

## QUALITY OF NILE TILAPIA NUGGETS FORTIFIED WITH MORINGA LEAF FLOUR

### Mutu Nugget Ikan Nila yang Difortifikasi Tepung Daun Kelor

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#### ABSTRACT

Nugget is a restructured meat from ground and molded meat. Generally nuggets are made from chicken. To enrich the nutritional content, the ingredients for making nuggets were diversified using tilapia fish meat and moringa leaf flour. This research aims to determine the effect of fortification of Moringa leaf flour on the quality of tilapia fish nuggets. This research used a Completely Randomized Design (CRD). The treatment consisted of fortification of Moringa leaf flour (TK), namely TK1 (0%), TK2 (5%), TK3 (10%), TK4 (15%), TK5 (20%) and TK6 (25%). Analysis of the observation data was carried out using Anova and BNJ further tests. The nugget quality parameters in this study were chemical and organoleptic parameters. Moringa leaf flour fortification had a significant difference on all nugget quality parameters except color. Moringa leaf flour could improve the quality of tilapia fish nuggets by increasing the protein content by 0.5-13.18% and producing tilapia fish nuggets which have a vitamin A ( $\beta$ -carotene) content of 1.82-20.76 %. Fortification of moringa leaf flour with a concentration of 10% was the best treatment to produce tilapia fish.

**Key words:** Fortification, Moringa leaf flour, Nuggets

#### ABSTRAK

Nugget merupakan suatu produk olahan daging yang terbuat dari daging giling dan dicetak. Umumnya nugget berbahan dasar daging sapi dan ayam. Untuk memperkaya kandungan gizinya, dilakukan diversifikasi bahan pembuatan nugget menggunakan daging ikan nila dan tepung daun kelor. Penelitian ini bertujuan untuk mengetahui pengaruh fortifikasi tepung daun kelor terhadap mutu nugget ikan nila. Penelitian ini menggunakan Rancangan Acak Lengkap (RAL) dengan perlakuan fortifikasi tepung daun kelor (TK) yaitu TK1 (0%), TK2 (5%), TK3 (10%), TK4 (15%), TK5 (20%) dan TK6 (25%). Analisis data menggunakan Anova dan uji lanjut BNJ. Parameter mutu nugget pada penelitian ini berupa parameter kimia dan organoleptik. Fortifikasi tepung daun kelor memberikan pengaruh signifikan terhadap semua parameter mutu nugget kecuali warna. Tepung daun kelor mampu meningkatkan mutu nugget ikan nila dengan peningkatan kadar protein 0,5-13,18% dan menghasilkan nugget ikan nila yang memiliki kandungan vitamin A ( $\beta$ -karoten) sebesar 1,82-20,76%. Fortifikasi tepung daun kelor dengan konsentrasi 10% menghasilkan nugget ikan nila dengan mutu terbaik.

**Kata Kunci:** Fortifikasi, Nugget, Tepung daun kelor

## INTRODUCTION

Nugget is included food fast serve, have mark nutritional, and safe for consumption. Nuggets are a practical or frequent food known as ready to cook and ready to eat. Based on basic ingredients, nuggets are classified into animal and vegetable nuggets (Ikrawan, 2020).

Animal nuggets generally made from chicken meat . A number of innovation material making nuggets like shrimp , beef and fish. One of materials that can be made The nugget ingredient is tilapia . Use of native tilapia fish from fresh water as another alternative form of consumption of marine fish (Effendy *et al.*, 2022). In 100 g of tilapia fish contains around 12 g-17 g protein, 0.1 g-0.18 g fat, 3.03 mg-4.78 mg calcium , and 360 mg-610 mg phosphorus (Ramlah *et al.*, 2016). Several studies show that tilapia can be processed into nuggets. According to Effendy *et al.*, (2022) in making tilapia fish nuggets produce quality best with the addition of 12% flour carrot . Behind The protein content in tilapia is quite high, omega 3 and other minerals, tilapia own a number of lack such as vitamin A, fiber and antioxidants (Inarest *et al.*, 2014). To increase mark tilapia fish nutrition then it needs to be done fortification with flour Moringa to produce nuggets with value complete nutrition from content animal and also vegetable.

