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Optimization of the Flour Formulation of Crispy Fried Soft Shell Crab Products using the Mixture Design Method

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Abstract— Crispy fried soft-shelled crab products are soft-shelled crabs that are coated with flour and then fried and dried until crispy. The type and formulation of flour used greatly influences the level of crispiness of crispy products. This research aims to determine the best flour formulation as a result of optimization for crispy fried soft-shelled crab products. The research method employed was the mixture design and de Garmo methods. The test parameters in this study were the hedonic sensory evaluation by 10 trained panelists, the significant difference test, and the productivity test which were carried out in 3 replicates. The results showed that optimization of flour formulations could improve the sensory quality of crispy fried soft-shelled crab products. The flour optimization treatment had a significant effect on the parameters of appearance, texture, crispiness and overall acceptability (p-value <0.05), while the optimization treatment did not have a significant effect on the parameters of taste, smell and color ((p-value> 0.05 The best optimized flour formulation for crispy fried soft shell crab products has a composition of 72.5% wheat flour, 10% rice flour and 17.5% cornstarch with a productivity value of 0.86.

Keywords— Fried Soft Shell Crab, Flour Formulation, Mixture Design.

I. INTRODUCTION

Fishery products with crispy texture (crispy) are processed products with fish raw materials which undergo a process of adding spices and flour and then frying until crispy at a predetermined temperature and time (SNI 7760:2013). Crispy fried soft-shelled crab products are soft-shelled crabs that are added with flour and then fried and dried until crispy. The processing of soft shell crabs starts with washing and removing the crab's eyes, mouth, abdomen and gills so that they are safe for consumption. The eyes, mouth and abdomen of the crab are removed using scissors, while the gills are taken slowly by hand by opening the crab shell (Smith B, 2015). The fishy smell of soft shell crabs can be removed by marinating them with lime juice for ± 15 minutes (Putri, 2019).

Crispy fried soft-shelled crabs generally undergo a processing process by adding dipping flour or eggs after cleaning, then coating with flour. Soft-shelled crabs that have been coated with flour are then fried until cooked and golden yellow. The fried soft shell crabs are then drained and served warm with additional sauce (Putri, 2019). Fried soft shell crab is one of the superior products in Tarakan City, East Kalimantan Province, Indonesia which is often used as souvenirs by regional specialties. This product is sold at IDR 85,000 in a carton containing 3 fried soft-shelled crabs (Florensia et al., 2017).

The type and formulation of flour used greatly influences the level of crispiness of crispy products. This type of low protein flour can absorb air and water better so that the product becomes soft and crunchy. In making crispy flour, wheat flour can function as a dyeing flour and as a final coating flour. Corn starch has a character that dissolves easily in water but is less able to hold water in the product. The use of corn starch as crispy flour is very effective when mixed with wheat flour because it can reduce the puffy (tender) taste so it is more recommended as dipping flour. The use of rice flour in crispy flour is intended to make the product crispy, easy to bite and can reduce wrinkles on the product surface. The use of rice flour as crispy flour is mixed with wheat flour and applied as dye flour (A Yuyun, 2011).

Sensory quality of crispy seafood products can be proven by the resulting delicious taste, level of crispiness and attractive product shape. One of the determining factors in determining sensory quality is the composition of the crispy flour used (Amar, 2019). Evaluation of crispy products by consumers tends to prioritize the level of crispiness produced from flour and the frying method (Puspitasari D, 2020). Soft shell crab is a fishery product with important economic value that can be developed for various processed products (Akbarsyah & Permadi, 2021) (Arthatiani et al., 2014). Based on this description, optimization of the right flour formulation needs to be done to get the acceptable quality of crispy soft-fried soft crab products in accordance with consumer expectations.

II. Material And Methods

The processing of crispy soft-fried soft-shelled crab products was carried out at the Ladong Intermediate Fisheries Business School (SUPM) Processing Workshop. The hedonic sensory evaluation activity was carried out at the Regional Technical Implementation Unit (UPTD) for Testing and Application of Quality of Fishery Products (PPMHP) Aceh Province, Indonesia. The equipments used were knives, scissors, cutting boards, electric deep fryers with temperature control, mixers, cutting boards, baskets, cell phones, hedonic sensory evaluation scoresheets (Appendix 2) and stationery.

