Organoleptic Quality of Tuna Porridge Canned with Fortified Tuna Bone Meal

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Abstract. Porridge is a cereal based meal which may be combined with tuna meat and bone meal for improved nutritional content, particularly calcium. Good quality tuna porridge canned must be beneficial to health, of high nutritional value and acceptable to sensory organs. This research aims at obtaining a formulation of tuna porridge canned product with fortified tuna bone meal with good organoleptic quality and acceptable to the society. The use of completely randomized design with fortification treatments 0%, 1%, 2% and 3% and three repetitions in the research method is expected to present an overview of the organoleptic quality of tuna porridge canned. The research result shows that fortified tuna bone meal significantly influences the organoleptic quality of taste and texture and does not significantly influence the organoleptic quality of color and smell. The analysis using the Bayes method results in the best product of tuna porridge canned with fortified tuna bone meal 1%.

1. Introduction

North Maluku is one of the provinces in the eastern part of Indonesia which is famous for its spices. It also has diversified traditional processed products made from fish such as tuna rica-rica, wood-dried tuna and tuna porridge. Diversification made from fish generally has low nutritional content, so that to increase the calcium content of these products, fortification can be done, one of which is by utilizing tuna fish bone meal derived from tuna fish bones ([1]; [2]).

Tuna bone is a waste of fishery product containing many important minerals needed by the body, thus utilizing tuna bone, besides reducing pollution, also serves as an effort to fulfill the body’s needs for nutrition, particularly calcium [3]. To obtain calcium content from tuna bone, tuna bone must be made a diversified product known as fish bone meal. Tuna bone that has become meal contains high minerals, particularly calcium and phosphor [4]. Further, tuna bone meal with high content of calcium and phosphor may become an alternative source for fulfilling the needs through a fortification process on food product, for example tuna porridge canned product [5].

Tuna porridge canned is one fishery diversification utilizing tuna flesh as the source of protein, so that it is certain that tuna porridge canned generally has low mineral contents, particularly calcium. Increasing calcium content requires fortification, which is a process to enrich or add a type of nutritional substance into food to prevent deficiency and enhance health ([6]; [7]). Fortified food product, even if it has high nutritional content, but if it is not liked and not accepted by the society, will not have value [8]. Good quality tuna porridge canned with fortified tuna bone meal must have beneficial nutritional value to health and be acceptable to sensory organoleptic, so this research was conducted with the aim of analyzing the effect of fortification of tuna bone meal on the sensory value of tuna porridge canned.
2. Materials And Method
This research was conducted in June-July 2020 at the Laboratory of Fishery Products Processing, Fishery Products Technology Study Program, Muhammadiyah University of North Maluku. The tools and materials needed in this research were tuna porridge processing, canning and testing instruments and tuna porridge making materials, including rice, seasoning, tuna meat and tuna bone meal for fortification.

![Flow Chart of Tuna Fish Flour Making Process](image)

**Figure 1.** Flow Chart of Tuna Fish Flour Making Process

![Research Implementation Flow Chart](image)

**Figure 2.** Research Implementation Flow Chart
The research initial process starts from preparation of fortification materials in the form of fish bone meal (Figure 1) and followed with tuna porridge making starting from preparation of materials consisting of 2kg rice, seasoning with composition of shallot, rice cleaning water, seasoning and tuna meat (150g) cut in dice shape in a size of 1 x 1cm. The next process was cooking of rice, tuna meat with seasoning and fish bone meal fortification process (Figure 2).

The research treatments were fish bone meal fortifications A0 (0%), A1 (1%), A2 (2%) and A3 (3%) of tuna meat weight, with 3 repetitions and randomly served to 25 panelists using hedonic test with 4 scales, consisting of scale 1 (dislike), scale 2 (rather like), scale 3 (like), and scale 4 (extremely like). An organoleptic test was conducted on the taste, color, texture, aroma and consistency or overall acceptance level aiming at examining the tuna porridge canned’s acceptability to consumers. The data of organoleptic test were descriptively analyzed and then analyzed using a Completely Randomized Design (RAL) with the following mathematics model [9]:

\[ Y_{ij} = \mu_i + \tau_i + \varepsilon_{ij}, \]

Where: \( i = 1, 2, \ldots, t \) and \( j = 1, 2, \ldots, r \); \( Y_{ij} \) = Observation on treatment \( i \) and repetition \( j \); \( \mu \) = General average; \( \tau_i \) = Influence of treatment \( i \); \( \varepsilon_{ij} \) = Random influence on treatment \( i \) and repetition \( j \).

