TEMPE, BANANA BUD AND MORINGA NUGGET (*TEJAKE NUGGET*) AS ALTERNATIVE HEALTH AND NUTRITIOUS SNACK

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ABSTRACT

Nugget is a food product which can be used as an alternative snack. One way to get the benefits of tempe, banana bud and moringa is by making processed nuggets which are healthy and nutritious snacks. The purpose of this study was to determine the level of preference and nutritional value of the Tejake nugget.

The research method is a quantitative test with an experimental approach and uses 25 panelists to see the level of preference based on organoleptic tests. Data were analyzed using the Friedman and Wilcoxon tests. Nutritional value is determined using the Nutrisurvey application. Organoleptic test results based on the highest level of preference on the taste and texture of the Tejake nugget were in the T2 treatment and the highest level of preference on color and flavor were in the T1 treatment. Based on the Friedman and Wilcoxon test, from the organoleptic test performed, the three parameters namely color, flavor and texture have a significant value smaller than 0.05 ($p < 0.05$), whereas for the taste parameter the significant value is greater than 0 .05 ($p > 0.05$).

This shows that the substitution of banana bud and moringa leaves does not affect the taste of Tejake nuggets produced. The high nutritional value of Tejake nuggets can makes an alternative to healthy and nutritious snacks.

Keywords: *Nugget, tempe, banana bud, moringa*

INTRODUCTION

Nugget is a food product made from meat. Nugget is one of the processed food ingredients that can be used as an alternative to snacks. Nugget on the market is usually in the form of nuggets derived from animal ingredients, where the nuggets contain high levels of fat and have a higher price. These animal-based nuggets can be replaced with vegetable ingredients. Compared to meat nuggets, production costs and materials needed for processing tempeh nuggets are far more economical. Tempe is known as a high protein source, in the process of tempe fermentation it can retain most of the nutrients contained in soy so that tempe can increase the digestibility of its protein. Various studies have shown that tempeh can be used as a cheap source of protein for food in developing countries [7].

Gorontalo Province is one of the regions that has good potential in agriculture, one of which is banana. But the use of banana buds has not been done optimally. The existence of a banana bud seemed to be getting rid of it. Even the bud of a banana is considered to be the lower middle class food menu. Banana bud contains a variety of substances that are good for health such as protein, phosphorus, minerals, calcium vitamins

B1, C and high fiber content (Panji, R. 2012). Banana bud has properties and health benefits. Since ancient times one of the benefits of banana bud to increase milk production. Because of that banana bud is very good to be consumed by mothers who are breastfeeding. Banana bud can be used as an alternative food to substitute meat which is generally the main ingredient in making nuggets.

Moringa oleifera Lam (Moringa oleifera) has been known for centuries as a multipurpose plant, nutrient-dense and medicinal. Gorontalo people only use this plant as fodder such as goats; so it is necessary to do technological innovations that make these plants worth promoting their benefits and efficacy. Wahyuni (2013), reported that Moringa leaves can be used to treat Hepatitis B. This shows that Moringa leaves are very potential as a source of nutrition and an excellent treatment for our bodies. In Africa and Asia Moringa leaves are also recommended as a nutrient-rich supplement for breastfeeding mothers and children in their infancy. The high nutritional value, efficacy and benefits have made Moringa a nickname as Mother's Best.

One of the best and easiest ways to get the benefits and benefits of tempeh, banana bud and moringa is to make processed nugget products which are the latest innovations in making healthy, inexpensive and nutritious snacks. Tempe, banana bud and Moringa are vegetable ingredients that have been used in making nuggets as a substitute for animal ingredients. However, the use of these three ingredients simultaneously in the making of nuggets has never been studied. Therefore, in this study it is necessary to know the right amount of addition of tempeh, banana bud and moringa to produce good quality nuggets, can be accepted by consumers and have good nutritional value.