The main ingredient used was frozen soft-shelled crab cultivation which was determined by means of a standard deviation with a weight of 140 gr ± 10 gr (Appendix 1). The raw material specifications were whole frozen soft shell crabs with complete organs. The size of soft shell crabs was influenced by the size of the seeds cultivated, soft shellcrab cultivators in Banda Aceh City generally use seeds measuring < 150 grams because at that size the moulting process can take place quickly and can avoid mortality (Iromo et al., 2019). The raw material was thawed for ± 15 minutes before being used by aerating at room temperature. Additional materials used were low protein wheat flour, rice flour, cornstarch, cooking oil, spices, salt, sugar, clean water, oil drying tissue and packaging.

The research was conducted using the mixture design method to determine the optimal flour formulation for a product. The sum of variables in formula design must always be 1 or 100 (Irianto & Giyatmi, 2021). The composition of the crispy flour formula is presented in Table 1.

Table 1. Composition of Crispy Flour Formula

NO	Composition	Total (gr)	Percentage (%)
1	wheat flour	250	25
2	Rice flour	50	5
3	Cornstarch	100	10
4	Baking soda ½ tsp	2	0,2
5	Powdered milk 1 tbsp	10	1
6	Garlic 2 cloves	20	2

7	Black pepper ½ tsp	2	0.2
8	Cold water	400	40
9	Salt	10	1
10	Sugar	25	2.5

Source: A, Yuyun, 2011

The total amount of wheat flour, rice flour and cornstarch as the main constituents of crispy flour was 40% (400 gr). The composition of flour in percentage 100 % was as follows:

Wheat Flour : (25/40) x 100 = 62.5 %

Rice Flour : (5/40) x 100 = 12.5 %

Maizena Flour : (10/40) x 100 = 25 %

The design of the mixture design method was carried out by determining the lower limits and upper limits of the variables to be formulated by making the basic formula the initial basis (Irianto & Giyatmi, 2021). Wheat flour was the main factor in making crispy flour, therefore the upper and lower limits were increased and decreased by 10%. Rice flour and cornstarch were additional flours that function to increase the crispiness and thickness so that the upper and lower limits were increased and decreased by 5%. The design of the crispy mixture flour formulation design 1 was presented in Table 2.

Table 2. Crispy Mixture Design Flour Formulation Design 1

No	Ingredients	Lower limit (%)	Recipe (%)	Upper limit (%)
1	wheat flour	52.5	62.5	72.5
2	Rice flour	7.5	12.5	17.5
3	Cornstarch	20	25	30

Mixture design method can be done by involving two or more components. The spatial dimension describing the mixture is called the simplex which is wider with the increasing number of components involved. Mixed profiles that depict a straight line indicate the two components involved while those that depict a triangle indicate the three components involved (Azizah et al., 2018). The area of the mixture design is determined from the intersection point of the formulation design (Irianto & Giyatmi, 2021). The area of mixture design 1 is presented in Figure 1.

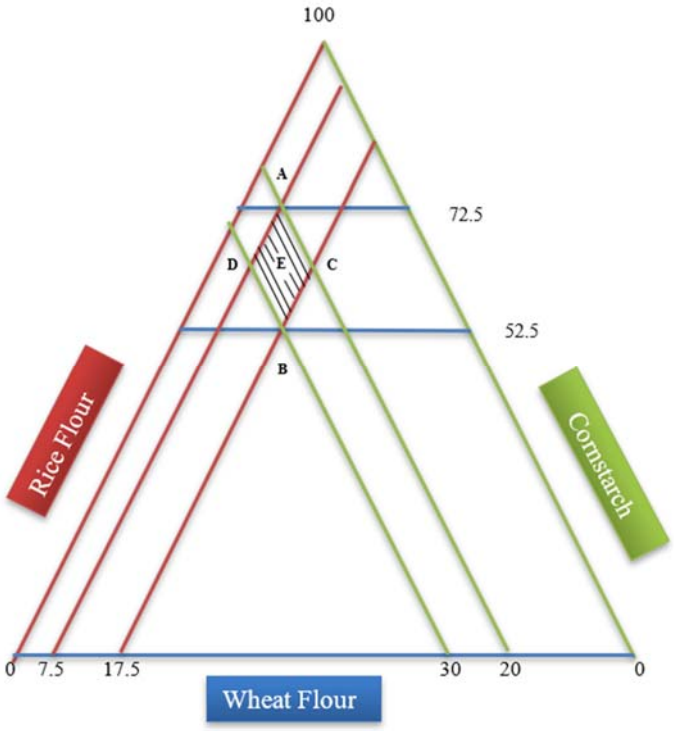


Figure 1. Mixture Design Area 1

Based on the combination of intersection points between the 3 variables, i.e. wheat flour, rice flour and cornstarch, the crispy flour formulation design (%) was as follows