The product was chosen using Bayes method, with the following mathematics formula [10]:

\[ \text{Total value } i = \text{value}_{ij} \sum_{j=1}^{m} \text{Crit}_j \]

Where: Total value \( i \) = total final value of alternative \( i \); \( \text{Value}_{ij} \) = value of alternative \( i \) with criterion \( j \); \( \text{Crit}_j \) = importance (weight) of criterion \( j \); \( i = 1, 2, 3, \ldots n \); \( n \) = number of alternative; \( j = 1, 2, 3, \ldots m \); \( m \) = number of criteria

3. Result And Discussion

The knowledge of whether a food product is good or bad is the basic thing to identify whether such product is consumable or marketable. The generally performed method is to observe the characteristics of whether such food product is good or bad through organoleptic test. Organoleptic test on a food is a subjective assessment using vision, taste and smell senses with which we may identify the quality or level of acceptance of a product ([11] in [12]). Hedonic / organoleptic analysis is an analysis of consumer preferences for taste, color, aroma, texture, smell and consistency/overall [13]. The results of organoleptic test on tuna porridge canned with fortified tuna bone meal conducted by 25 semi-trained panelists using hedonic test covering flavor, color, texture and smell are presented in Figure 3.

![Figure 3. Organoleptic Test Results of Tuna Porridge Canned](image-url)
The value of organoleptic quality test was then analyzed using a completely randomized design to observe the influence of each treatment on the organoleptic quality of tuna porridge canned with fortified tuna bone meal.

3.1. Flavor

Flavor is a factor to determine consumer’s final decision to accept or reject a product, that even if the color and aroma of a product is good, but it does not taste good, the product will be rejected. Taste starts from sense of taste’s (tongue) response to chemical stimulation to all interactions between the aroma, flavor and texture characteristics as food taste as a whole. The result of panelists’ assessment of the taste of tuna porridge canned (Figure 3) shows that the flavor in treatments A₀, A₂ and A₃ is rather liked with respective treatment value of 2.30, 2.30 and 2.42, while treatment A₁’s value is 2.97 falling into like criteria. The taste of a food material may be derived from the characteristics of the material itself or because of other substance added during processing [14]. The results of variance analysis on the flavor of tuna porridge canned are presented in Table 1.

| Source of Variation | SS   | df | MS    | F     | P-value | F crit |
|---------------------|------|----|-------|-------|---------|--------|
| Treatment           | 0.912| 3  | 0.304 | 8.046 | 0.008   | 4.066  |
| Galat               | 0.302| 8  | 0.037 |       |         |        |
| Total               | 1.214| 11 |       |       |         |        |

Table 1 shows that fortified tuna bone meal significantly influences the flavor of tuna porridge canned with F_count value (8.046) which is higher than F_table (4.066) and P-value (0.008) which is lower than \( \alpha \) (0.05). The result of further test finds that treatments A₀, A₂ and A₃ do not show any significant difference between treatments, but the three treatments are significantly different from treatment A₁. The panelists were more interested in treatment A₁ with added tuna bone meal 1%, which is supposedly caused by less added tuna fish meal, so that it does not influence it much. Besides, taste is influenced by some factors, namely chemical compound, temperature, concentration and interaction with other taste components [15] and food material generally does not consist only of one taste, but a whole flavor [16]. The characteristics of taste assessment greatly influence consumer’s final decision to accept and reject a product, even if other characteristics are good [17].

3.2. Color

Color is the first sensory characteristic directly seen by the panelists, in which color plays an important role in the acceptance and as the factor to indicate any chemical change in a food product [18] states that color is the quickest and easiest parameter of impression. The result of panelists’ assessment on the color of tuna porridge canned with treatments A₀, A₁, A₂ and A₃ (Figure 3), shows the color liked with the respective treatment’s value of 2.49, 2.49, 2.45 and 2.47.

The result of variance analysis (Table 2) shows that fortified fish bone meal does not significantly influence the color of tuna porridge canned, as may be observed from F_count value (0.235) which is lower than F_table (4.066) and P-value (0.869) which is higher than \( \alpha \) (0.05). White fish meal and low percentage of tuna bone meal used in the fortification cause no significant change in the color of tuna porridge canned. This causes the panelists’ acceptance value of the color of tuna porridge canned tends to be equal.
Table 2. Analysis of Variance of Tuna Porridge Canned Color

| Source of Variation | SS  | df | MS   | F    | P-value | F crit |
|---------------------|-----|----|------|------|---------|--------|
| Treatmen            | 0.005 | 3   | 0.002 | 0.235 | 0.869   | 4.066  |
| Galat               | 0.058 | 8   | 0.007 |      |         |        |
| Total               | 0.063 | 11  |      |      |         |        |

3.3. Texture

Texture is the value of touch on a surface, either actual or false, which may be rough, smooth, hard, soft and coarse or slippery. Food texture is also a component which also determines food flavor since the sensitivity of the sense of flavor is influenced by food texture. Food with solid or thick texture will stimulate human sense more slowly. The result of the panelists’ assessment on the texture of tuna porridge canned (Figure 3) shows the texture of treatments A0, A1 is rather liked with respective value of 2.22 and 2.44, while with treatments A2 and A3 the texture of fish porridge is liked by the panelists with respective quality value of 2.53 and 2.63.

