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The Effect of Adding Carrot Flour (*Daucus carota* L) to The Nutritional Value and Organoleptic Snakehead Fish Nuggets (*Channa striata*)

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Abstract: Nuggets are one of the results of fishery diversification as a practical and fast food. The aim of this study to determine the effect of adding carrot flour (*Daucus carota* L) on the nutritional value and organoleptic of snakehead fish nuggets (*Channa striata*). The research method used a completely randomized design (CRD) with 4 treatments and 3 replications. The best test results for the nutritional value of snakehead fish nuggets were the Addition of 75 grams of carrot flour to a weight of 500 grams of snakehead fish meat which had a water content of 33.36%, protein content of 25.30%, ash content of 2.45%, fat content of 19.09% and carbohydrate content of 19.79%. The best organoleptic test results were the Addition of 75 grams of carrot flour to a weight of 500 grams of snakehead fish meat based on preference and willingness on the average nugget taste of 5.8, average nugget color 5.8, average nugget aroma 5.9 and average nugget texture 5.9 . The best result of the nugget effectiveness index test was the Addition of 75% carrot flour to the weight of 500 grams of snakehead fish meat with an effectiveness index value of 0.57.

Keywords: Fish nuggets; Nutritional value; Organoleptic; Snakehead

Introduction

Snakehead fish (*Channa striata*) lives in freshwater, a food with a source of albumin for hypo albumin and wounds both in surgical wounds and burns (Pratama et al., 2020; Suprayitno, 2017). In Addition, snakehead fish also has essential and non-essential amino acids, which can increase the body's resistance (Pratama et al., 2020). Snakehead fish contains immunonutrient elements such as very high albumin protein, animal antioxidants, and complete essential amino acids, Zn, and Fe, which help to repair damaged body tissue cells, improve nutritional status and increase endurance, scavenge radicals and play a role in the process cleaning as well as capture of ROS (Prastari et al., 2017).

Snakehead fish can be processed into various foods, such as nuggets which can be used as an alternative food source of protein (Ginta, 2020). Snakehead fish nuggets contain high levels of zinc and function to accelerate the healing process of diarrhea, which is related to the role of zinc in cell proliferation. In Addition, it also has a sufficiently high Fe content so that it can be the basic material for the formation of hemoglobin. The results of published research showed that the provision of snakehead fish treatment in various forms of presentation increased super oxide dismutase (SOD), albumin levels and zinc levels in patients (Asfar et al., 2014; Mustafa et al., 2012). The provision of snakehead fish nuggets is expected to meet the need for protein for people with infectious diseases, where this need ranges from 75-100 grams per day. Snakehead fish nuggets given per 100 grams are very suitable as a snack because they can meet 15-20% of protein needs.

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The provision of snakehead fish nuggets will be better combined with other functional foods such as colored fruit and vegetables. Carrots (*Daucus carota* L.), among the most crucial root vegetables in the Apiaceae family, are cultivated worldwide (Que et al., 2019). The storage root is widely used due to its richness in carotenoids, anthocyanins, dietary fiber, vitamins, and other nutrients. Carrot extracts, which serve as sources of antioxidants, have essential functions in preventing many diseases (da Silva Dias, 2014). Carrot flour is high in fiber and low in calories, thus it can improve the nutritional value of food products. Similar research conducted by Yulianti et al. (2018), Anggraini et al. (2021), and Ayu et al. (2022), it also showed that the addition of carrot flour to fish nuggets can increase the protein and fiber content of the product, as well as increase the liking level of consumers towards the product.

According to Syadiah et al. (2022), the Addition of 15% carrot flour can increase the nutritional value of nuggets, especially: moisture content, ash content, fat content, protein content, and carbohydrate content, as well as the organoleptic nuggets, especially: taste, aroma, color, and texture. The utilization of snakehead fish for making nuggets as a practical and fast food with the addition of carrot flour is a form of diversification of fishery products that are more varied with high quality and economic nutritional value (Ayu et al., 2022). There is no doubt that snakehead fish has good nutritional value for health and is supported by the nutrition found in carrot flour.

Overall, research on the effects of adding carrot flour to the nutritional value and organoleptic properties of snakehead fish nuggets will have important implications for the development of food industry products and consumer health. Therefore, it is necessary to conduct research to analyze the Effect of Adding Carrot Flour (*Daucus carota* L) on the Nutritional Value and Organoleptic Properties of Snakehead Fish (*Channa striata*) Nuggets.