Formulation A: 72.5% wheat flour, 7.5% rice flour, and 20% cornstarch

Formulation B: 52.5% wheat flour, 17.5% rice flour, and 30% cornstarch

Formulation C: 62.5% wheat flour, 17.5% rice flour, and 20% cornstarch

Formulation D: 62.5% wheat flour, 7.5% rice flour, and 30% cornstarch

The total crispy flour used in 1 kg of raw material was 400 gr, so the composition of the formulation was as presented in Table 3.

Table 3. Composition and Proportion of Crispy Flour Formulation

No	Crispy Flour	Composition (gr) and Portions			
		A	B	C	D
1	Wheat flour	290 gr (high)	210 gr (low)	250 gr (medium)	250 gr (medium)
2	Rice flour	30 gr (low)	70 gr (high)	70 gr (high)	30 gr (low)
3	Cornstarch	80 gr (low)	120 gr (high)	80 gr (low)	120 gr (high)
	Total	**400 gr**	**400 gr**	**400 gr**	**400 gr**

The results of sensory evaluation of the mixture design 1 underwent an effect study by comparing the effects of each formulation. The results of the analysis obtained were used as a basic developing mixture design 2 by adjusting the upper and lower limits of the main components forming the flour formulation. The study was carried out with three repetitions (Irianto et al., 2017). The stages of the processing of crispy soft shell crabs are receiving raw materials, removing eyes, gills and abdomen, cutting, washing,

marinating ± 15 minutes, dipping and coating with crispy flour, deep frying, draining and packaging (Smith B, 2015) (Putri, 2019) (Florensia et al., 2017).

The research parameters were hedonic sensory evaluation for parameters of appearance, smell, taste, texture, crispiness, color and overall acceptance of crispy soft-fried soft-shelled crab products using various flour formulation. The hedonic sensory evaluation involved 10 trained panelists from UPTD PPMHP Aceh Province who were determined based on their educational background, work experience and sensory evaluation training (Rahayu et al., 2019) (Appendix 3). The sensory evaluation method was carried out based on Indonesian National Standard (SNI) 2346:2015. The results obtained are then calculated using the following formula:

$$P\left(\tilde{x} - \left(1{,}96.\frac{s}{\sqrt{n}}\right)\right) \leq \mu\left(\tilde{x} + \left(1{,}96.\frac{s}{\sqrt{n}}\right)\right) \cong 95\%$$

$$\bar{x} = \frac{\sum_{i=1}^{n} xi}{n}$$

$$S^2 = \frac{\sum_{i=1}^{n}(x_i - \bar{x})}{n}$$

$$S = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \tilde{x})}{n}}$$

Information:

n = Panelist

S^2 = Diversity of quality values

1,96 = Standard deviation coefficient at 95% level

$\bar{x}$ = Average quality value

x_i = Quality value from panelist i, I = 1,2,3,…. N

s = Standard deviation

The effect of the formulation on each test parameter was analyzed using the Analysis of Variance (ANOVA) method at a 95% confidence level with the Statistical Product and Service Solutions (SPSS) software Version 26. Determination of the best flour formulation as a result of optimization was carried out by determining the value of productivity using the de Garmo method. where each parameter was given a weight rating according to importance. The weight value determined the effectiveness index of each formulation which could determine the final value (productivity value). The calculation of the de Garmo test method was as follows (Diniyah et al., 2014):

$$\text{BNP} = \frac{\text{BN}}{\text{BNT}}$$

$$\text{NE} = \frac{\text{Treatment Value} - \text{Lowest Value}}{\text{Highest Treatment Valuei} - \text{Lowest Treatment Value}}$$

$$\text{NP} = \text{BNP x NE}$$

Information:

BNP = Parameter Value Score

BN = Value Score

BNT = Total Value Score

NE = Effectiveness Value

NP = Productivity Value

The best treatment from the de Garmo method refers to the highest productivity value in each formulation. The productivity value obtained describes the average value of the relationship with the weight value and sensory quality value of each formulation (Nastiti et al., 2014).