The result of variance analysis (Table 3) finds that fortified tuna bone meal significantly influences the texture of tuna porridge canned, with F count value (9.012) which is higher than F table (4.066) and P-value (0.006) which is lower than (0.05). The result of further Tukey HSD test finds that treatment A0 is significantly different from treatments A2 and A3 but not significantly different from treatment A1.

Table 3. Analysis of Variance of Tuna Porridge Canned Texture

| Source of Variation | SS  | df | MS   | F    | P-value | F crit |
|---------------------|-----|----|------|------|---------|--------|
| Treatmen            | 0.289 | 3   | 0.096 | 9.012 | 0.006   | 4.066  |
| Galat               | 0.085 | 8   | 0.010 |      |         |        |
| Total               | 0.374 | 11  |      |      |         |        |

Tuna porridge canned has more solid texture in line with increasing percentage of fortified tuna bone meal, which causes the panelists to like the texture of tuna porridge canned with fortified material 1% and 2% more. In addition, based on other research result, the change in texture may change the taste and smell since it may influence how fast olfactory cells and water gland are stimulated [12].

3.4. Smell

Smell is one of the parameters which determine the deliciousness of a food product and in many cases smell has its distinguished attractiveness to determine the deliciousness of food product itself. In food industry, smell test is deemed important since it may present an assessment to a product, whether or not the product is liked by consumers [12]. The result of the panelists’ assessment on the smell of tuna porridge canned with treatments A0, A1, A2 and A3 is respectively 2.19, 2.19, 2.20 and 2.20 which fall into rather like criteria.

The result of variance analysis on the smell of fish porridge is presented in Table 4, in which fortified tuna bone meal does not significantly influence the smell of tuna porridge canned, as may be observed with F count value (0.012) which is lower than F table (4.066) and P-value (0.998) which is higher than (0.05). According to [18], tuna bone meal has very strong fishy aroma, but with its low percentage in use as fortification material, it has no effect on the smell, not to mention the smell of tuna porridge canned is dominated more by the smell of specific spices used, such as clove and nutmeg.
Table 4. Analysis of Variance of Tuna Porridge Canned Smell

| Source of Variation | SS  | df | MS   | F    | P-value | F crit |
|---------------------|-----|----|------|------|---------|--------|
| Treatment           | 0.000 | 3  | 1E-04 | 0.012 | 0.998   | 4.066  |
| Galate              | 0.064 | 8  | 0.008 |      |         |        |
| **Total**           | **0.064** | **11** |       |      |         |        |

3.5. Over all

The overall acceptance is analyzed using Bayes method, which is a technique used in analysis to make the best decision out of a number of alternatives aiming at gaining optimal result [19]. Based on the analysis with Bayes method, tuna porridge canned with fortified tuna bone meal 1% (treatment A₁) is the best product with score 2.58, followed with treatments A₃, A₂ and A₀ with respective score 2.49, 2.42 and 2.36. The matrix of assessment decision with Bayes method is presented in Table 5.

Table 5. Matrix of Assessment Decisions by Bayes Method

| Treatment | Taste | Colour | Texture | Smell | Value | Ranking |
|-----------|-------|--------|---------|-------|-------|---------|
| A₀        | 2.30  | 2.49   | 2.21    | 2.19  | 2.36  | 4       |
| A₁        | **2.97** | **2.49** | **2.44** | **2.19** | **2.58** | **1** |
| A₂        | 2.30  | 2.44   | 2.52    | 2.20  | 2.42  | 3       |
| A₃        | 2.42  | 2.47   | 2.63    | 2.20  | 2.49  | 2       |

Criteria Weights 0.256 0.256 0.256 0.256

4. Conclusion

The research result shows that fortified tuna bone meal significantly influences the organoleptic quality of taste and texture of tuna porridge canned with $F_{\text{count}}$ value respectively 8.046 and 9.012 which are higher than $F_{\text{Table}}$ 4.066 and does not significantly influence the organoleptic quality of color and smell with $F_{\text{count}}$ value respectively 0.235 and 0.012 which are lower than $F_{\text{Table}}$ 4.066. The result of analysis using Bayes method shows that treatment A₁ (fortified tuna bone meal 1%) has the highest score of 2.58, followed with treatments A₃, A₂ and A₀ (fortified tuna bone meal 3%, 2% and 0%) with respective score of 2.49, 2.42 and 2.36. Based on this, the best product is tuna porridge canned with fortified tuna bone meal 1%.

Acknowledgement

Our deepest thanks to LP3M UMMU Ternate, Rector of the University of Muhammadiyah North Maluku and Dean of the Faculty of Agriculture of UMMU-Ternate for their cooperation in facilitating us with the facilities and infrastructure in the Internal Research Grant.

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