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The Effect of *Eucheuma cottonii* Seaweed Flour Addition on the Preference Level of Dogol Shrimp Nuggets

Pengaruh Penambahan Tepung Rumput Laut *Eucheuma cottonii* pada Tingkat Preferensi Nugget Udang Dogol

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ABSTRACT

This study aims to determine the effect of adding *Eucheuma cottonii* seaweed flour on the preference level of dogol shrimp (*Metapenaeus monoceros*) nuggets. Dogol shrimp nuggets have high protein content but are low in fiber, so adding seaweed flour as a dietary fiber source is expected to improve the nutritional value and product quality. The research used an experimental method with four treatments of seaweed flour addition to dogol shrimp nuggets: 0% (control), 1.5%, 2.5%, and 3.5%. Hedonic testing was conducted with 25 semi-trained panelists as replicates to evaluate sensory attributes (color, aroma, taste, and texture). Based on panelist preference level and Bayes test results, the priority product was subsequently analyzed through proximate analysis (moisture, protein, fat, and ash), crude fiber content, and texture testing (Texture Profile Analysis). The research showed that adding seaweed flour significantly affected the increase in fiber content. The treatment with 1.5% seaweed flour addition was the best treatment with moisture content values of 61.11%; protein 8.47%; ash 1.84%; fat 1.78%; crude fiber 2.15%; and texture analysis values of hardness 4,315.7523 gForce; fracturability not detected; springiness 0.8487%; cohesiveness 0.5813%; gumminess 2,500.1247 gForce; chewiness 2,110.6553 gForce; and resilience 0.2553%. The addition of *Eucheuma cottonii* seaweed flour to dogol shrimp nuggets can serve as an innovation in developing healthier fishery product processing that consumers prefer.

Keywords: Dogol shrimp nugget, *Eucheuma cottonii*, Seaweed flour.

ABSTRAK

Penelitian ini bertujuan untuk mengetahui pengaruh penambahan tepung rumput laut *Eucheuma cottonii* terhadap tingkat preferensi nugget udang dogol (*Metapenaeus monoceros*). Nugget udang dogol memiliki kandungan protein yang tinggi namun rendah serat, sehingga penambahan tepung rumput laut sebagai sumber serat makanan diharapkan dapat meningkatkan nilai gizi dan kualitas produk. Penelitian menggunakan metode eksperimental dengan empat perlakuan penambahan tepung rumput laut pada nugget udang dogol: 0% (kontrol), 1,5%, 2,5%, dan 3,5%. Pengujian hedonik dilakukan dengan 25 panelis semi terlatih sebagai replika untuk mengevaluasi atribut sensorik (warna, aroma, rasa, dan tekstur). Produk prioritas berdasarkan tingkat preferensi panelis dan hasil pengujian Bayes kemudian dianalisis melalui analisis proksimat (kadar air, protein, lemak, dan abu), kandungan serat kasar, dan pengujian tekstur (Analisis Profil Tekstur). Hasil penelitian menunjukkan bahwa penambahan tepung rumput laut berpengaruh signifikan terhadap peningkatan kandungan serat. Perlakuan dengan penambahan tepung rumput laut 1,5% merupakan perlakuan terbaik dengan nilai kadar air sebesar 61,11%; protein 8,47%; abu 1,84%; lemak 1,78%; serat kasar 2,15%; dan nilai analisis tekstur kekerasan 4.315,7523 gForce; fraktabilitas tidak terdeteksi; kenyal 0,8487%; kohesivitas 0,5813%; gumminess 2,500.1247 gForce; kenyal 2.110,6553 gForce; dan ketahanan 0,2553%. Penambahan tepung rumput laut *Eucheuma cottonii* ke nugget udang dogol dapat menjadi inovasi dalam mengembangkan pengolahan produk perikanan yang lebih sehat yang disukai konsumen.

Kata Kunci: Nugget udang Dogol, *Eucheuma cottonii*, Tepung rumput laut.

