



## Testing the Level Organoleptics for Moringa (*Moringa oleifera*) Biscuits with the Addition of Tuna (*Thunnus Sp*) Bone Flour as an Additional Food for Children Toddlers

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### ABSTRACT

One of the 2030 SDG targets, namely SDG target 2, the Indonesian government has attempted to provide interventions to reduce stunting rates, both specific interventions and sensitive interventions. One of the government's efforts is to provide functional food in the form of high-calorie biscuits to stunted toddlers. Several obstacles often occur, one of which is distribution where the PMT biscuits are produced outside Papua and it takes time for distribution until when they arrive in the community the biscuits have expired and cannot be consumed. Organoleptic test results for color preference levels, panelists liked Moringa Biscuits with the addition of 20% tuna bone meal; for the level of preference for aroma, panelists liked Moringa Biscuits with the addition of 10% tuna bone meal; for taste preference level, panelists liked Moringa Biscuits with the addition of 30% tuna fish bone meal; For the level of preference for texture, panelists liked Moringa Biscuits with the addition of 20% tuna bone meal.

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## INTRODUCTION

Currently, Indonesia is faced with three burdens of nutritional problems, namely the problems of malnutrition, *stunting* and *wasting* ; nutritional problems such as *overweight* and *obesity* ; as well as problems with micronutrient deficiencies, namely anemia, vitamin A deficiency and iodine deficiency. This nutritional problem often occurs in high-risk age groups, namely toddlers, pregnant women and breastfeeding mothers. Nutritional problems that occur in mothers and children are a challenge for Indonesia to achieve national development.

UNICEF-WHO-World Bank (2021) globally the prevalence of stunting has decreased since 2000 . One in five children under five in the world or 149.2 million children under five will experience stunting in 2020 and 45.4 million will suffer from wasting. SSGI data for 2022 shows that 21.6% of toddlers experience stunting. Even though there has been a decline in stunting cases in Indonesia, the prevalence of stunting cases in Papua is still quite high, namely 34.6%, where Papua is ranked third in the highest prevalence of stunting cases after East Nusa Tenggara and West Sulawesi.

The prevalence of stunting which is still high in the Papua region is a challenge for the progress of Papuan Community Resources. Studies show that short childhood is strongly associated with poor educational achievement, decreased years of education and lower income as an adult. Short children face a greater likelihood of growing into adults who are less educated, poorer, less healthy and more vulnerable to non-communicable diseases. Therefore, short children are a widely accepted predictor of poor quality of human resources, which in turn reduces a nation's productive capacity in the future (Unicef, 2012).

One of the 2030 SDG targets is SDG target 2.2 to end all forms of malnutrition, including achieving stunting and wasting targets in children under 5 years of age, and meeting the nutritional needs of adolescent girls, pregnant and breastfeeding mothers, and the elderly. The Indonesian government has attempted to provide interventions to reduce stunting rates, both specific interventions and sensitive interventions. One of the government's efforts is to provide additional food in the form of high-calorie biscuits to stunted toddlers and pregnant women. Several obstacles often occur so that providing additional food becomes ineffective and inefficient. One of them is distribution where the PMT biscuits are produced outside Papua so it takes time for distribution so that by the time they arrive in the community the biscuits have expired so the community cannot feel the benefits.

Based on the above, researchers want to conduct research by making high-protein biscuits using basic ingredients from local Papuan food mix flour, namely a mixture of sago flour, sweet potato flour, moringa leaf flour, flour with the addition of tuna fish bone meal, as a solution for stunting toddlers. It is hoped that this biscuit formulation can be produced in Papua and the Papuan people will feel the benefits.