III. Results And Discussion

Sensory Quality of Mixture Design 1

The sensory quality of crispy fried soft-shelled crab products produced from the flour formulation in mixture design 1 can be seen in Table 4.

Table 4. Total Average Score of Sensory Mixture Design Test 1

No	Sensory evaluation Parameters	Average Score of Each Formulation			
		A	B	C	D
1	Apparition	7.19	6.27	6.64	6.56
2	Smell	7.02	6.91	6.99	6.92
3	Taste	6.99	6.98	6.95	7.03
4	Texture	7.22	6.14	6.55	6.44
5	Crisp	7.02	6.10	7.10	6.35
6	Colour	6.96	6.91	7.01	6.94
7	General Acceptance	7.10	6.53	6.88	6.89
Average Total		**7.07**	**6.51**	**6.87**	**6.69**

Based on the average score, formulation A had the highest score in terms of appearance, smell, texture, and general acceptability. Wheat flour was the largest proportion in this formula. The nature of wheat flour which is not easily soluble in water due to the complex starch can make the flour crispy on the surface of the product more evenly so that the appearance and texture of the product is better (A Yuyun, 2011). Formulation B did not have a striking sensory score for each parameter. This was presumably due to the low use of wheat flour and the use of high proportions of cornstarch. The use of cornstarch in crispy food was very good when it was mixed with wheat flour in small amounts. Excessive cornstarch tended to make the product hard and break easily when bitten (A Yuyun, 2011)

Formulation C had the highest sensory score on the crispiness and color parameters. This fact was allegedly due to the use of rice flour in high quantities. Rice flour was a type of flour that did not contain gluten, so its main function was to increase the crispiness of the product. The nike fish savory chips product with the formulation of rice flour and tapioca (2:1) was a product that is preferred by the panelists with the characteristics of a crunchy texture and brownish yellow color (Yusuf et al., 2012). The amount of rice flour used in formulation C was the same as in formulation B, but formulation C had a better crispiness level, presumably because the amount of cornstarch used is in a small proportion. The use of cornstarch in large quantities can cause the amylose and amylopectin contained to easily absorb and release water content, making the product compact and difficult to break (Karin Karjo et al., 2015).

Formulation D had the highest sensory score on the taste parameter. This occurrence was presumably due to the use of high cornstarch. Cornstarch had the ability to form a thick gel because it contained amylopectin and amylose so that it could maintain the natural taste of the additional spices given to the flour (A Yuyun, 2011). The taste of fried-based products is

generally influenced by the absorption of oil in the product. Amylose contained in cornstarch is able to absorb oil better so that it can increase the savory taste of fried products (Karin Karjo et al., 2015)

The sensory evaluation results on mixture design 1 showed that the effect of using wheat flour and rice flour was very decisive for each parameter, especially the parameters of appearance, texture, crispiness, and overall acceptability, while for the parameters of smell, taste and color the difference between the highest and lowest scores was not too wide. This can be seen in the difference in the sensory score of each parameter presented in Table 5.

Table 5. The Difference in The Score of The Sensory Evaluation Results for Each Parameter

No	Sensory Evaluation Parameters	Sensory Evaluation Average Score		
		The highest score	Lowest Score	Difference
1	Apparition	7.19	6.27	0.92
2	Smell	7.02	6.91	0.11
3	Taste	7.03	6.99	0.04
4	Texture	7.22	6.14	1.08
5	Crisp	7.10	6.10	1.00
6	Colour	7.01	6.91	0.33
7	Overall Acceptance	7.10	6.53	0.57

Analysis of sensory evaluation results on mixture design 1 showed that panelists tended to like the appearance, texture, and crispiness of products given by the high amounts of wheat flour and rice flour formulations, while using low amounts of corn starch. Based on the results of the analysis, a mixture design 2 formulation was carried out with a combination of increasing the lower limit of wheat flour by 57.5% and rice flour by 10%, while the upper limit remained. The upper and lower limits of cornstarch were reduced to 25% and 17.5%. The composition selection aimed to increase the composition of wheat flour and rice flour and reduce the composition of cornstarch with the same number of formulations, i.e. 400 gr.