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INTRODUCTION

Shrimp, a major fishery commodity in Indonesia, has high economic value and great demand. Dogol shrimp (*Metapenaeus monoceros*) is commonly found on Pangandaran Beach and sold at affordable prices (Slamet, 2023). Dogol shrimp is rich in nutrients but is highly perishable, thus requiring processing to extend shelf life and maintain its nutritional value. One potential form of processing is nugget production (Nainggolan et al., 2022).

Nuggets are practical, ready-to-eat foods that support the modern lifestyle of today, which is occupied by various activities, including shrimp nuggets that are already commercially marketed (Sari, 2023; Widiastuti et al., 2019). Nuggets are typically made from processed, seasoned meat, frozen, stored in a freezer, and consumed after frying (Astawan, 1989). Good shrimp nuggets have a tender texture, savory taste without fishy odor, and an attractive yellowish-brown color (Nainggolan et al., 2022). However, shrimp nuggets are generally low in fiber, as shown in research by Pebri et al. (2015), which found that the fiber content of baby shrimp nuggets was 0.58%. Fiber is very important for health (Rahmah, 2017), while Indonesian people's fiber consumption is still only 10.5g/day, indicating that this amount is still far below the WHO recommendation of 25–30 g/day (Fitriyani, 2013).

Adding seaweed flour to shrimp nuggets can increase dietary fiber content, considering that nuggets made from fish, chicken, or shrimp are generally low in fiber. *Eucheuma cottonii* seaweed flour is known to have very high total dietary fiber content, reaching 91.3% in dry weight form, which is higher compared to fresh seaweed that contains approximately 57.2% fiber per 100 g (Astawan et al., 2004; Kesuma et al., 2015).

Panelist preference level is an important factor in food product success, so hedonic testing must assess consumer acceptance of products (Ismawati & Putri, 2018). This test emphasizes the ability of the senses to detect, recognize, differentiate, compare, and express preference levels toward products (Permadi et al., 2019). Therefore, the addition of *Eucheuma cottonii* seaweed flour to dogol shrimp nuggets needs to be conducted to determine its effect on panelist acceptance, sensory characteristics, proximate composition, fiber content, and Texture Profile Analysis (TPA) of the nugget product.

MATERIALS AND METHODS

Time and Place

This research was conducted at the Fisheries Product Processing Laboratory, Faculty of Fisheries and Marine Sciences, Universitas Padjadjaran for nugget production; proximate testing was carried out at the Technical Implementation Unit for Testing and Application of Fisheries Product Quality, Department of Fisheries and Marine Affairs, West Java Province; fiber content testing was conducted at the Biotechnology Research and Testing Laboratory, Faculty of Animal Husbandry, Universitas Padjadjaran; and TPA (Texture Profile Analysis) testing was performed at the Testing Services Laboratory, Faculty of Agricultural Industrial Technology Universitas Padjadjaran during February-April 2025.

Method

The research method was an experimental method consisting of 4 treatments of *Eucheuma cottonii* seaweed flour addition in dogol shrimp nugget production. The percentage of seaweed flour used was based on the weight of dogol shrimp meat. These four treatments were tested on 25 semi-trained panelists, referring to the research by Adhamatika and Murtini (2021), consisting of students from the Fisheries Study Program, Faculty of Fisheries and Marine Sciences, Universitas Padjadjaran. The treatments used in this research were as follows:

Treatment A : Addition of 0% *Eucheuma cottonii* flour (control).
Treatment B : Addition of 1,5% *Eucheuma cottonii* flour
Treatment C : Addition of 2,5% *Eucheuma cottonii* flour
Treatment D : Addition of 3,5% *Eucheuma cottonii* flour

The most preferred product and the product with control treatment will be tested for proximate content, fiber content, and texture profile analysis. The proximate content will be compared with the Indonesian National Standard for Fish Nuggets (SNI 7758:2013).

Procedures

Dogol shrimp (*Metapenaeus monoceros*) were cleaned by removing the cephalothorax, carapace, and tail.