### ***Research Objectives and Benefits***

1. General purpose  
The aim of this research is to determine the nutritional, organoleptic and microbiological content of PMT biscuit formulations based on local food ingredients for Stunting Toddlers and Pregnant Women.
2. Special purpose
  - a. To determine the level of preference for Moringa biscuits with the addition of 10% fish bones
  - b. To determine the level of preference for Moringa biscuits with the addition of 20% fish bones
  - c. To determine the level of preference for Moringa biscuits with the addition of 30% fish bones
3. Benefits of research
  - a. Implementing the Tri Dharma of Higher Education and producing superior research and innovation in the field of food and its relation to health.
  - b. As a PMT solution for specific nutritional interventions in reducing nutritional problems, namely stunting in toddlers.
  - c. Achieving campus accreditation resulted in publication and IPR of PMT biscuit products for stunted toddlers
  - d. As teaching material for the Local Papua Food Processing Course and the Food Processing Technology Course at the Faculty of Public Health.

## **THEORITICAL REVIEW**

### ***Biscuits***

Indonesian National Standard 2973-2011, biscuits are a dry food product made by baking dough made from wheat flour or its substitutes, oil or fat with or without the addition of other permitted food ingredients. Biscuits are made from wheat flour which is added with other additional ingredients such as sugar, eggs, margarine, emulsifier, shortening and flavoring ingredients. Biscuits have a water content of less than 5%, which makes the shelf life of biscuits longer, protected from moisture, and makes biscuits a practical food ingredient for the public.

Biscuits can be classified into several types based on the texture of the biscuit, the method of forming the dough, and the addition of ingredients. Biscuits can be grouped into crackers, cookies, wafers and pies (Manley, 2001). Biscuits are snacks that have a quality standard of water content of less than 5% so they have a crunchy texture (Manley, 2001). The chemical properties of biscuits can be seen from the parameters of water content, fat content, protein content and ash content which are in accordance with Indonesian National Standards. Changes in the chemical properties of biscuits can occur due to the influence of several factors, such as ingredient composition, temperature and baking time. Overall biscuit quality standards have been regulated in SNI 2973-2011 which can be seen in Table 1.

Table 1. SNI 2973-2011 Biscuit Quality Requirements

No.	Test Criteria	Unit	Condition
1	Protein (N x 6.25) (w/w)	%	Min 3-5
2	Free fatty acids	%	Max 1.0
3	<i>E. coli</i> contamination	APM/g	< 3
4	contamination.	-	Negative/ 25 g
5	Mold and yeast contamination	Colonies/g	Max. $2 \times 10^2$

Source: SNI 2973:2011

### Stunted Toddlers

Short toddlers (Stunting) is a problem of chronic malnutrition caused by inadequate nutritional intake over a long period of time due to providing food that is not in accordance with nutritional needs. Stunting can occur from the fetus in the womb and only appears when the child is two years old. (Eko Putro Sandjojo, 2017). Stunting is nutritional status which is based on the PB/U or TB/U index where in the standard anthropometric assessment of children's nutritional status, the measurement results are at the threshold ( $Z$  - Score)  $< 2$  SD to  $- 3$  SD (short / stunted) and  $< -3$  SD (very short/severely stunted) (Trihono, et al, 2015).

### Research Road Map

This research will be carried out on an ongoing basis. The road map for this research is as follows:

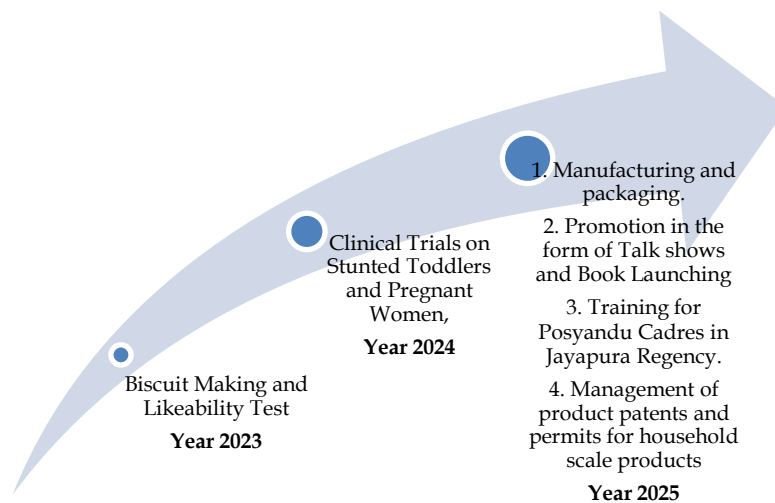


Figure 1. Research Road Map

#### 1. Biscuit making

Moringa Biscuits are made by mixing several types of flour such as; Sago flour, sweet potato flour, and moringa flour are made specifically as additional food for stunted toddlers. Biscuit making is done by applying food processing technology knowledge which is carried out at the Nutrition Laboratory of the Faculty of Public Health.