METHODS

This research is a quantitative study with an experimental approach, in this study there are control variables and experimental variables as a reference between the initial state and the state after being treated. The experimental design used in this study was a randomized block design (RCBD) with a control group and 3 treatments with 3 replications. Control group T0: 100% tempe and treatment group T1: 75% tempe: 23% banana bud: 2% moringa leaves, T2: 50% tempe: 46% banana bud: 4% moringa leaves and T3: 25% tempe: 69% Banana bud: 6% Moringa leaves. This research was conducted at the Microbiology and Food Laboratory of the Polytechnic of the Ministry of Health Gorontalo in July 2019.

The ingredients used in making Tejake nuggets are tempeh, banana bud, moringa leaf, wheat flour, tapioca flour, eggs, oil, spices (garlic, onion, pepper, cayenne pepper, salt and sugar). The tools used are dough pan, molds, stoves, knives, blenders, pans and knives. This research was conducted in two stages, namely the preparation phase and the implementation phase. The preparation phase consists of preparation of materials, namely the selection of quality ingredients and weighing all the materials used in this study, while the implementation phase consists of the process of making banana and Moringa bud tempe nuggets. The first step is the smoothing of Moringa leaves. Freshly prepared Moringa leaves, then separate the Moringa leaves from the stem. The next process is washing Moringa leaves using running water, drain and then mashed using a blender. Tempeh is cut into small pieces, then steamed for ± 10 minutes at a temperature of 98 ° C. After the texture of the tempeh becomes tender, puree the tempe using a blender. Seasoning (garlic, onion, pepper, cayenne pepper, salt and sugar) is mashed and sauteed until smooth with a little oil until cooked.

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All ingredients are mixed together except bread flour, then poured into a baking pan that has been oiled and steamed for 30 minutes. The steamed dough is allowed to stand for 1 minute at room temperature then cut into pieces with a size of 6 x 1 cm. Heating is carried out in two stages, namely immersion of the nuggets that have been cut into eggs and bread / panir flour. The nuggets are packed in transparent plastic and then glued the edges together into a freezer. For the serving stage the nugget is fried for 2 minutes at 185 ° C. A temperature that is too low will cause the product coating to be less mature otherwise if the frying temperature is too high the product coating becomes charred (Yuliani, 2013).

After the nugget is finished, the next step is organoleptic test to determine the level of preference by ranking the average value of each treatment. Then the statistical test is performed using the Friedman test and Wilcoxon follow-up test. The nutritional value of nuggets products is calculated using the Nutrisurvey application (free).

RESULTS AND DISCUSSION

Organoleptic Test

The organoleptic nugget test was carried out with a panelist preference level test on the quality of color, taste, aroma and texture with three treatments and 1 control. There were 25 panelists who were unskilled panelists from the students of Pharmacy Health Polytechnic of Gorontalo.

Color

Color is the first appearance that greatly influences consumers to choose a product [9]. Color has a very important function in a food because it can affect consumer tastes and can arouse appetite.

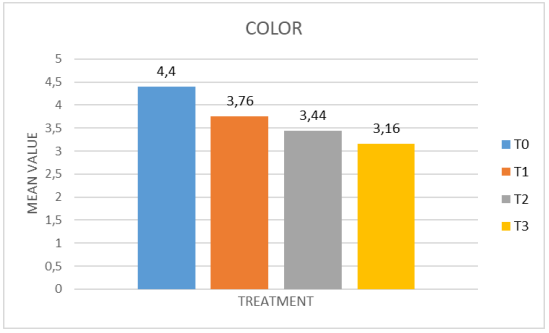

Diagram 1. Level of Preference for the Color of *Tejake* Nugget

Based on organoleptic tests, the level of preference of panelists on the color of the nugget varies greatly, ranging from dislikes to likes. The addition of banana and Moringa leaf in the making of tempe nugget gives a real influence on the color of *Tejake* nugget. Based on Diagram 1, the highest average level of preference for tejake nugget color is in the control (T0) with a typical light brown color on the inside and tempe on the outside. In the treatment, T1 has the highest average value compared to other treatments with a value of 3.76. To determine the effect of banana bud and Moringa substitution on the tempe nugget, a statistical test was carried out by testing the normality using *Shapiro-Wilk* where the data obtained were not normally distributed. Data that is not normally distributed are then analyzed using the *Friedman* Test.