The shrimp meat, green onions, and celery were washed thoroughly with running water, then drained. All ingredients were weighed according to the formulation. The shrimp meat was ground using a food processor with gradual addition of ice cubes for ±10 minutes to maintain a stable temperature. The ground shrimp was mixed with eggs, wheat flour, tapioca flour, and seaweed flour until homogeneous for ±3 minutes. Other seasonings such as salt, flavor enhancer, pepper, oyster sauce, shallots, garlic, green onions, and celery were added, then the mixture was ground again for ±3 minutes. The batter was poured into an oiled pan, steamed for 30 minutes at 100°C, then cooled and cut into 2 × 3 cm pieces. The nugget pieces were dipped into batter mix (wheat flour: water 2:1), coated with breadcrumbs, stored at -18°C, then fried at 170°C for ±3–5 minutes until golden brown before conducting hedonic testing.

Data Analysis

The data analysis of hedonic test results was subsequently analyzed using non-parametric analysis employing two-way analysis of variance with the *Friedman* test and the *Chi-Square* test. The significant value of the observed X^2c is determined based on the Chi-square table with df = k-1 and $\alpha = 0.05$. Decision rule: H0 (treatment has no significant effect at $\alpha = 0.05$) and H1 (treatment has a significant effect at $\alpha = 0.05$). H0 is accepted if calculated $X^2c <$ tabulated X^2c, while H1 is accepted if calculated $X^2c >$ tabulated X^2c. If H1 is accepted, the treatments are significantly different, and a multiple comparison test is followed to determine the differences between treatments. The test method used to determine the priority value of the selected product is the Bayes method. The Bayes method is one of the techniques that can be used to perform analysis and make the best decision from several alternatives to produce results that consider various criteria.

Data obtained from proximate analysis, fiber content, and Texture Profile Analysis (TPA) of the priority product and control treatment were analyzed descriptively and comparatively. Descriptive comparative analysis was conducted by comparing the values from the test results in this study with previous research results, as well as the predetermined Indonesian National Standards (SNI) for each parameter.

RESULT AND DISCUSSION

Hedonic Test

Appearance is the initial assessment element for consumers towards a food product that is served. The results of the hedonic test on the appearance attribute are presented in Table 1.

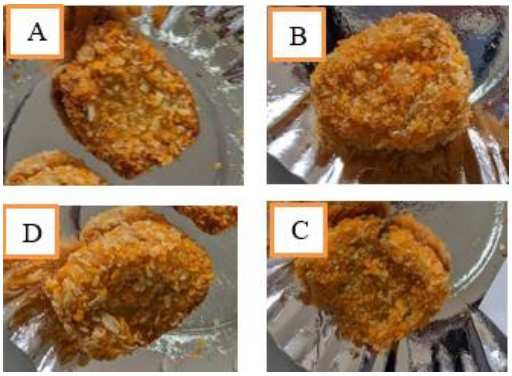

Figure 1. Appearance of dogol shrimp nuggets with the addition of *Eucheuma cottonii* flour at various treatments

Table 1. Shrimp nugget appearance with the addition of *E. cottonii* flour

E. cottonii flour treatment	Average
0%	8,04[a]
1,5%	8,36[a]
2,5%	7,16[a]
3,5%	7,48[a]

The average values of the hedonic test for the appearance of dogol shrimp nuggets with the addition of *Eucheuma cottonii* seaweed flour ranged from 7.16 to 8.36. The Friedman statistical test results in Table 1 showed that adding *Eucheuma cottonii* seaweed flour did not significantly affect the preference level for the appearance of dogol shrimp nugget products. This was due to the coating process with breadcrumbs, which caused the product's final appearance on the outer part to look the same. According to Chen et al. (2009), the battering process

aims to form a crust layer during deep frying. The observation results of dogol shrimp nugget appearance can be seen in Figure 1.

Aroma can be a particular attraction in determining the quality of a product (Nurhuda et al., 2017). Aroma assessment was conducted by directly smelling the nugget product. Good shrimp nuggets will produce a specific aroma without additional aromas or odors. The observation results of dogol shrimp nugget aroma can be seen in Table 2.