#### 2. Test Likeability Level

3. *IPR publication and registration*

The publication target in this research is 1 Scopus indexed international journal for each formula. The IPR target for this research is 4 IPRs, namely 2 IPRs for biscuit products and 1 IPR for biscuit making guide books.

4. *Clinical Trials (Year 2024)*

At this stage, clinical trials will be carried out on stunted toddlers and pregnant women in Jayapura Regency.

5. *Research Downstream (2025)*

At this stage, researchers will provide assistance to micro, small and medium enterprises (MSMEs) or the food industry to produce biscuits as a form of community service.

## **METHODOLOGY**

### ***Types of Research***

This type of research is *a true experiment*. In this research, the Moringa biscuit formula was developed with the addition of 10%, 20% and 30% tuna fish bone meal. The development of this formula was to determine the level of preference for color, aroma, taste and texture of each biscuit by adding fish bone meal in different concentrations.

F0 : Moringa Biscuits without the addition of fish bone meal (0%).

F1 : Moringa Biscuits with the addition of 10% fish bone meal.

F2 : Moringa Biscuits with the addition of 20% tuna fish bone meal.

F3 : Moringa Biscuits with the addition of 30% tuna fish bone meal.

### ***Time and Place of Research***

1. Research time

The research was conducted for 1 month from July to August 2023.

2. Research Place

Making biscuit samples and testing the level of liking was carried out at the Nutrition Laboratory, Faculty of Public Health, Cenderawasih University.

### ***Research Stages/Flow***

The 2023 PNBPN research stages are:

1. Making fish bone meal

a. Tuna fish bones taken from Yotefa market are weeded and soaked in lime juice for 1 hour.

b. The bones that have been soaked are then cooked in a pressure cooker for approximately 1 hour, then removed and air-dried.

c. Dry in the hot sun until completely dry (2-3 days)

d. Blend until smooth then strain.

e. Tuna fish bone meal is ready to use.

## 2. Biscuit making

Biscuits are made in 3 formulas, namely F1 moringa biscuits with the addition of 10% tuna fish bones for stunting toddlers and formula F2 moringa biscuits with the addition of 20% fish bone meal, and the addition of 30% fish meal.

a. Biscuit making tools: Basin, *mixer* , spatula, digital scale for ingredients, measuring spoon, biscuit mold, aluminum cake pan, oven, airtight container/jar.

b. Ingredients for making biscuits:

eggs, powdered sugar, Dancow Milk sachet powder, Wijsman Roombutter, Blueband Butter, wheat flour, Moringa flour, sago flour, tapioca flour, fish bone flour.

The flour prepared is:

- 1) Formula F0: Wheat Flour Mix A (wheat flour, sago flour, flour sweet potato, moringa flour, fish bone meal 0%),
- 2) Formula F1: Wheat Flour + Mix B Flour (sago flour, sweet potato flour, Moringa flour, tuna fish bone meal 10%), and
- 3) Formula F2: Wheat Flour + Mix B Flour (sago flour, sweet potato flour, Moringa flour, tuna fish bone meal 20%), and
- 4) Formula F3: Wheat Flour + Mix C Flour (sago flour, sweet potato flour, Moringa flour, tuna fish bone meal 30%),

c. How to make biscuits:

- 1) Prepare the ingredients and weigh them according to the formula.
- 2) Mix butters, eggs, powdered sugar, salt, *baking powder* in a container using a medium speed *mixer* until it expands.
- 3) Pour in the wheat flour and *mix A* flour or wheat flour and *mix B* or wheat flour and add to the dough little by little while stirring using a spatula until the dough is thick and strong.
- 4) Mold the dough into a flat round with a diameter of 5 cm and a thickness of 0.5 cm.
- 5) Place it on the aluminum gutter, put it in the oven.
- 6) Bake in the oven at 150 °C for 10 minutes.