In an attempt diversity One of the foods is producing mixed nuggets that is combining two materials standard animal and vegetable to fulfill need nutrition. Mixed nuggets are nuggets made from standard main originate from animal and vegetable. Merger done to enrich content nutrition in nuggets (Nisa, 2013). Vegetable ingredients sourced from vegetables to add vitamins and fiber to the existing animal nuggets own protein and fat content will but low fiber (Agusta *et al.*, 2014). O mixed nugget land with additions leaf Moringa as a source vegetable will produces nuggets that have high protein, fiber and also vitamin A which is beneficial for the body , growth flower toddlers, and prevent from various disease.

Moringa leaves (*Moringa oleifera*) have content high nutrition Because contains 11300 IU vitamin A; 440 mg calcium; 6.7 g protein; and 7 mg of the substance iron. Apart from that, Moringa also contains nutrients and compounds that are important for the body form phytochemicals like tannins, steroids, triterpenoids, saponins, anthraquinones and alkaloids. To increase mark nutrition Moringa can be processed become powder or flour. Flour Moringa contains 25.3% protein and 24.97% fiber food (Peñalver *et al.*, 2022) . Another study conducted by Ntshambiwa *et al.*, (2023), flour leaf Moringa own protein content 28.41%; fat 5.21%; fiber rough 8.72%; Zn 17.14 mg; Ca 113.1 mg; Mg 2760.84 mg; and Fe 141.46 mg.

Addition leaf Moringa as much as 18% produces nuggets that have mark nutrition tall namely 10.13% protein content and 18.10% vitamin C content (Krisnandani *et al.*, 2016). Research by Suhaemi *et al.*, (2021), show the more Lots addition flour leaf Moringa will lower Crude fat and cholesterol content of chicken nuggets. Research conducted Pramono *et al.*, (2021) shows the nuggets made from lemuru with the addition of 40% flour leaf Moringa produce protein content 22%. Based on research results from Winnarko & Mulyani (2020), the addition of 15% flour Moringa produce skipjack tuna nuggets best textured solid , tasteful savory, and has *after taste* is a bit bitter from leaf Moringa. Supported by Setiaboma *et al.*, (2021), in progress Added catfish meatballs flour Moringa as much as 10% yield Favorite meatballs panelists. Furthermore supported by Faidah *et al.*, (2022), report in progress added catfish sausage flour Moringa 5% is known to be sufficient protein needs are 33.7% - 52.5% and calcium is 7% - 8.2% for needs body.

Based on preliminary research that has been done carried out at a concentration of 20% flour Moringa produces a very bitter taste and strong unpleasant aroma So, it's not preferred panelists. Difference material the standard used will be produce different products mark nutrition, so difference the type of fish used will also produce difference from facet texture, taste, and also level favorite. This research was conducted to find out quality of fortified tilapia fish nuggets flour leaf Moringa.

## METHODS

### Time and place

The research was carried out in July – August 2023 at the Laboratory Food Processing, Laboratory Faculty Quality Control Food Technology and Agoindustry, University of Mataram.

### Tools

The tools used in this research were grinding, glass measuring (Isolab, Germany), steamer, stainless steel knife, aluminum foil, flask distillation, UV-Vis spectrophotometry.

### Materials

The ingredients used in this research include tilapia, garlic, onions red, salt, pepper, mineral water (Narmada), ice, domestic chicken eggs, flour Moringa, flour panir (Triangle blue), flour tapioca (Rose brand) and cooking oil (Fortune), K<sub>2</sub>SO<sub>4</sub>, CuSO<sub>4</sub>, H<sub>2</sub>SO<sub>4</sub>, distilled water, powder zinc, H<sub>3</sub>BO<sub>3</sub> and methanol.

### Research Design

This research uses Completely Randomized Design (CRD) with treatment fortification flour leaf Moringa (TK), namely TK1 (0%), TK2 (5%), TK3 (10%), TK4 (15%), TK5 (20%) and TK6 (25%). Analysis of observational data use Anova and BNJ further test. The nugget quality parameters in this study were chemical and organoleptic parameters.

## RESULTS

Treatment fortification flour leaf Moringa give influence significant all quality parameters except color in a way hedonic. The research results can be seen in Tables 1 and 2.

