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RESEARCH

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Chemical and Physical Quality Biscuits Substitution Pumpkin and Leaves Katuk

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Abstract

Dependence on wheat flour is very high, so food diversification efforts need to be made to reduce this dependence. Biscuits are a product made from wheat flour as the main ingredient which has the potential to be developed using pumpkin and katuk leaves. The aim of this research was to determine the chemical and physical quality of biscuits substituted for pumpkin and katuk leaves. This research was an experimental study with a completely randomized design (CRD), consisting of 3 treatments and 1 standard treatment, with 3 repetitions of each treatment, so there were 12 treatment units. Chemical quality includes energy, carbohydrate content, protein, fat, Fe, calcium, vitamin C, β - carotene, and vitamin A. Physical quality is assessed using diameter, thickness, and spread ratio). Data were analyzed using *One Way Anova* and *Kruskal Tests Wallis*. The results of research on the chemical quality of biscuits show that there is a significant effect of the substitution of pumpkin and katuk leaves on the levels of protein, calcium, zinc, Fe, β - carotene, and vitamin C in biscuits. However, for energy, fat and carbohydrate levels decreased as the substitution of pumpkin and katuk leaves increased. The physical quality of biscuits substituted for pumpkin and katuk leaves shows that the diameter and thickness of the biscuits decrease as the percentage of substitutes for pumpkin and katuk leaves increases. This situation causes the value of the spread ratio (spread) is increase. The conclusion of this research is that there is a significant effect of the substitution of pumpkin and katuk leaves in biscuits on the chemical and physical quality of the biscuits.

Keywords: Biscuits, Leaves Katuk, Pumpkin Yellow.

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1. INTRODUCTION

The Indonesian government is currently continuing to promote the development of local food products to offset the influx of foreign products during the free market era. One of the food products developed is biscuits. Biscuits are a product that is quite popular with the public. The results of research on 1,500 adult consumers in Indonesia, and 500 housewives found that biscuits was the product most consumed (11%) compared to other products (Syana, 2017). Results Riskesdas (2013) about the consumption of food from processing flour wheat states as much as 13.4% of Indonesia's population consumes biscuits ≥ 1 time per day.

Dependency on wheat flour is very high, so effort in diversification of food is needed to reduce such dependency and improve food diversity. Biscuits are a bakery product made with method of grilling dough made of flour wheat with or without the substitution, oil/fat, with or without the addition of foodstuffs and additional ingredients the food permitted (Badan Standardisasi Nasional, 2011). Potential local food developed as a biscuit product is pumpkin yellow and katuk leaves.

Yellow pumpkin (*Cucurbita moschata*) is a type of creeping vegetable plant which is classified as an annual plant that immediately dies after bearing fruit. Pumpkin plants can grow in the lowlands and highlands with the ideal height being between 0-1500 meters above sea level (Pujimulyani, 2012). Yellow pumpkin contains carbohydrates which can reach 70% of the pumpkin puree making, so it has the potential to replace some of the use of wheat flour.

Katuk leaves (*Sauropus androgynous*) in Indonesia grows in the plains at an altitude of 2,100 meters above sea level. Katuk leaves are also rich in iron, provitamin A in form β -carotene, vitamin C, and minerals. Table Composition Food Indonesia (TKPI) include that leaf content proteins which is enough compared to other types of vegetables that is 6.4g/100g ingredients.

The research results of Sariani, et al (2019) showed a very real effect on the organoleptic tests of sago biscuit products with the addition of katuk leaf flour (Sariani, 2019). The research results of Suryati, et al (2019) show that the best treatment is the addition of puree pumpkin 53% and shell flour egg 7% chicken affects ash content, calcium content and cookie texture (Suryati, Maherawati, 2019). The research results of Khoirunnisah, (2020) showed that 5% katuk leaf substitution in cookies was acceptable to panelists (Khoirunnisah, 2020).

This research aims to develop biscuits with the substitution of pumpkin and katuk leaves in a different form from biscuit products that have already been studied. Biscuits are substituted with pumpkin puree and fresh katuk leaves which are blanched and mashed. The development of this biscuit is to make it easier if it is carried out in the community because there is no need to make pumpkin flour and katuk leaf flour. Apart from that, this biscuit product can be an alternative for Posyandu cadres in providing local food-based PMT.