Table 1. *Friedman* Test Results on the *Tejake* Nugget Taste

N	25
Chi-Square	42,366
Df	3
Asymp. Sig.	,000

Based on the *Friedman* test results, the average level of panelists preference for T0, T1, T2 and T3 is 3.56, 2.64, 2.10 and 1.70, respectively. From the ranking results it is known that T0 which is the control gets the highest response, followed by T1, T2 and T3. The statistical test table shows that the value of Chi Square = 42,366 and asymp sig 0,000. Chi Square significance test results showed that sig <

0.05 so that it can be concluded that the level of panelists preference for the color of the *Tejake* nugget with one control and three treatments performed were significantly different. Furthermore, a further test using the Wilcoxon Test is to compare each of the 2 groups.

Table 2 Wilcoxon Test Results on the *Tejake* Nugget Color

Test Statistics[a]

	WARNAT1 - WARNAT0	WARNAT2 - WARNAT0	WARNAT3 - WARNAT0	WARNAT2 - WARNAT1	WARNAT3 - WARNAT1	WARNAT3 - WARNAT2
Z	-3,398[b]	-4,062[b]	-4,021[b]	-2,309[b]	-3,260[b]	-2,333[b]
Asymp. Sig. (2-tailed)	,001	,000	,000	,021	,001	,020

a. Wilcoxon Signed Ranks Test

b. Based on positive ranks.

Based on the results of the calculation of the *Wilcoxon* Signed Rank Test, then from the 6 treatment comparisons analyzed and compared, the six treatment comparisons have a p value (Asymp. Sig 2 tailed) less than the critical limit of research 0.05 so that the hypothesis decision is to accept H1 or meaningful there are significant differences between these treatments.

Statistical test results indicate the influence of the addition of banana bud and moringa leaves on the color of the tempe nugget produced, which is seen from the significant value of 0,000 (<0.05). The higher the amount of addition of banana bud and moringa leaves, the resulting color will be more blackish green. This is influenced by the content of anthocyanins found in the bud of bananas, and the content of chlorophyll found in moringa leaves. Based on research by Yanuarti, 2008 in Lestario 2014, the anthocyanin content in the bud of Kepok bananas is 46.7 mg / 100 grams of material weight. According to Krisnadi (2013) in Mardiyah (2019) Moringa leaves have a high concentration of chlorophyll. Chlorophyll is a substance that causes the natural green color of leaves that are commonly found in leaves, so it is often called leaf green. Fresh Moringa leaves contain chlorophyll at 6,890 mg / kg [6].

Taste

Taste is one of the properties of food, drinks and seasonings can be defined as a collection of perceptions of sensory stimulation combined with digestive stimulation in the form of impressions received through chemical stimulation of a product in the mouth (Meilgaard, 1999).

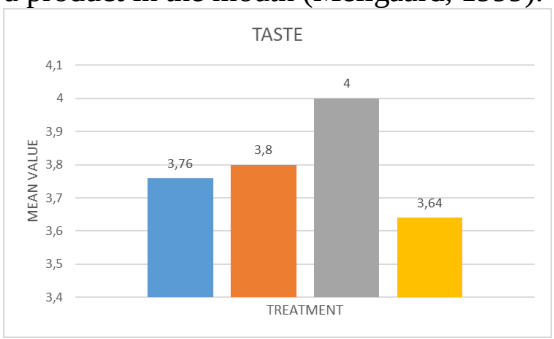

Diagram 2. Level of Preference for the Taste of *Tejake* Nugget

Based on the results of the organoleptic test of tempe nugget flavor with the subtitution of Moringa leaves and banana bud with an average difference in each treatment combination. From the data obtained shows that the level of panelists preference for the taste of tempe nugget ranges from dislike and really like. The subtitution of banana bud and Moringa leaf in the making of tempe nugget gives a real influence on the taste of *Tejake* nugget. Based on Diagram 2, the highest average level of preference for the taste of tejake nugget is at T2 with a ratio of 50% tempe: 46% banana bud: 4 moringa leaves with an average value of 4. To find out the effect of banana bud and Moringa substitution on the nugget tempe was tested statistically by the *Friedman* test and the *Wilcoxon* test.