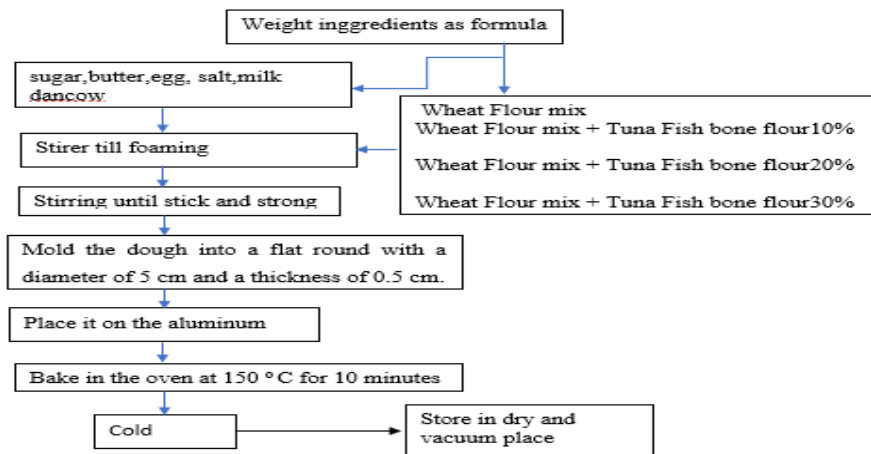


Figure 2. Framework : Biskuit Flowcart

### 3. Test Likeability Level

Samples were tested at the Nutrition Laboratory of the Faculty of Public Health to determine color, texture, taste, aroma, and texture using the sense of sight for color, the sense of taste for taste, the sense of taste for texture, and the sense of smell for aroma. Testing was carried out by trained panelists consisting of 20 FKM Uncen students.

Every student before entering the Lab room. Gizi were given a letter of willingness to be involved in this research, then they were given an explanation of how to test their level of liking and how to fill in their results/assessments in the assessment sheet.

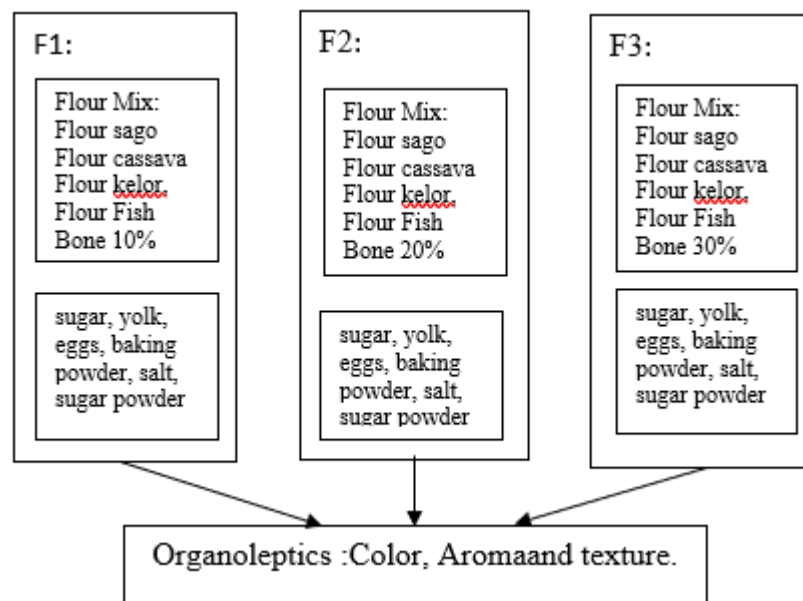


Figure 3. Research Flow

## RESULTS

### *Like Level Testing*

Organoleptic testing of product aroma, taste, texture and color is carried out using a hedonic scale. Using a limited 30 panelists. Panelists gave their favorite responses to the product, namely: really like (5), like (4), like somewhat (3), and somewhat dislike (2) don't like. Panelist responses are presented in bar charts and described.