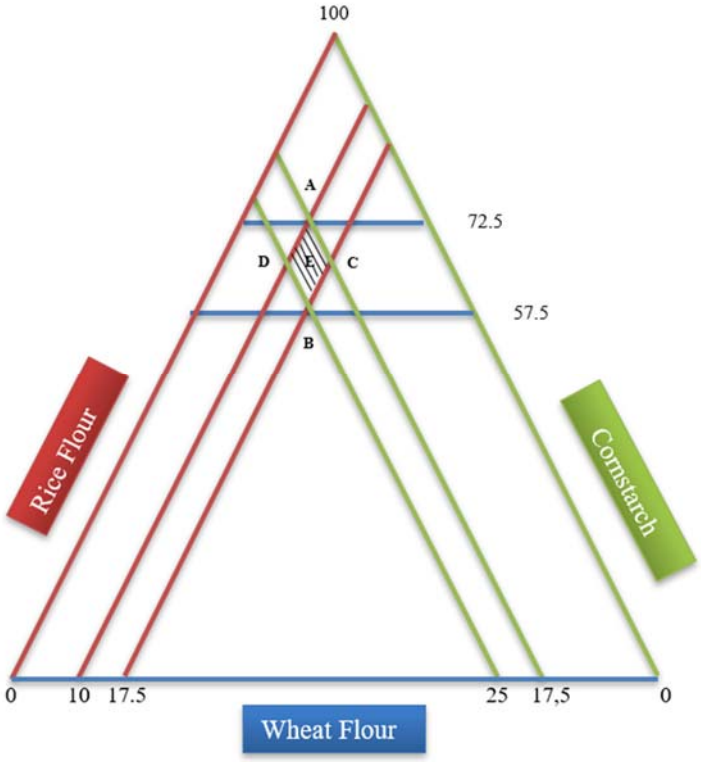
Mixture Design 2 of Flour Formulation

Mixture design 2 was an optimization stage that was carried out based on an effect study from mixture design 1. Mixture design 2 added one additional formulation which was the center point area of the entire formulation (center point). The addition of the center point (E) formulation added an alternative optimization of crispy flour formulation in determining the best formula. The design of the mixture design 2 formulation can be seen in Table 6

Table 6. Crispy Mixture Design 2 of Flour Formulation Design 2

No	Ingredients	Lower limit (%)	Center Point (%)	Upper limit (%)
1	Wheat flour	57.5	65	72.5
2	Rice flour	10	13.75	17.5
3	Cornstarch	17.5	21.25	25

The area of mixture design 2 could be seen from the point of intersection of the formulation design which can be seen in Figure 2.



Gambar 2. Area *Mixture Design* 2

Formulation of mixture design 2 based on Figure 2 is as follows:

Formulation A: 72.5% wheat flour, 10% rice flour, and 17.5% cornstarch

Formulation B: 57.5% wheat flour, 17.5% rice flour, and 25% cornstarch

Formulation C: 65% wheat flour, 17.5% rice flour, and 17.5% cornstarch

Formulation D: 65% wheat flour, 10% rice flour, and 25% cornstarch

Formulation E: 65% wheat flour, 13.75% rice flour, and 21.25% cornstarch

The total crispy flour used in 1 kg of raw material is 400 gr, so the composition of the mixture design 2 formula can be seen in Table 7.

Table 7. Composition and Proportion of the Mixture Design 2 of Flour Formulation

No	Tepung *Cripsy*	Composition (gr) and Portions				
		A	**B**	**C**	**D**	**E**
1	Wheat flour	290 gr (high)	230 gr (Low)	260 gr (medium)	260 gr (medium)	260 gr (medium)
2	Rice flour	40 gr (Low)	70 gr (high)	70 gr (high)	40 gr (Low)	55 gr (medium)
3	Cornstarch	70 gr (Low)	100 gr (high)	70 gr (Low)	100 gr (high)	85 gr (medium)
	Total	**400 gr**	**400 gr**	**400 gr**	**400 gr**	**400 gr**

Quality Sensory of Mixture Design 2

The sensory quality of crispy fried soft-shelled crab products produced from the flour formulation in mixture design 2 can be seen in Table 8.