Table 3. Friedman Test Results on the *Tejake* Nugget Taste

N	25
Chi-Square	3,328
df	3
Asymp. Sig.	,344

Table 4. Wilcoxon Test Results on the Tejake Nugget Taste

	T1 - T0	T2 - T0	T3 - T0	T2 - T1	T3 - T1	T3 - T2
Z	-,393[b]	-1,604[b]	-,647[c]	-1,073[b]	-,708[c]	-1,806[c]
Asymp. Sig. (2-tailed)	,694	,109	,518	,283	,479	,071

Friedman and *Wilcoxon* test results stated that there was no effect of Moringa leaf and banana bud substitution on the tempe nugget taste, seen from the significant value of 0.344 (greater than 0.05) in the *Friedman* test and *Wilcoxon* test.

The statistical test results are not in accordance with the literature, namely the more addition of Moringa leaves, the taste of tempe nuget becomes rather bitter. This is because the amino acid content of Moringa leaves which acts as one of the components forming aroma and taste. Bitter taste is caused by the hydrolysis of amino acids that occur in the heating process during processing. In addition, Moringa leaves have a distinctive taste because of the tannin content in it. Tannins are antinutrient compounds that can cause a sense of sepat because when consumed, cross-bonds between tannins and proteins or glycoproteins in the oral cavity are formed which results in a feeling of dryness and wrinkling or rough feeling.

Flavor

Flavor is a certain substance or component that has several functions in food, including being able to improve and make a product more valuable (Hasniar et al, 2019).

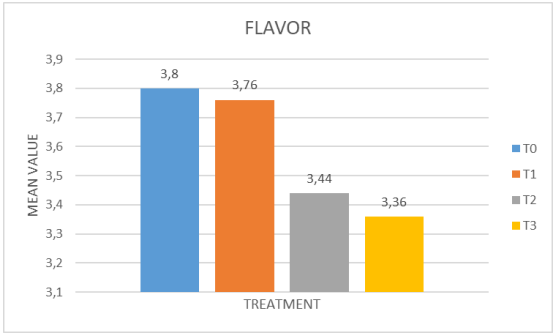

Diagram 3. Level of Preference for the Flavor of *Tejake* Nugget

Based on the organoleptic test results, the flavor of tempe nugget with the subtitution of Moringa leaves and banana bud with criteria value of 1 is very scented in tempe, 2 is not flavorful in tempe, 3 is somewhat flavorful in tempe, 4 is flavorful in tempe, 5 is very flavorful in tempe, 36 up to 3.8.

Table 5. Friedman Test Results on Flavor *Tejake* Nugget

N	25
Chi-Square	10,320
Df	3
Asymp. Sig.	,016

Friedman test results stated the influence of the addition of Moringa leaves and banana buds on the aroma of tempe nuggets, seen from a significant value of 0.016 (smaller than 0.05).

Table 6. Wilcoxon Test Results on the Flavor *Tejake* Nugget

	T1 - T0	T2 - T0	T3 - T0	T2 - T1	T3 - T1	T3 - T2
Z	-,333[b]	-2,066[b]	-2,021[b]	-2,000[b]	-1,927[b]	-,535[b]
Asymp. Sig. (2-tailed)	,739	,039	,043	,046	,054	,593

Based on Table 6. T0 and T1 and T2 and T3 did not differ significantly. This can be seen from the significant values of 0.739 and 0.539, respectively (greater than 0.05). The higher the number of tempeh additions, the stronger the nugget produced is flavorful. The addition of Moringa leaves affects the flavor of the nuggets because Moringa leaves contain the enzyme lipoxidase. Moringa leaves have essential oils and lipoxysase en-

zymes that cause unpleasant flavor. According to Andarwulan et al., (2011) green vegetables contain lipoxidase enzymes which if the cooking process is not perfect can cause unpleasant scent. The flavor can be reduced by boiling vegetables with salt, or soaking vegetables in ice water, just before the vegetables are cooked.

Texture

Texture is an appearance that can be seen directly by consumers so that it will affect the assessment of the product's acceptability. Good texture is influenced by the basic ingredients used (Hasniar et al, 2019).