#### *a. Panelists' Level of Likeness for Color*

Color is the first factor that is easy to observe in the quality of food ingredients. Sensory quality assessment of food products can be seen from the shape, size, clarity, color, and surface characteristics such as rough-smooth, dull, shiny, homogeneous-heterogeneous, and other shapes (Trihaditia and Puspitasari, 2020).

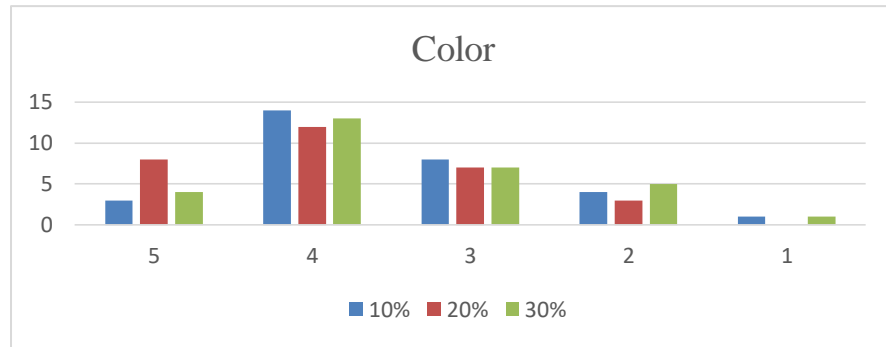


Figure 4. Distribution of Panelist Assessment Results on the Color of Moringa Biscuits with the Addition of 10%, 20% and 30% Fish Bone Meal

Based on figure 4, the panelists' ratings liked the color of Moringa Biscuits made from local food the most at a concentration of 20%. Based on statistical tests on the color preference level of Moringa Biscuits made from local food with concentrations of 10%, 20% and 30% using the Kruskal Variant Test at a confidence level of 95%, the  $p$ -value ( $sig$ ) = 0.88, because  $the\ p\text{-value}\ (sig) > \alpha\ 0.05$ , then there is no significant difference in the level of preference for the color of Moringa Biscuits made from local food at 10%, 20% and 30%.

**b. Panelists' Level of Likeness for Aroma**

The aroma of a food product is an important factor in determining the consumer's level of an ingredient. The aroma determines the deliciousness of the food, usually someone can judge whether a food is delicious or not from the aroma it produces (Hadi and Siratunnisak, 2016)

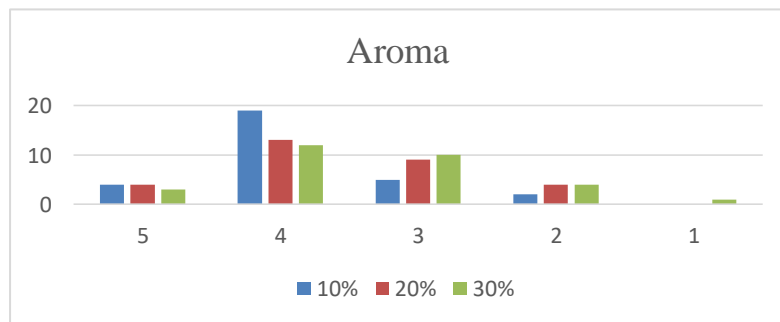


Figure 5. Distribution of Panelist Assessment Results on the Aroma of Moringa Biscuits made from local food: 10%, 20% and 30%.

Based on figure 5, the panelists' ratings liked the aroma of Moringa Biscuits made from local food the most at a concentration of 10%. Based on statistical tests on the level of preference for the aroma of Moringa Biscuits made from local food with concentrations of 10%, 20% and 30%. Testing with the Kruskal Variant Test at a confidence level of 95%, obtained  $p\text{-value}\ (sig) = 0.32$ , because  $p\text{-value}\ (sig) > \alpha\ 0.05$ , there is no real difference in the level of

liking for the color of Moringa Biscuits made from local food base 10%, 20% and 30%.

**c. Panelists' Level of Likeness for Flavors**

Taste is an assessment regarding preferences for food/products. In this taste assessment, panelists were given the opportunity to differentiate the taste of samples of Moringa Biscuits made from local food at 10%, 20% and 30%.