Method

This research was conducted at the Laboratory of Fisheries Product Technology Study Program, Department of Fisheries, Faculty of Agriculture, University of Palangka Raya for 3 months (March to May 2022), using a Completely Randomized Design (CRD) with 4 treatments and 3 replications. According to Hanafiah (2001), the general form of the additive linear model is a Completely Randomized Design (CRD):

$$(Y_{ij} = \mu + \tau_i + \varepsilon_{ij}) \quad (1)$$

Information:
i = 1, 2, …, t (treatment)
j = 1, 2, …, r (replications)
Yij = Observations on the i treatment and j repetition
μ = General mean
τi = Effect of the i treatment (μi - μ)
εij = Random effect on the ith treatment and j replication

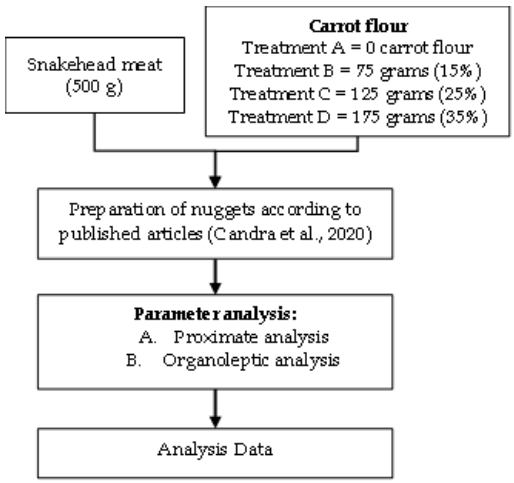

Figure 1. Research flowchart

The Treatment

The treatment plan and research repetition for adding carrot flour to snakehead fish meat are as follows: (1) Treatment A = Without the Addition of carrot flour; (2) Treatment B = Addition of 75 grams (15%) of carrot flour from the weight of 500 grams of snakehead fish meat; (3) Treatment C = Addition of carrot flour 125 grams (25%) of the weight of 500 grams of snakehead fish meat; (4) Treatment D = Addition of carrot flour 175 grams (35%) of the weight of 500 grams of snakehead fish meat. The composition for making nugget dough made from snakehead fish meat and carrot flour is as shown in Table 1.

Table 1. Composition for Making Nugget Dough

Material	Treatment			
	A	B	C	D
Snakehead fish meat	500 g	500 g	500 g	500 g
Carrot flour	-	75 g	125 g	175 g
Chicken eggs	2 pcs	2 pcs	2 pcs	2 pcs
Clean water	150 ml	150 ml	150 ml	150 ml
Red onion	25 g	25 g	25 g	25 g
Garlic	25 g	25 g	25 g	25 g
Pepper	2 g	2 g	2 g	2 g
Salt	10 g	10 g	10 g	10 g
Cooking oil	1 liter	1 liter	1 liter	1 liter
Bread crumb	200 g	200 g	200 g	200 g
Flour	150 g	150 g	150 g	150 g
Tapioca flour	150 g	150 g	150 g	150 g

Preparation of Nuggets

The process of making snakehead fish nuggets with the Addition of carrot flour uses a modified method that refers to published articles (Candra et al., 2020) as follows:

a. Put the fish meat into a medium-sized basin or container, then mix the carrot flour, tapioca flour, and wheat flour, and add other spices according to the size determined for each treatment then stir all the ingredients until evenly distributed;
b. If all these ingredients have been mixed, the next step is molding the dough. Printing on the dough is done by taking the mixed dough ingredients little by little and then putting them in a nugget tin that has been greased with oil so they don't stick and then flattening them out;
c. Then the nugget pan is steamed for 20 minutes or until cooked. If the nuggets are cooked, remove the dough from the tin and then cut them into squares of the same size;
d. Dip the nuggets into the egg white, then roll in the breadcrumbs until the surface is tightly covered;
e. Heat cooking oil, then fry over medium heat until cooked while turning it over and over, remove and drain;
f. Snakehead fish nuggets are ready to be consumed.

Proximate Analysis

Proximate analysis was performed using a modified, published method (Oppong et al., 2021). The parameter of this analysis was moisture, protein, carbohydrate, fat, and ash content.