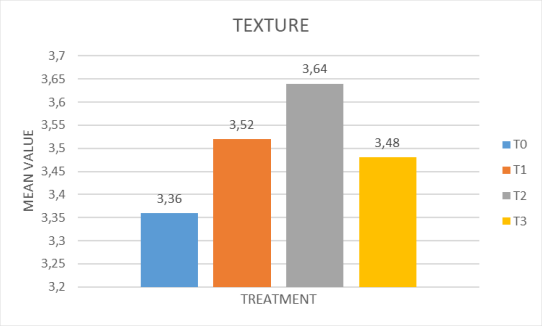

Diagram 4. Level of Preference for the Texture of *Tejake* Nugget

Based on the organoleptic test results, the texture of tempe nugget with the subtitution of Moringa leaves and banana bud with the criteria value of 1 is not very hard, 2 is not hard, 3 is hard, 4 is hard, 5 is very hard, tempeh texture is obtained an average value ranging from 3.36 to with 3.64.

Table 7. *Friedman* Test Results on *Tejake* Nugget Texture

N	25
Chi-Square	3,733
Df	3
Asymp. Sig.	,292

Table 8. *Wilcoxon* Test Results on the *Tejake* Nugget Texture

	TT1 - TT0	TT2 - TT0	TT3 - TT0	TT2 - TT1	TT3 - TT1	TT3 - TT2
Z	-,733[b]	-1,380[b]	-,832[b]	-1,134[b]	-,302[c]	-1,155[c]
Asymp. Sig. (2-tailed)	,464	,167	,405	,257	,763	,248

Friedman test results stated that there was no effect of adding tempe to the texture of the tempe nugget, seen from the significant value of 0.292 (greater than 0.05). Likewise with the *Wilcoxon* test results where all the significant values of the parameters being compared are greater than 0.05. This is not in accordance with the literature where the higher the number of tempe additions the harder the resulting texture and the higher the average value. The hardness of a product is influenced by the water content. Product hardness decreases with increasing water content in the ingredients (Chin, et al., 2004).

Nutritional Value

Table 9. *Tejake* Nugget Nutrition Value

	T0	T1	T2	T3
Energy (kcal)	405,1	361,4	317,7	273,9
protein (24%) (g)	25,1	20,7	16,4	12
fat (19%) (g)	9,2	7,5	5,7	4
carbohydrate (57%) (g)	59,5	56,6	53,8	50,9
dietery fiber (g)	4,2	4,5	4,7	4,9
PUFA (g)	4,9	4	3	2
cholesterol (mg)	4,2	4,2	4,2	4,2
Vit A (Ug)	210,9	246,8	282,6	318,5
vit E (mg)	1,1	1	1	1
Vit B1 (mg)	0,2	0,2	0,2	0,1
Vit B2 (mg)	0,2	0,2	0,2	0,1
Vit B6 (mg)	0,4	0,4	0,3	0,3
Total Folic acid (Ug)	68,1	64,8	61,4	58,1
Vit C (mg)	0	6,8	9	11,2
sodium (mg)	10,2	10,3	10,3	10,4
potassium (mg)	547,4	497	446,6	396,3
calcium (mg)	111,6	96,2	80,8	64,8
magnesium (mg)	90,3	76,3	62,3	48,3
phosphorus (mg)	281,6	238,8	196	153,2
iron (mg)	3,3	3	2,8	2,6
zinc (mg)	2,8	1,9	1,5	1,1

Based on the table above it can be seen that the substitution of banana bud and moringa leaves in the tempe nugget can increase food fiber, vitamin A, vitamin C and sodium. In this study, not all nutritional values increased, this was because in the treatment only material substitutions were carried out. Based on the literature, the addition of banana buds and Moringa leaves can increase the nutritional value.

CONCLUSION

Based on the results of the study it can be concluded that the highest level of panelist preference on the taste and texture of the Tejake nugget is in the T2 treatment and the highest level of panelist preference in color and aroma is in the T1

treatment, with a ratio of 75% tempeh: 13% banana bud and 2% moringa leaf. The high nutritional value of Tejake nuggets can make an alternative to healthy and nutritious snacks.

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