2. RESEARCH METHOD

Type of experimental research with completely randomized design (CRD), substitution factors for pumpkin puree (0%, 40%, 45%, 50%) and katuk leaves (0%, 3%, 4%, 5%) with 3 repetitions, so there are 12 treatment units. The ingredients for making biscuits are wheat flour (125 g, 100 g, 110 g, 120 g), tapioca (25 g), butter unsalted (30 g), egg yolk (8 g), powdered sugar (62.5 g), liquid milk (50 ml), pumpkin puree (0, 60 g, 67.5 g, 75 g), katuk leaves (0, 4.5 g, 6 g, 8 g), baking powder (2 g), salt (1.5 g) and vanilla (2 g).

The yellow pumpkin is cleaned, cut into pieces and steamed for 15 minutes and mashed until it becomes puree, then roasted at 70°C for 20 minutes. Katuk leaves are washed and blanched for 2 minutes. Puree yellow pumpkin, katuk leaves and liquid milk are mixed and blended for 3 minutes. Then mixed into the biscuit dough. Previously beat the egg yolks for 2 minutes, add powdered sugar, cake ammonia, salt and vanilla, mix well. Enter unsalted butter stir again. Then add the tapioca and pumpkin puree mixture, add the wheat flour and stir well until it forms a dough that can be rolled out with noodles maker. Mold the biscuits in a round shape and make a hole in the top. Bake the biscuits for 30 minutes at 130°C. Then the biscuits are removed, cooled and packaged.

The chemical Quality (Nutrient Analysis). Biscuit nutritional analysis includes energy and protein using the micro method kejlhdhal, fat using the Shoxlet method, carbohydrates using the Luff method scroll, iron, calcium, zinc each using the Atomic method Absorption Spectrophotometry (AAS), vitamin C and vitamin A using spectrophotometry.

The physical quality of the biscuits was assessed by diameter and thickness parameters using a caliper (mm) and ratio distribution (spread ratio) which is the most important parameter for assessing the quality physical biscuits.

The data collected was each tested for data normality. If the data is normal, then a One Way Anova test is carried out with a confidence level of 95% and a further Duncan test. If it is not normal, then test with Krusskal Wallis with a confidence level of 95% and further Mann-Whitney test.

3. RESULTS AND DISCUSSION

The results of the research show that the energy content of biscuits substituted for pumpkin and katuk leaves is on average in the range of 520.40 - 535.40 Kcal /100 g. The energy content of this biscuit decreased by 2.2% from F3 compared to F0.

Protein levels increased by 48.9% and the results of the *One-Way Test Anova* showed that there was a significant effect of substitution of pumpkin and katuk leaves in biscuits ($p=0.019$) on the protein content of biscuits. However, fat and carbohydrate levels have decreased (figure 1).