Organoleptic Analysis

Determination of the best value for nutritional and organoleptic values uses the effectiveness index method as follows:

1. Give weight to each variable with relative numbers 0 to 1. The weight value depends on each variable produced and obtained as a treatment.
2. Variables such as water content, protein, fat, and carbohydrates are given a weight of 1 because these 3 variables complement the product quality, while a weight of 0.9 is given to organoleptic properties.
3. Grouping the variables into two groups, namely: (a) Group A consisted of variables with a higher average the better, namely: protein content, carbohydrate content, and organoleptic properties (color, aroma, taste, and texture); (b) Property B consists of variables: the higher the average, the worse it is moisture, fat, and ash.
4. Determine the normal weight, namely: Variable weight/total weight.
5. Determine the value of effectiveness (Neff) using a formula from a Published journal (ALMisned et al., 2021).

$$Neff = \frac{\text{Treatment score} - \text{The worst score}}{\text{Best score} - \text{The worst score}} \quad (2)$$

To determine the variable with an average, the higher the better; the lowest value is the worst value and the highest value is the best value, while for the best average variable, the highest value is the worst value.

6. Calculating the result value (Nhsl) normal weight x effectiveness value.
7. Add up the result values of all variables and select the best treatment from the treatment with the highest result value.

Data Analysis

Observational data were made in tabulations before the data were analyzed for the homogeneity test with the Bartlett test (P = 5%). If the data was homogeneous, an analysis of variance (ANOVA) was carried out with the F test (P = 5%), and if there were significant differences or, a significantly further test of Significant Path Difference (BNJ) is carried out. The data is presented as tabulations or graphs and is discussed descriptively using the literature.

Result and Discussion

The results of research conducted on snakehead fish (*Channa striata*) nuggets included nutritional value tests (protein content, fat content, moisture content, ash content and carbohydrate content) and organoleptic tests (color, aroma, taste and texture). Treatment A is a control without adding carrot flour; treatment B is adding 75 grams (15%) of carrot flour to a weight of 500 grams of snakehead fish meat. Treatment C is adding 125 grams (25%) of carrot flour to a weight of 500 grams of fish meat. cork and treatment D is the Addition of carrot flour as much as 175 grams (35%) of the weight of 500 grams of snakehead fish meat. Test results for the nutritional and organoleptic values of snakehead fish nuggets with the Addition of carrot flour are described below.

Nutritional Value of Nuggets

Test results for the nutritional value of nuggets. They are processing data from observations of the nutritional value of nuggets with the Addition of carrot flour as shown in Figure 2.

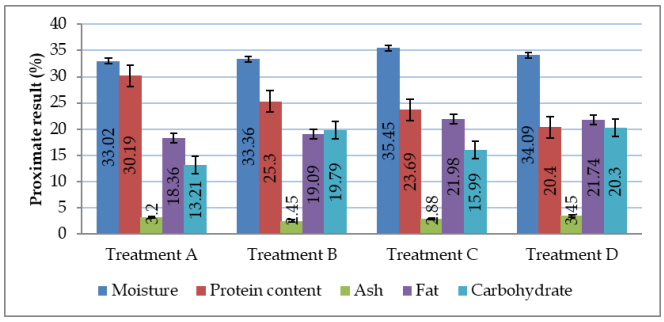

Figure 2. The nutritional value of nuggets with the Addition of carrot flour as shown in

The Addition of carrot flour 75 grams (15%) of the weight of 500 grams of cork fish meat can increase protein levels of nuggets by 25.3% and increase carbohydrate levels of nuggets by 19.8%, and can reduce nugget water content by 33.4%, ash content of nuggets by 2.5% and levels Fat Nugget 19.1%. Figure 2, showing the Addition of carrot flour increased by 125 grams (15%) from the weight of 500 grams of cork fish meat. There was a decrease by 2.9% and increased levels of fat nuggets by 21.9%.

Organoleptic Analysis

Data processing observation of organoleptic nugget with the addition of carrot flour as shown in Figure 3.