Table 8. Average Sensory Score of Mixture Design Test 2

No	Sensory evaluation Parameters	Average Score of Each Formulation				
		A	B	C	D	E
1	Apparition	7.43	6.48	6.97	6.83	7.30
2	Smell	7.30	7.17	7.30	7.19	7.19
3	Taste	7.42	7.35	7.24	7.32	7.50
4	Texture	7.38	6.53	7.10	6.70	7.30
5	Crisp	7.30	6.19	7.55	6.75	7.25
6	Colour	7.30	7.20	7.31	7.10	7.38
7	Overall Acceptance	7.42	6.53	7.02	7.06	7.19
	Average Total	**7.36**	**6.78**	**7.21**	**6.99**	**7.30**

Based on Table 8, formulation A had the highest sensory score in terms of appearance, smell, texture and general acceptance. Formulation A was the formula with the highest sensory evaluation score. The optimization carried out increased the sensory score of formulation A from 7.01 to 7.36. Formulation B did not have a striking score on any sensory evaluation parameters, but the optimization treatment gave an increase in sensory score from 6.51 to 6.78. Formulation C has the highest score in the crispiness parameter. The optimization treatment gave an increase in the sensory evaluation score of formulation C from 6.78 to 7.21.

Formulation D did not have a striking score for each sensory evaluation parameter, but the optimization treatment increased the sensory score of formulation D from 6.69 to 6.99. Formula E was the center point treatment formula which had the highest score in taste and color parameters. The average score of the formula E was 7.30. Optimization treatment could be carried out on the formulation of ingredients in a product to determine the optimal treatment so that it could directly improve product quality (Montgomery, 2013).

Based on Table 2.8, formulations A, C and E had final sensory scores that were not too different. The sensory score of formulation A was 7.36. Formulation C was 7.21 and Formulation E was 7.30. The closeness of the sensory scores obtained could affect the determination of the best formulation, so an analysis of the effect of treatment on sensory evaluation parameters was carried out.

Effect of Flour Formulation Optimization on Sensory Evaluation Parameters

The results of the ANOVA analysis on the sensory scores for the crispy soft-fried soft-shelled crab product can be seen in Table 9.

Table 9. ANOVA Analysis Results for Each Sensory Parameter

ANOVA					
Parameters	**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
Apparition	1.702	4	0.425	43.864	0.000
Smell	0.051	4	0.013	0.941	0.479
Taste	0.121	4	0.030	1.932	0.182
Texture	1.656	4	0.414	43.529	0.000
Crisp	3.483	4	0.871	105.411	0.000
Colour	0.141	4	0.035	1.689	0.228
Overall Acceptance	1.286	4	0.322	25.370	0.000

Based on Table 9, flour formulation optimization had a significant effect on parameters of appearance, texture, crispiness and overall acceptability where the p-value was <0.05. Optimization of flour formulation had no significant effect on odor, taste and color parameters where the p-value was > 0.05.

The flour formulation had a significant effect on the appearance parameters thought to be due to differences in the product shapes observed by the panelists. Flour formulation affected the viscosity and adhesion to the product. The thicker the flour formula, the stronger the adhesion. A flour formulation that was too thick caused the shape of the product to become unclear, while a flour formulation that was too runny will easily come off when fried. Flour formulations in fried-based food products affected the shape of the final product so that it could affect the panelist's assessment (Tauhidiyah & Ismawati, 2019)

The flour formulation had no significant effect on the odor parameters presumably because the dominant odor evoked by the product was the specific smell of crab with additional seasonings in each formulation. The addition of ingredients with the same composition to crispy flour made the flour smell relatively the same in each end product. The specific smell of fresh crabs has a characteristic sea and brackish smell which is influenced by their habitat in the mangrove trees along the coastline. This area is muddy brackish waters that allows microorganisms as a food source for crabs to grow rapidly. (Iromo et al., 2021). In the process, the brackish smell of the crab can be removed by the washing process, but the sharp sea odor remains even though it is washed and processed (Putri, 2019). The addition of spices can affect the aroma of the product because of the volatile compounds contained in it so that it can increase consumer attractiveness (Jamaluddin, 2018)

The flour formulation had no significant effect on the taste parameters presumably because the panelists judged that the most dominant flavor that appeared in the product was the savory taste of the crab and the additional ingredients given. This factor is mainly due to the additional ingredients composition, method, temperature and frying period used the same in each formulation. Fried products made using the deep frying method produce a juicy and savory taste on the inside (Pudjihastuti et al., 2019). The different frying period demonstrated a different effect on the taste of dragon leg products (Nugroho et al., 2014).