Table 2. Average results of shrimp nugget aroma with the addition of *E. cottonii* flour

E. cottonii flour treatment	Average
0%	7,64[a]
1,5%	7,56[a]
2,5%	7,32[a]
3,5%	7,72[a]

The average hedonic test results for the aroma of dogol shrimp nuggets with the addition of *Eucheuma cottonii* seaweed flour ranged from 7.32 to 7.72. The *Friedman* statistical test results in Table 2 showed that the preference level for dogol shrimp nugget aroma did not provide a significant effect at the 95% confidence level from the addition of *Eucheuma cottonii* seaweed flour. The aroma values found in each treatment did not show significant differences. This result is consistent with the research findings of Nurhuda et al. (2017) that seaweed flour did not significantly affect the aroma of manyung fish meatballs. According to Seulalae et al. (2023), volatile compounds in seaweed are organic compounds that easily evaporate and produce sulfur aroma.

Taste is important in determining panelist acceptance or rejection of a food product (Sormin et al., 2020). Taste becomes one of the assessments of a product that aims to determine the preference level for a product (Iqbal, 2016). The observation results of dogol shrimp nugget taste can be seen in Table 3.

Table 3. Average results of shrimp nugget taste with the addition of *E. cottonii* flour

E. cottonii flour treatment	Average
0%	8,12[a]
1,5%	8,28[a]
2,5%	7,72[a]
3,5%	7,4[a]

The average hedonic test results for the taste of dogol shrimp nuggets with the addition of *Eucheuma cottonii* seaweed flour ranged from 7.4 to 8.28. The Friedman statistical test results in Table 3 showed that the taste preference level did not differ significantly between treatments of *Eucheuma cottonii* seaweed flour addition at the 95% confidence level. This result is inconsistent with the research by Yuliana (2019); Firmansyah et al. (2024), which stated that the addition of seaweed flour significantly affected the taste of catfish and stuffed milkfish dragon claws. The nugget taste in this study was still dominated by savory and umami sensations originating from shrimp. Although statistically not significantly different, the average preference level for taste experienced a slight decrease as the amount of seaweed flour added increased. According to Sriket et al. (2007), this decrease is caused by the amino acid content in *Eucheuma cottonii* seaweed, such as lysine, phenylalanine, methionine, valine, and leucine, which can produce a bitter taste.

Texture is one of the sensory parameters that can be perceived through skin touch or tasting (Martiyanti & Vania, 2018). Texture is one of the important parameters of food quality, which has pressure sensations that can be observed with the mouth when bitten, chewed, swallowed, or through touch using fingers. The observation results of dogol shrimp nugget texture can be seen in Table 4.

Table 4. Average results of shrimp nugget texture with the addition of *E. cottonii* Flour

E. cottonii flour treatment	Average
0%	7,8[a]
1,5%	8,04[a]
2,5%	7,24[a]
3,5%	7,56[a]

The average hedonic test results for the texture characteristics of dogol shrimp nuggets ranged from 7.24 to 8.04. Based on the *Friedman* statistical test, the panelists' preference level for texture characteristics did not differ significantly between treatments of *Eucheuma cottonii* flour addition at the 95% confidence level. According to Setyoko & Kristiningrum (2019), nuggets have chewy and elastic texture characteristics. These elastic properties

are influenced by the type of shrimp, the freshness level of shrimp, the pH, and water content of shrimp meat, washing, shrimp age, heating temperature, time, and the type and concentration of added substances.

Decision Making for the Best Treatment of Dogol Shrimp Nuggets Based on the *Bayes* Method

The *Bayes* method aims to produce the best and most appropriate decision based on appearance, aroma, taste, and texture criteria, or decision-making to select the treatment with the best concentration at the formulation determination stage (Harmain, 2017). Based on the Bayes method calculation, the results showed that dogol shrimp nuggets added 1.5% *Eucheuma cottonii* seaweed flour, the product most preferred by panelists because it had the highest alternative value and priority value. Shrimp nuggets with the addition of 1.5% *Eucheuma cottonii* flour overall had a rectangular appearance with golden brown color, distinctive shrimp aroma, balanced savory taste with other ingredients used, as well as a chewy, dense, and compact texture, but crispy on the outside.