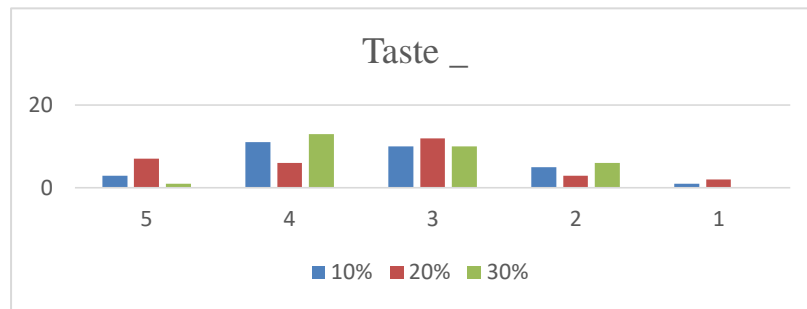


Figure 6. Distribution of Panelist Assessment Results on the Taste of Biscuits made from local food: 10%, 20% and 30%.

Based on figure 6, the panelists' ratings liked the taste of Moringa Biscuits with the addition of snakehead fish flour the most at a concentration of 30%. Based on statistical tests on the level of preference for the taste of Moringa Biscuits made from local food with concentrations of 10%, 20% and 30%. Kruskal Variant Testing with a confidence level of 95%, obtained  $p\text{-value (sig)} = 0.79$ , because  $p\text{-value (sig)} > \alpha 0.05$ , there is no real difference in the level of liking for the color of food-based Moringa Biscuits local 10%, 20% and 30%.

**d. Panelists' level of liking for texture**

Texture is an important characteristic of food products that can influence consumer acceptance. Texture is usually related to sensing or organoleptic tests on solid materials, namely impressions in the mouth such as chewing and tasting (Sari and Yohana, 2015).

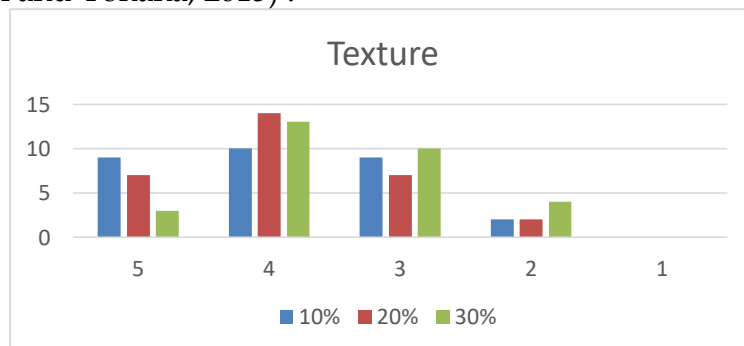


Figure 7. Distribution of Panelist Assessment Results on the Texture of Moringa Biscuits made from local food with concentrations of 10%, 20% and 30%.

Based on figure 7, the panelists' ratings liked the texture of Moringa Biscuits with the addition of fish meal the most at a concentration of 20%. *value (sig) = 0.195*, because *the p-value (sig)* was obtained.  $) > \alpha 0.05$ , then there is no real difference in the level of preference for the texture of Moringa Sago Biscuits with the addition of tuna fish flour.

## DISCUSSION

### *Color*

The brownish color of the biscuits is caused by the Maillard reaction during the baking process. This process causes amino acids to react with reducing sugars. These moringa biscuits, which are added with fish bone meal, contain more amino acids than biscuit flour which is not formulated with other fish meal. The resulting brownish color is thought to be due to fish meal substitution. This is in accordance with research which states that fish meal has a lower degree of whiteness than wheat flour, meaning that the more fish meal you add, the darker the color of the biscuits produced. Apart from that, the same results show that the higher the fish meal substitution, the darker the resulting color tends to be. Biscuits were least liked because certain proportions caused F3 biscuits (30% addition of fish bone meal) to be less liked (56.7%). This is because the proportion of fish meal in this biscuit (30%) exceeds the color preference limit based on organoleptic tests. This is supported by Sari, et al. (2014) which shows that the preferred color of fishmeal substitute biscuits is (10%–20%). This is thought to influence the panelists' acceptance of color because certain proportions have been shown to reduce color acceptance. The higher the fish meal substitution, the lower the color characteristics of the processed product.