The flour formulation had a significant effect on the texture parameters presumably due to differences in the distribution of crispy flour and lumps that occurred in several areas on the product surface. Flour clumping can occur due to the water absorption and the less fine flour texture . High protein flour has the ability to retain water in the product, thus allowing lumps to form on the surface. Clumping can be avoided if low-protein wheat flour is used in frying-based products. (A Yuyun, 2011) (Zaqie et al., 2018)

The flour formulation did not significantly affect the color parameter, presumably because the panelists assessed that the most dominant color appearing in the product was brownish yellow (buff) in each formulation. This occurrence was due to the deep-frying temperature period employed in each formulation was the same, i.e. 1700 C for 15 minutes. The buff color of the crispy fried soft shell crab product was brought about by a combination of the blackish brown color of the crab carapace and

crispy flour. This color appeared when the product underwent an even and uniform frying process (Pudjihastuti et al., 2019). The living habitat of crabs which are found in mud areas causes the crab shells to have a brown or black color (Iromo et al., 2021).

The flour formulation had a significant effect on the crispiness parameter, presumably because the panelists evaluated that there was a difference in the degree of crispiness of the product when bitten, some crumbled in the mouth when bitten and some needed several bites. This fact was due to the influence of the composition of wheat flour, rice flour and cornstarch as the main constituents of crispy flour given in different amounts in each formulation. The crispiness of fried products could be determined through the flour formulation, and the results revealed that there was a significant effect of the flour formula on the crispiness of the final product (Tauhidiyah & Ismawati, 2019).

The flour formulation had a significant effect on the overall acceptance parameter. The panelists probably observed that there was overall differences in the product. The crispy flour formulation produced a product that immediately made the panelists wanted to consume it again and not want to enjoy it again. This occurrence was probably due to the significant differences in the appearance, texture and crispiness of the product.

Determination of the Best Flour Formulation

The best flour formulation were determined using the de Garmo test by assessing the weight of each sensory evaluation parameter and the effectiveness value until the final value (productivity) was found for each formulation (Nuryahyani et al., 2022). The range of weight values was adjusted for the number of sensory evaluation parameters, in which the lowest value was 1 and the highest value was 7. Based on Table 2.10, the crispiness parameter is the highest value chosen by the panelists, i.e. 0.24 while the lowest value is the overall acceptance parameter of 0.04. The productivity value of flour formulation can be seen in Table 10.

Table 10. Productivity Value of Crispy Flour Formulation

Parameters	Score value	Value of Effectiveness and Productivity of Each Formula									
		Formula A		Formula B		Formula C		Formula D		Formula E	
		NE	NP	NE	NP	NE	NP	NE	NP	NE	NP
Apparition	0.14	1.00	0.14	0.00	0.00	0.52	0.07	0.37	0.05	0.86	0.12
Smell	0.14	1.01	0.14	0.00	0.00	1.04	0.14	0.19	0.03	0.18	0.03
Taste	0.21	0.70	0.15	0.44	0.09	0.00	0.00	0.30	0.06	1.00	0.21
Texture	0.13	1.00	0.13	0.00	0.00	0.67	0.09	0.20	0.03	0.91	0.12
Crisp	0.24	0.82	0.20	0.00	0.00	1.00	0.24	0.41	0.10	0.78	0.19
Colour	0.10	0.73	0.07	0.34	0.03	0.74	0.07	0.02	0.00	1.00	0.10
Overall Acceptance	0.04	1.00	0.04	0.00	0.00	0.55	0.02	0.60	0.03	0.75	0.03
Average Total		**6.25**	**0.86**	**0.79**	**0.13**	**4.51**	**0.64**	**2.08**	**0.29**	**5.48**	**0.79**

Note: NE: Effectiveness Value, NP: Productivity Value.

The results of the de Garmo test showed that there were differences in the productivity value of each crispy flour formulation. Formula A was the best flour formula for crispy fried soft-shelled crab products with a productivity value of 0.86. The composition of flour in formula A was 72.5% wheat flour, 10% rice flour, and 17.5% cornstarch with a combination of using high amounts of wheat flour, low amounts of rice flour and low amount of cornstarch. The productivity value of a formula is an indicator of the weight generated from the given effectiveness index, the higher the effectiveness index, the higher the productivity value produced (Diniyah et al., 2014)

IV. CONCLUSION

Optimization of flour in each formula could improve the sensory quality of crispy soft shell crab products. The formulation of flour in crispy fried soft-shelled crab products had a significant effect on appearance, texture, crispiness and overall acceptance. The formulation had no effect on the taste, smell and color of the product. The best crispy flour formulation consisted of 72.5% wheat flour, 10% rice flour, and 17.5% cornstarch with a formulation effectiveness value of 6.25 and a productivity value of 0.86.

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