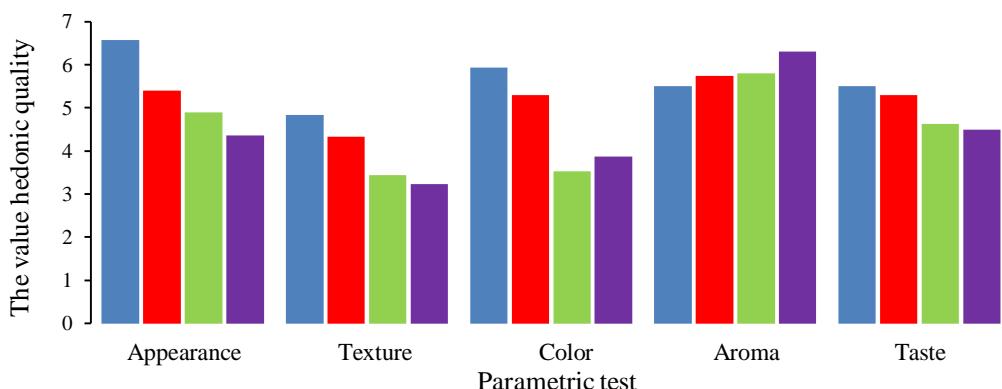


Figure 2. Histogram of hedonic quality analyze of ilabulo skipjack fish crackers fortified nano calcium bone on different formulas (■ A ■ B ■ C ■ D).

The highest hedonic quality of the appearance among the ilabulo crackers was formulation A. The surface was flat with an appearance hedonic value of 6.57 (figure 2). Formulation D had the lowest hedonic value of the appearance, which was 4.83. The Kruskal-Wallis test showed that the appearance of ilabulo skipjack fish crackers fortified nano calcium bone with different formulations showed significant results ($p<0.05$). Based on Duncan's further test results obtained that formulation A was significantly different from formulation B, C and D. The highest value of the hedonic quality texture of ilabulo skipjack fish crackers fortified nano calcium bone is a formulation A. neutral criteria with a value of 4.83 and the lowest was a formulation D with rather harsh criteria with a value of 3.23. The Kruskal-Wallis test showed the texture of ilabulo skipjack fish crackers fortified nano calcium bone showed that all four formulation significant results ($p<0.05$). Based on the results of Duncan's test, it was found that formulation A was significantly different from formulation C and D. The panelists preferred formulation A because the addition of the same flour composition with crushed meat produces non-hard crackers. The highest color hedonic quality analyze results in formulation A with criteria of brownish yellow with a value of 5.93 and the lowest was a formulation D with aslightly brownish criteria with a value of 3.87. Based on the Kruskal-Wallis test that the color of ilabulo crackers of skipjack fish fortified nano calcium bone showed significant results ($p <0.05$). Duncan's further test results showed that formulation A was significantly different from C and D but not significantly different formulation B. This was due to the fortification of nano calcium bone which also influenced the color of the ilabulo crackers in the roasting process.

The treatment process during heating and roasting also contributed to the formation of color, namely the *Maillard* reaction. The *Maillard* reaction is an enzymatic browning non reaction that occurs between reducing genes with amino acids that produce brownish color in food ingredients when experiencing a heating process.

The hedonic quality of aroma of ilabulo skipjack fish crackers fortified nano calcium bone obtained the highest value in formulation D with fish scented quality criteria with a value of 6.30 and the lowest was formulation A slightly fish scented criteria with a value of 5.50. The results of Kruskal Wallis analyses showed that all formulations had a significant effect. Duncan's test results showed formulation A was significantly different formulation D.

The formulation was significantly different due to the difference in the composition of wheat flour. Aroma of ilabulo skipjack fish crackers derived from raw material skipjack fish and nano calcium bone although with addition of the same seasoning. In addition due to the processing including beaking who contribute to the aroma of ilabulo skipjack fish crackers fortified nano calcium bone.

The highest taste hedonic quality analyze in a formulation A with a slightly fishy. slightly savory criteria with a value of 6.30 and the lowest in a formulation D with neutral criteria with a value of 4.50. The

results of Kruskal Wallis analysis showed that all formulations had significant effect. Duncan's test results showed formulation A was significantly different formulation C and D.

5. Conclusion

The results that presented in this research that ilabulo skipjack fish crackers fortified nano calcium bone were the highest physical texture was formulation B 17875.7 /gf and the lowest in control treatment was 4884 /gf. The hedonic quality analysis have found formulation A as the selected formula the criteria of appearing intact, flat surface, neutral texture, brownish yellow colour, slightly flavorful fish aroma and somewhat tastefully.

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