### *Aroma*

This happens because tempeh flour has a distinctive smell, so using a lot or a little tempeh flour affects the resulting smell. Apart from that, biscuits are also processed using biscuit-making ingredients such as margarine. Using margarine and room butter in making cookies will make the cookies smell good.

The results of research and the opinions of other researchers show that the aroma of this biscuit can be influenced by the proportion of flour and roombutter which masks the unpleasant odor that arises from the dominance of the formulated fish bone flour. This smell is acceptable because it does not cause rotten odors or unpleasant odors caused by certain components, for example ammonia contained in fish. Most flours mixed with smaller amounts of fish meal combined can produce an acceptable odor (not fishy). These results indicate that the proportion (30%) of fish meal can be the limit of the proportion that produces the panelists' favorite aroma.

### *Taste*

The panelists' preference for the taste of this biscuit was the highest with the percentage found in biscuits with the addition of 30% fish bone flour. The

addition of up to 30% fish bone meal was most preferred by the panelists because it does not give a bitter taste or unpleasant odor.

This is different from several studies which state that adding >35% fish bone meal can make biscuits or cookies taste bitter. This happened because of the research because using fish bones means that the bones can give a bitter taste after being swallowed. Fish have a certain taste depending on the active flavor components in the fish and the variety of fish body parts used. Processing of processed fish products using fish bones as in this study can produce a bitter taste. Some of the active components that can cause a bitter taste in these biscuits are the amino acid arginine, peptides such as alanine-proline, glycine-phenylalanine, glycine-tyrosine, glutamate-phenylalanine, tyrosine-proline, phenylalanine-proline. There is a lot of glutamic acid in these biscuits which organoleptically produces a savory taste, but during processing glutamic acid can bind with the amino acid phenylalanine, giving this biscuit a bitter taste. The bitter taste due to the amino acid phenylalanine combined with tyrosine should be able to increase the savory or umami taste below the concentration threshold in the presence of salt and free amino acids. The cause of the bitter taste in this biscuit is that the amino acid components combine and are at a concentration that exceeds the threshold, giving rise to an undesirable bitter taste.

### *Texture*

Biscuit texture is the physical characteristic (hard) or crunchy/breaks easily like dry cakes in general (Mutmainna, 2013). Regarding Moringa biscuits, according to the panelists' assessment, Moringa biscuits with the addition of 20% fish bone meal were most preferred.

The three biscuit samples (F1, F2 and F3) had almost the same texture organoleptically, namely having a low level of hardness. This is due to the protein contained in the flour and the low starch content. The substitution of tuna fish bone flour results in the absence of gluten content in the dough, so the dough is loose or has a low level of hardness. The level of hardness of Moringa biscuits can be influenced by the biscuit formulation, the protein content in the flour, and the starch content in the flour. Tuna Fish bone meal does not contain gluten. The gluten content that is not found in fish causes the texture of the biscuits to become soft. The absence of gluten causes biscuits to crumble easily because gluten plays a role in giving strength to the dough. This is supported by Doporto, et al. (2017) that the hard texture is caused by the interaction of protein and starch through hydrogen bonds during dough development and baking. The texture of gluten-free biscuits is due to the gelatinization of starch and sugar at low temperatures and the development of the protein-starch structure occurs more slowly. (Doporto, et al., 2017)

## **CONCLUSION AND RECOMMENDATION**

1. The results of the organoleptic test for the level of color preference, the panelists liked Moringa Biscuits with the addition of 20% tuna bone meal.
2. Organoleptic test results for the level of preference for aroma, panelists liked Moringa Biscuits with the addition of 10% tuna bone meal.
3. The results of the organoleptic test for the level of taste preference, the panelists liked Moringa Biscuits with the addition of 30% tuna bone meal.
4. The results of the organoleptic test for the level of preference for texture, the panelists liked Moringa Biscuits with the addition of 20% tuna bone meal.

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