Table 1. Effect of Moringa Leaf Flour Fortification on Chemical Parameters of Tilapia Fish Nuggets

Fortification of Moringa Leaf Flour	Crude Protein Content	V vitamin A
0%	8.88 <sup>f</sup>	1.82 <sup>e</sup>
5%	9.73 <sup>e</sup>	7.49 <sup>d</sup>
10%	10.82 <sup>d</sup>	8.49 <sup>d</sup>
15%	11.60 <sup>c</sup>	11.22 <sup>c</sup>
20%	12.41 <sup>b</sup>	18.38 <sup>b</sup>
25%	13.18 <sup>a</sup>	20.76 <sup>a</sup>
BNJ	0.583	1,092

Note: Numbers with the same letters in the same column have values that are not significantly different at the 5% significance level.

Table 2. Effect of Fortification of Moringa Leaf Flour on Organoleptic Parameters ( Hedonics / Liking Level ) of Tilapia Fish Nuggets

Fortification of Moringa Leaf Flour	Aroma	Texture	Flavor	Color
0%	3,1ab	3.85a	3ab	3.65a
5%	3,4ab	3.5ab	3.35ab	3,4a
10%	4.05a	3,4ab	3.6a	3.25a
15%	2.95bc	3.25ab	3.25ab	3.1a

20%	2.6bc	3.15ab	2,7ab	2.85a
25%	2.3c	3b	2.5b	2.65a
BNJ	1.09	0.71	0.94	1.21

Note: Numbers with the same letters in the same column have values that are not significantly different at the 5% significance level.

## DISCUSSION

Protein is a macronutrient that is important for life and is material builder of all cells life. Protein functions as a builder new tissue during the body's growth and development, maintaining, repairing and replacing damaged or dead tissue, as well provide amino acids required for formation enzyme digestion and metabolism. Analysis Crude protein content can be determined using Kjeldahl method (Nielsen, 2010). Protein content in food determine quality food. Protein content of flour / powder leaf Moringa classified as very high that is amounting to 23.37% (Kurniawati *et al.*, 2018). So that protein content of tilapia fish nuggets tend increase along the more many use flour leaf Moringa.

This was reported by Pramono *et al.*, (2021), in research on skipjack tuna nuggets fortified with 40% starch leaf Moringa increase protein content up to 22%. Also supported by Aprilianti (2016), report highest protein content found in meatballs given catfish treatment flour leaf Moringa 30%, meanwhile lowest protein value found in meatballs catfish without additions flour leaf Moringa. The more Lots flour leaf added moringa so content the protein tend experience enhancement. Protein levels produced capable fulfil SNI 7758:2013 requirements regarding fish nuggets, namely has a minimum protein content of 5%. Flour protein content leaf Moringa capable increasing the protein of tilapia fish nuggets. In this test, the highest protein content results at a concentration of 25% were 13.18%.

$\beta$ - carotene contains a lot of provitamin A found in vegetables and fruit colored yellow, orange, and green dark. This vitamin is a fat- soluble vitamin. Function the main vitamin A is prevent damage to cell membranes. Sources of vitamin A are retinol ( animal origin ) and leaves Moringa as pro vitamin A (vegetable) (Carazo *et al.*, 2021) . Flour leaf Moringa own  $\beta$ -carotene content 13.17 mg-16.73 mg per 100 g (Itodo *et al.*, 2021). Therefore, the level of vitamin A in tilapia fish nuggets tend increase along enhancement use flour leaf Moringa.

Reported by Aprilianti (2016), that addition flour leaf Moringa as much as 30% yield  $\beta$ - carotene levels highest in catfish meatballs.  $\beta$ - carotene levels will increase in line with the increase flour leaf added moringa. Based on the BNJ results it is known that 0% concentration is different significant with treatment other. 0% concentration produces  $\beta$ - carotene levels amounted to 1.82 mg/g.  $\beta$ - carotene levels at concentrations of 5% and 10% were not different real will but different real with concentrations of 15%, 20% and 25%.