Proximate Analysis

Proximate analysis is a chemical test that determines the content of a food material by testing for water, protein, ash, and fat. The results of proximate analysis conducted on dogol shrimp nuggets in the control treatment (0%) and treatment with *Eucheuma cottonii* seaweed flour, most preferred by panelists (1.5%), can be seen in Table 5.

Table 5. Proximate analysis results of dogol shrimp nuggets with the addition of *E. cottonii* Flour

Proximate composition	Treatment		SNI 7758:2013
	A(0%)	B(1,5%)	
Moisture	61,45%	61,11%	Max 60%
Protein	8,72%	8,47%	Min 5,0%
Ash	1,69%	1,84%	Max 2,5%
Fat	1,42%	1,78%	Max 15,0%

Moisture content is the total amount of water in a food material without showing the condition or degree of water binding. Moisture content is one of the very important chemical laboratory test methods in the food industry because it can determine the quality and resistance of food to possible damage (Daud et al., 2019). The moisture content in food products can be influenced by several factors, including the raw materials used, filler materials, and the product manufacturing method (Jusniati et al., 2017).

According to SNI 7758:2013 (BSN, 2013) regarding the chemical quality requirements for fish nugget safety, the maximum moisture content in nuggets is 60%. This shows that the moisture content in the dogol shrimp nugget products made, both in the control treatment and with 1.5% seaweed flour, has not met the standards set by SNI 7758:2013 (BSN 2013). The water-binding process in seaweed flour can cause a decrease in moisture content. This can be attributed to the high carbohydrate capacity in seaweed flour, especially polysaccharides such as carrageenan and agar, which form a gel and bind water during heating. The carbohydrate content of *Eucheuma cottonii* flour in Agusman et al. (2014) research reached 69.99% db.

Protein Content

Protein content is the amount of protein substances in food materials (Anissa, 2019). Protein is an organic compound with the highest amount in animal bodies based on dry weight. Protein is a substance contained in food and is important for the body because it functions as a building substance and a regulator. According to SNI 7758:2013 (BSN, 2013) regarding the chemical quality requirements for fish nugget safety, the minimum protein content in nuggets is 5%. This shows that nuggets with 0% and 1.5% addition of *Eucheuma cottonii* flour are appropriate and meet the established SNI standards. The addition of seaweed flour caused a decrease in protein content. This result is consistent with the research by Murniyati et al. (2010), which states that the addition of seaweed flour caused a decrease in protein content in wet noodles. According to Prastyawan et al. (2015), the salt content in seaweed can cause protein denaturation, thus reducing protein content.

Ash content is the ash content of food materials that indicates the residue of organic material remaining after the organic material in food is destructed (Yuliana, 2019). Ash is the residual result from the combustion of organic materials in the form of inorganic substances whose content and composition depend on the material and the ashing method. According to SNI 7758:2013 (BSN, 2013) regarding the chemical quality requirements for fish nugget safety, the maximum ash content in nuggets is 2.5%. The addition of seaweed flour can cause an increase in ash content. This is supported by research from Yuliana (2019), which shows that the ash content in catfish dragon claws continues to increase along with the increasing concentration of seaweed flour used. The factor that

can cause this increase in ash content is that *Eucheuma cottonii* seaweed has mineral components such as Ca (calcium), Na (sodium), K (potassium), I (iodine), Cl (chloride), Mg (magnesium), and Fe (iron). The mineral components of food materials are closely related to ash content. *Eucheuma cottonii* contains quite high minerals at 22.39% dry weight (BPPT, 2011), which can cause high ash content values in nuggets.

Fat content is one of the most important elements in food materials because it improves the shape and physical structure of food materials, adds nutritional value and calories, and can enhance the savory taste of food materials (Putri et al., 2024). According to SNI 7758:2013 (BSN, 2013) regarding the chemical quality requirements for fish nugget safety, the maximum fat content in nuggets is 15%. This shows that dogol shrimp nugget products at 0% and 1.5% concentrations of *Eucheuma cottonii* flour addition already meet the established SNI standards. The addition of seaweed flour can cause an increase in fat content. This is consistent with research by Lufhiana (2015), which shows that the fat content of catfish *nuggets* increased along with the increasing concentration of seaweed flour added. According to Mahmud et al. (2018), the fat content in *Eucheuma cottonii* seaweed is 0.3% dry weight, which contributes to the fat content in food.