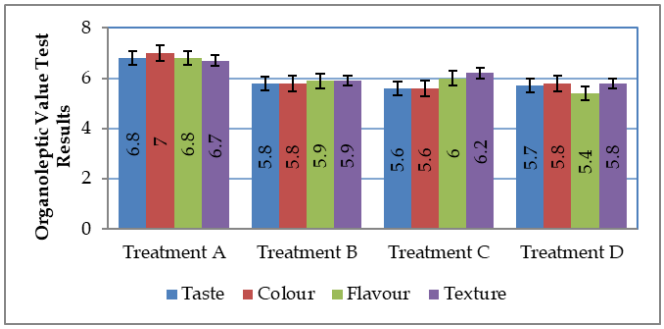

Figure 3. Organoleptic Nugget test results with the Addition of carrot flour

The Addition of carrot flour 75 grams (15%) of the weight of 500 grams of cork fish meat can increase the average value of the taste of nuggets by 5.8 (somewhat like) and increase the average color value by 5.8 (somewhat like) and can reduce the average value The aroma of nuggets is 5.9 (somewhat like) and decreases the average value of the nugget texture by 5.9. Figure 3, shows the addition of carrot flour increased by 125 grams (15%) of the weight of 500 grams of cork fish meat; there was a decrease to the average value of the nugget taste of 5.6; and a decrease in the average value of the color of the nugget was 5.6 and increase the average value of the aroma of nuggets by 6 (somewhat like) and increase the average value of texture nuggets by 6.2.

Nugget Effectiveness Index Test Results

The results of the nugget effectiveness index test with the addition of carrot flour as shown in Figure 4.

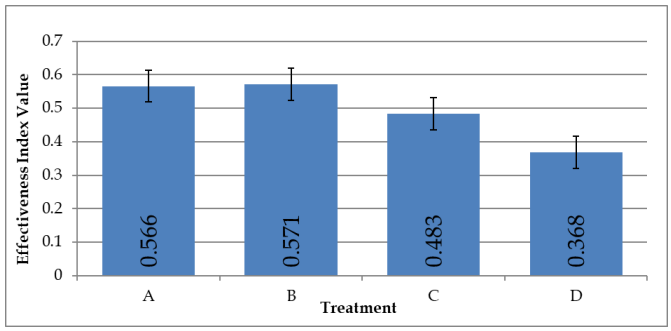

Figure 4. Test Results of the Effectiveness of Nuggets Index with the Addition of carrot flour

Adding carrot flour 75 grams (15%) of the weight of 500 grams of cork fish meat can increase the value of the nugget's effectiveness of 0.571. Figure 4 shows that the Addition of carrot flour increased by 125 grams (25%) from the weight of 500 grams of cork fish meat; there was a decline in the value of the nugget's effectiveness 0.483.

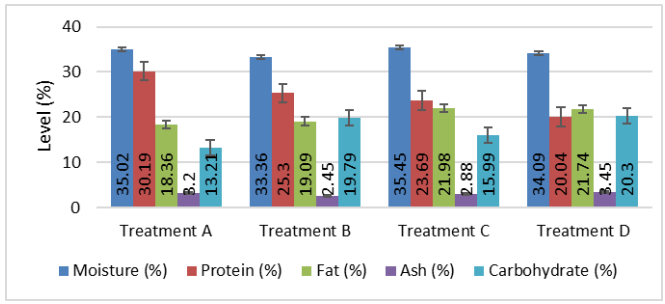

Figure 5. Proximate analysis results of nugget test with the Addition of carrot flour.

The average water content of the B treatment is 33.36%, treatment C is 35.45%and treatment D is 34.09%. The results of the data analysis of water content P <5% in Figure 5, stated that the treatment A and B, A and D, B and C, and C-D, and C-D were significant differences, while there were no significant differences. The Addition of carrot flour 75 grams (15%) of the weight of 500 grams of cork fish meat is more effective in a stable of the average water content of nuggets when compared to the Addition of carrot flour increased.

The average protein content of the B treatment is 25.30%, treatment C is 23.69%and treatment D is 20.40%. The results of the data analysis of water content P <5% in Figure 5, stated that the treatment A and B, A and D, B and D, B and C have significant differences, while the B and C, C and D are not significant differences. The Addition of carrot flour 75 grams (15%) of the weight of 500 grams of cork fish meat is more effective in increasing the average protein nugget content when compared to the Addition of carrot flour.

The average fat Nugget level B treatment is 19.09%, treatment C is 21.98% and treatment D is 21.74%. The results of the data analysis of water content P <5% in Figure 6, stated that the treatment A and B, A and D, B and D were significant differences, while there were no significant differences. The Addition of carrot flour 75 grams (15%) of the weight of 500 grams of cork fish meat is more effective in stabilizing the average fat level of nuggets when compared to the Addition of increased carrot flour.