A scent product can be detected when compound volatiles enter the cavity nose and perceived by the system smell. Volatile compounds present in sufficient concentrations can be easily going to system smell at the top nose and interacts with receptors smell (Sharif *et al.*, 2017). Moringa leaf flour has a pleasant aroma, so increasing the concentration of Moringa leaf flour will increase the pleasant aroma of tilapia fish nuggets. Fortification of Moringa leaf flour at 0% and 5% produced nuggets that were somewhat liked by panelists, while at a concentration of 10% it had favorable criteria. Moringa leaf flour concentrations of more than 10% produce nuggets that our panelists don't like because they produce a more dominant and unpleasant aroma. In Moringa leaves there is a lipoxidase enzyme which gives it a distinctive unpleasant aroma and is generally undesirable in food processing. Some panelists don't like the smell of fish, so adding 10% Moringa leaf powder will balance the taste of fish and Moringa leaf powder. This result is supported by Pramono *et al.*, (2021), in making lemuru fish nuggets which added moringa to produce a balanced aroma so they tend to be preferred over nuggets with a dominant fish or moringa aroma.

Food texture plays a role in determining the taste of food, because sensory sensitivity is very dependent on the texture and consistency of food. These sensory properties are described through viscosity, hardness, softness, and crispness. Texture is test organoleptic Which done using touch (Sharif *et al.*, 2017). Fortifications of 0%, 5% and 10% produced nuggets that were somewhat favorable and favorable, while fortifications of more than 10% were not liked by panelists. This is because a concentration of 0%-10% has a soft texture, whereas at a concentration of 15%-25% the texture of tilapia nuggets is not very soft. Supported by Hasniar & Ratnawaty (2019); Faidah *et al.*, (2022), who researched fortified Moringa leaf flour in tuna nuggets or tempeh meatballs. The higher the proportion of Moringa leaf flour, the less tender the product will be, thus reducing consumer preferences.

Taste is the main factor influencing consumer preferences. The aspects assessed are taste when eaten and appearance when served (Sharif *et al.*, 2017) . Moringa leaves produce a bitter and unpleasant taste, so the higher the concentration of Moringa leaf flour added will increase the bitter and unpleasant taste of tilapia fish nuggets. Fortification of Moringa leaf flour 0%, 5%, 20% and 25% produces nuggets that are quite favorable. Panelists most liked tilapia fish nuggets that were fortified with 10% Moringa leaf flour because at this concentration it produces a taste that is not dominant from any one ingredient. Research by Cahyaningati & Sulistiyati (2020) also reported that too high fortification of Moringa leaf flour in making catfish meatballs can produce a dominant bitter taste because it contains phenol and tannin compounds.

Color is an important factor in consumer acceptance of food products. Color is also a determining factor in quality as an indicator of freshness and ripeness (Stefanowicz, 2013) . According to Fajri *et al.*, (2018) , the green color of Moringa leaf flour is due to the presence of 10.92 mg/L to 16.51 mg/L of chlorophyll, so the higher the concentration of Moringa leaf flour added results in a greater increase in the color of the tilapia fish nuggets. green. The 0% fortification of Moringa flour showed that the panelists liked nuggets. Fortification of 5%-25% produces unfavorable and somewhat favorable nuggets. Based on Table 2, it is known that the higher the concentration of Moringa leaf flour can reduce the panelists' level of acceptance/likeability. The higher the fortification of Moringa leaf flour, the greater the intensity of the green color, resulting in darker colored nuggets. This result is supported by research by Fajri *et al.*, (2018) , reporting that the green color is due to the high concentration of chlorophyll in Moringa leaves. Generally, fish nuggets on the market are white/yellow. So changing the color of the nuggets to a darker color tends to reduce the panelists' liking.

## CONCLUSION

Fortification flour leaf Moringa with some concentration influential real to quality chemistry (protein and vitamin A ( $\beta$ - carotene) and quality organoleptic hedonic (aroma, texture and taste) and has no effect real to organoleptic test color hedonic tilapia fish nuggets. Flour leaf Moringa capable increase improving the quality of tilapia fish nuggets protein content of 0.5-13.18% and produces tilapia fish nuggets that have Vitamin A ( $\beta$ - carotene) content is 1.82-20.76%. Fortification flour leaf Moringa with a concentration of 10% produces quality tilapia fish nuggets best.

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