The crude fiber content test was conducted to determine the level of fiber content contained in a product. Fiber is found in food materials derived from plants that are resistant to breakdown by enzymes in the digestive tract and cannot be absorbed. Fiber belongs to the carbohydrate group consisting of cellulose, hemicellulose, pectin, and gum, which aid food digestion in the intestines (Arief & Asnawi, 2011). The observation results of the crude fiber content test on dogol shrimp nuggets can be seen in Table 6.

Table 6. Crude fiber content test results of dogol shrimp nuggets with the addition of *E. cottonii* flour

Treatment	Fiber Content (%)
A (0%)	1,05
B (3,5%)	2,15

Based on the results of fiber content testing on dogol shrimp nuggets that have been conducted, the crude fiber content found in treatment A (0% *Eucheuma cottonii* flour) was 1.05% and treatment B (1.5% addition of *Eucheuma cottonii* flour) was 2.15%. This is consistent with research by Yuliana (2019), which found that fiber content increases with the increasing concentration of seaweed flour used in catfish dragon claw products. The addition of fiber in processed products such as shrimp nuggets can provide added value from a health perspective. Fiber in food has a positive influence on the human body's metabolism. Fiber can facilitate digestive processes, reducing the risk of constipation, colon cancer, and obesity (Mukti et al., 2022).

The fiber content of 2.15% in the production of dogol shrimp nuggets with the addition of *Eucheuma cottonii* seaweed flour has not met the requirements to be claimed as a "source of fiber" based on Codex Alimentarius and BPOM standards, which require a minimum of 3g per 100g of product. Nevertheless, increased fiber content in shrimp nuggets with added seaweed flour still has functional impacts that can contribute to total fiber consumption. Seaweed contains pigments commonly called "green food" and can be beneficial as a functional food rich in natural fiber (Sanger et al., 2018).

Texture Profile Analysis (TPA)

The results of texture profile analysis on dogol shrimp nuggets can be seen in Table 7.

Table 7. Texture Profile Analysis (TPA) test results of dogol shrimp nuggets with the addition of *E. cottonii* flour

Proximate composition	Treatment	
	A(0%)	B(1,5%)
Hardness (gForce)	3.289,3500	4.315,7523
Fracturability	Not detected	Not detected
Springiness (%)	0,8033	0,8487
Cohesiveness (%)	0,5690	0,5813
Gumminess (gForce)	1.866,9630	2.500,1247
Chewiness (gForce)	1.502,4913	2.110,6553
Resilience (%)	0,2447	0,2553

The TPA (Texture Profile Analysis) test results on treatment A (0%) showed hardness values of 3,289.3500 gf, fracturability not detected, springiness 0.8033%, cohesiveness 0.5690%, gumminess 1,866.9630 gf, chewiness 1,502.4913 gf, and resilience 0.2447%. The texture values on treatment B (1.5%) were hardness 4,315.7523 gf, fracturability not detected, springiness 0.8487%, cohesiveness 0.5813%, gumminess 2,500.1247 gf, chewiness 2,110.6553 gf, resilience 0.2553%.

This shows that the values of hardness, springiness, cohesiveness, gumminess, chewiness, and resilience in the 1.5% addition of *Eucheuma cottonii* flour treatment have higher values than the 0% treatment. The different texture analysis results occurred due to the addition of *Eucheuma cottonii* seaweed flour, which contains hydrocolloid compounds that act as gel-forming agents and thickening materials.

Hardness is the maximum peak at the first compression or bite. Table 7 shows that the hardness value in the 0% *E. cottonii* flour treatment was 3,289.3500 gf, while the 1.5% *E. cottonii* flour treatment was 4,315.7523 gf. The addition of *Eucheuma cottonii* seaweed flour increased the hardness value. This occurred due to the high fiber content found in *Eucheuma cottonii* flour. The presence of crude fiber in products can affect the hardness value. Fiber, as a compound insoluble in water, can strengthen the tissue of food materials as a texture enhancer.