The average Nugget ash content in treatment B is 2.45%, treatment C is 2.88%and treatment D of 3.45%. The results of the data analysis of water content P <5% in Figure 5, stated that the treatment A and B, A and D, B and D, and B and C have significant differences, while there are no significant differences. The Addition of carrot flour 75 grams (15%) of the weight of 500 grams of cork fish meat is more effective in stabilizing the average level of ash nuggets when compared to the Addition of increased carrot flour.

The average carbohydrate content of the B treatment nugget is 19.79%, treatment C is 15.99%and treatment D is 20.03%. The results of the data analysis of water content P <5% in Figure 5, stated that the treatment B and A, C and A, D and A, C, and D were significant differences, while the C and B, D and B were no significant difference. The Addition of carrot flour 75 grams (15%) of the weight of 500 grams of cork fish meat is more effective in stabilizing the average carbohydrate level of nuggets when compared to the Addition of carrot flour increased.

Discussion

The nutritional value of nuggets with the Addition of 75gram carrot flour (15%) of the weight of 500 grams of cork fish meat has a protein content of 25.3%, carbohydrate content of 19.8%, a water content of 33.4%, ash content of 2.5%and fat content of 19.1%. The nutritional content is good enough for human health; according to Hwalla et al. (2023) state that the World Health Organization (WHO) discusses nutritional issues, including the main risk factors for the cause of the world's sharing gaps on the prevalence of malnutrition and micronutrient deficiency. Nuggets are a type of processed meat product that are popular among urban consumers who prefer ready-to-cook functional foods with nutritional content. They typically consist of rectangular pieces of meat coated with seasoned flour. Nuggets are a type of fast food that is widely enjoyed, and can be made using a variety of meats, although raw fish meat is not a common ingredient (Simanjuntak et al., 2021).

The Addition of carrot flour 75 grams (15%) of the weight of 500 grams of cork fish meat is more effective in a stable of the average water content of nuggets of 33.4% when compared to the Addition of carrot flour increased. According to Pentury (2020), the more the Addition of mangrove flour substituted to carrot flour, the water content in fish nugget products decreases if the water content is high enough can affect the protein content in nuggets. The best water content value in the treatment of Biduri's protease concentration is 1.5% with a hydrolysis time for 90 minutes to 47.84%, meaning heating or boiling causes the breakdown of meat structure in a polypeptide chain that results in denaturation so that the ability to bind water in the meat disappears (Sundari et al., 2015).

The Addition of 75gram carrot flour (15%) of the weight of 500 grams of cork fish meat is more effective in increasing the average protein nugget content by 25.30% when compared to the Addition of carrot flour increased. According to Yulianti et al. (2018), cork fish protein content was initially 25.2 %. Undergoes a process of decline after being processed into a nugget. It is because the protein processing will be denatured and react with reducing sugar to form a Maillard reaction, which is a reaction between aldehyde groups from reducing sugar with amino groups, especially epsilon-amino-lysine and alpha-amino acid N-terminal. Protein is a source of amino acids, both essential and non-essential, protein content in a portion of food will determine the quality of the food itself because the protein contained in fish is dissolved protein (Alviodinasyari et al., 2019). According to Syadiah et al. (2022), the protein content is a source of amino acids that contain elements of C, H, O, and N as the primary function of the protein to form new tissues and maintain existing tissues. Besides that, protein also functions as a regulator of the body's metabolic processes. The protein content in food varies, both in amount and type.

The Addition of carrot flour 75 grams (15%) of the weight of 500 grams of cork fish meat is more effective in stabilizing the average fat level of nuggets of 19.09% when compared to the Addition of carrot flour increased. According to Syadiah et al. (2022), based on the analysis results, the lowest fat content with the Addition of carrot flour is inversely proportional to the results of the analysis of water content. The lowest fat content is given as much as 50% carrot flour with an average fat content of 20.93% in fish nuggets; the Addition of carrot flour in nuggets can bind fat because during the process of forming fish protein denatured and reacting with reducing sugar to form amino acid groups (Pentury, 2020).