Fracturability is a parameter that describes the brittleness or ease of destruction of the tested product (Pratama et al., 2014). Table 7 shows that the fracturability values in both dogol shrimp nugget treatments were not detected. This indicates that both nugget products are not brittle because they tend to be chewy and elastic, so when pressure is applied, the nuggets do not experience cracking or damage. This is also caused by the relatively high moisture content in the nuggets, so this moisture absorbs pressure without cracking. According to Nuraenah et al. (2022), the lower the fracturability value of a product, the smaller the compressive force required to break the food.

Springiness is an indicator that can determine the level at which a sample can return to its original shape (Amelia et al., 2020). The springiness values in Table 7 show that the 0% *E. cottonii* flour treatment was 0.8033, and the 1.5% *E. cottonii* flour treatment was 0.8487%. The addition of *E. cottonii* flour caused the springiness value to increase. This occurred because seaweed flour contains hydrocolloid compounds that can form an elastic gel. According to Debora et al. (2023), the higher the *springiness* value, the more chewy and elastic the product becomes.

Cohesiveness is the compactness of food products related to the binding power of starch in a product (Jayanti et al., 2023). Table 7 shows the cohesiveness value in the 0% *E. cottonii* flour treatment was 0.5690%, while the 1.5% *E. cottonii* flour treatment was 0.5813%. The addition of *Eucheuma cottonii* seaweed flour to dogol shrimp nuggets caused the cohesiveness value to increase. This is due to the ability of seaweed flour to form a more compact and stable network structure. According to Jayanti et al. (2023), the higher the *co*hesiveness value, the more compact the product's texture becomes.

Gumminess is the energy required to disintegrate semi-solid food until it is ready to be swallowed (Setiaboma et al., 2021). Based on Table 7, the gumminess value in the 0% *E. cottonii* flour treatment was 1,866.9630 gf, while the 1.5% *E. cottonii* flour treatment was 2,500.1247 gf. The addition of seaweed flour increased the gumminess value. This increase is closely related to the rise in hardness and cohesiveness values obtained from multiplying these two indicators. High gumminess values cause the product texture to become more solid. The higher the gumminess value, the more difficult it is to destroy (Prijambodo et al., 2014).

Chewiness is the energy required to chew solid products until they can be swallowed (Sholichah et al., 2020). Based on Table 7, the chewiness value in the 0% *E. cottonii* flour treatment was 1,502.4913 gf, while for the 1.5% *E. cottonii* flour treatment it was 2,110.6553 gf. The addition of Eucheuma cottonii seaweed flour to dogol shrimp nuggets can cause an increase in chewiness value. This occurs due to increases in gumminess and springiness values, which are the components that form chewiness (Prijambodo et al., 2014).

Resilience measures the magnitude of sample deformation recovery level in terms of speed and strength (Indiarto et al., 2012). Based on Table 7, the resilience value in the 0% *E. cottonii* flour treatment was 0.2447%, while in the 1.5% *E. cottonii* flour treatment it was 0.2553%. The addition of seaweed flour increased the resilience value. This is due to changes in the product's internal structure, which becomes more elastic and absorbs and releases energy more efficiently when pressure is applied. Seaweed flour has contributed to the overall quality of the product, including texture (Danella, 2024).

CONCLUSION

Based on the research results regarding the effect of adding *Eucheuma cottonii* seaweed flour on the preference level of dogol shrimp nuggets, it can be concluded that the concentration of 1.5% *Eucheuma cottonii* flour addition is the priority product chosen by panelists, with moisture content values of 61.11%; protein 8.47%; ash 1.84%; fat 1.78%; crude fiber 2.15%; as well as texture analysis values of hardness 4,315.7523 gForce; fracturability not detected; springiness 0.8487%; cohesiveness 0.5813%; gumminess 2,500.1247 gForce;

chewiness 2,110.6553 gForce; and resilience 0.2553%. Adding 1.5% seaweed flour increased crude fiber content by 1.1% and improved the texture of dogol shrimp nuggets.

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