The Addition of carrot flour 75 grams (15%) of the weight of 500 grams of cork fish meat is more effective in stabilizing the average level of nugget ash by 2.45% when compared to the Addition of carrot flour increased. Ash content is an organic substance from the

remaining combustion of an organic material associated with the mineral of an ingredient. According to Pentury (2020), the more the Addition of carrot flour, the ash content of skipjack fish nuggets increases, and the ash content in a food product depends on the magnitude of the mineral content of the material used. Based on the results of the data analysis, there is a decrease in ash levels of each proportion of additional carrot flour; this indicates the influence of carrot flour substitution in fish meat. Besides that, the fish steam process is indicated to reduce the ash levels because the ash content will dissolve by water during the steaming process (the steaming process (Syadiah et al., 2022).

The Addition of carrot flour 75 grams (15%) of the weight of 500 grams of cork fish meat is more effective in stabilizing the average carbohydrate level of the nugget by 19.79% when compared to the Addition of carrot flour increased. Carbohydrates are compounds that are formed from carbon molecules, hydrogen, and oxygen sourced from carrot flour as an additional ingredient in making nuggets. According to Syadiah et al. (2022), based on the results of the analysis of carbohydrate content in white snapper nuggets with carrot flour substitution, has a significantly different effect due to reducing 100% of the amount of water content, ash content, fat content, and protein content so that the carbohydrate content produced is higher.

The observations of organoleptic from panelists to the addition of 75-gram carrot flour (15%) from the weight of 500 grams of cork fish meat can increase the average value of the nugget taste by 5.8, the average color value is 5.8, the average value of the nugget aroma is 5.9, and the average value of the nugget texture is 5.9. According to Shalmawidati (2019), Consumer Acceptance of Fish Nuggets aims to receive consumers of the fish nuggets offered. Based on the results of interviews with respondents, it turns out that fish nuggets are very suitable for sale on the market and has a quality that is not inferior to similar products. The Hedonic Value of Fish Nugget Products on average above 7 means consumers accept this nugget product. The more carrot flour added to the white snapper nugget significantly affects the nature of the panelist (organoleptic), such as color, taste, and aroma but does not significantly affect its texture (Syadiah et al., 2022).

Panelists like the colors produced by the tilapia nugget in orange but not conspicuous (Effendy et al., 2022). The Addition of carrot flour concentrations can affect the color of tilapia nuggets because carrots have carotene content that can be decomposed by fat when frying and making orange colors on the inside of the nugget, the higher the concentration of carrots are given, the more carotene is decomposed and causes the color of the nugget orange. Interesting colors will be the tastes of consumers to consume these foods, especially nutritional value, good taste, and good texture if unpleasant colors are seen as not attracting consumers (Yulianti et al., 2018).

According to Mulono & Rujiah's statement (2017), during the fermentation process of hydrophobic amino acids, because hydrophobic amino acids are typical cocoa aroma precursors based on fermented cocoa beans have reduced almost all amino acids except hydrophobic amino acids such as isoleucine, leucine, and methionine. The highest value of the panelist assessment results on the aroma of tilapia nuggets that produce a distinctive nugget aroma, namely carrots, fish, and other additional ingredients or spices (Effendy et al., 2022). According to Yulianti & Mutia's statement (2018), aroma or smell can be observed with the sense of smell. The aroma comes from volatile compounds that are soluble in water and soluble in fat. The aroma of cork fish nuggets produced shows that the less carrot flour used, the more like the aroma of the nugget produced due to the high concentration of carrot flour will cover the aroma of cork fish.

According to Yulianti et al. (2018), the texture is a pressure sensation that can be felt by the mouth when bitten, chewed and swallowed, while a large amount of starch causes the texture to be denser and tends to be hard, starch content in cork fish nuggets comes from tapioca flour And the higher the flour is the higher the concentration, the texture of the nugget produced is solid and liked by panelists. The texture is one-factor influencing consumer choice of a food product. The most important texture of solid, dry, and crispy food. Factors that affect the texture value in food include the ratio of protein content, fats, processing temperatures, water content, and water activity (Effendy et al., 2022).

Conclusion

The results of the study concluded that the Addition of carrot flour 75 grams (15%) of the weight of 500 grams of cork fish meat is more effective in increasing the nutritional value of nuggets, especially in protein content and carbohydrate levels and stabilizes water content, ash content and fat content. It also can increase the taste and color of nuggets and stabilize their aroma and texture. Suggestions for the Addition of carrot flour for the manufacture of cork fish nuggets no more than 15% and avoid denaturation during the hydrolysis process of cork fish meat less than 90 minutes.

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