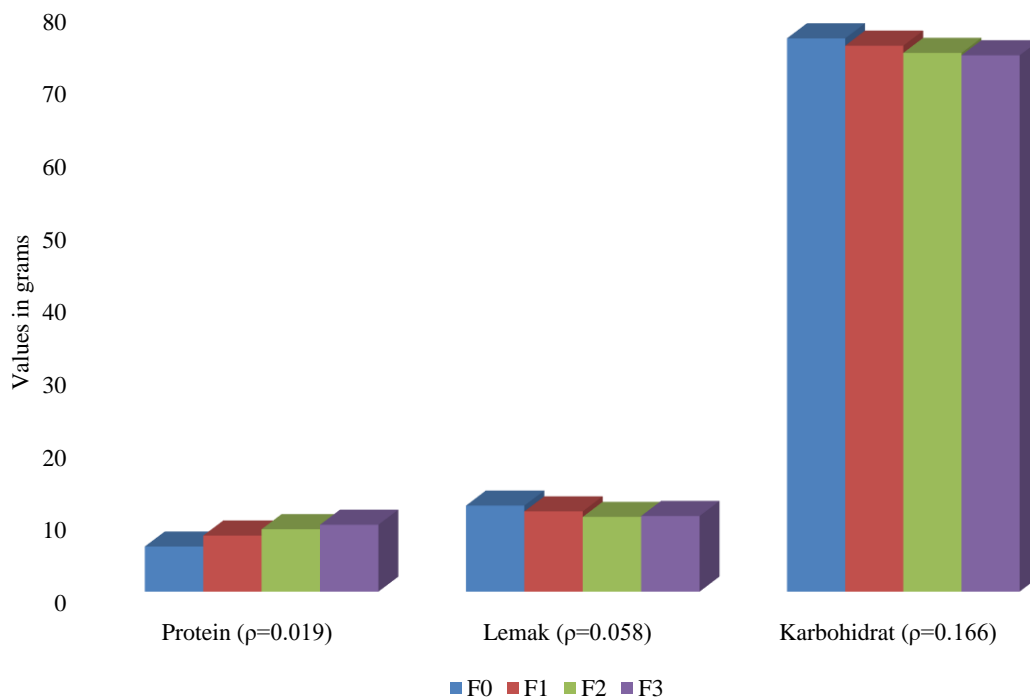


Figure 1. Macronutrient content of biscuits substituted for yellow pumpkin and katuk leaves

Micronutrient levels in biscuits substituted for pumpkin and katuk leaves showed an increasing trend in levels calcium, zinc, Fe, and β - carotene. However, vitamin A and vitamin C levels decreased.

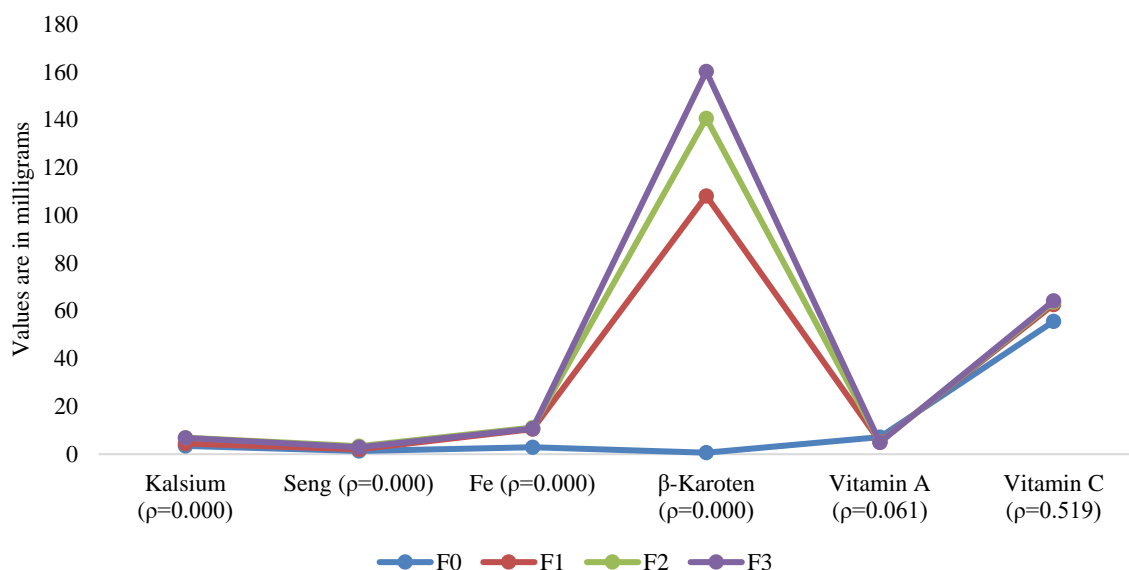


Figure 2. Nutrient Content of Micro Biscuits Substitute for Yellow Pumpkin and Katuk Leaves

The results showed that the physical quality of the biscuits changed in diameter, thickness and *spread ratio*, after being substituted with *pureed* yellow pumpkin and blanched katuk leaves (Table 1). The results of the *One Way-Anova test* show that there is no significant difference in substitution pumpkin and leaves cough on diameter ($\rho=0.053$), thickness ($\rho=0.077$) with *spreads ratio* ($\rho=0.280$) biscuits.

Table 1 . Physical Quality of Substitute Biscuits for Yellow Pumpkin and Katuk Leaves

Biscuit formula	Thickness (mm)	Diameter (mm)	<i>Spreads ratio</i>
F0	5.59±0.60 ^a	51.21±4.02 ^a	8.80±0.50 ^a
F1	4.75±0.80 ^a	46.76±2.33 ^a	9.54±1.51 ^a
F2	5.43±0.51 ^a	47.93±2.78 ^a	8.41±0.31 ^a
F3	4.93±0.40 ^a	47.13±1.74 ^a	10.05±1.25 ^a

Source: Primary Data, 2023

Description: The value displayed is the average \pm standard deviation. The average value in the same column with a letter different shows difference significant $\rho < 0.05$

DISCUSSION

Chemical Quality

Energized contained from something product determined from content energy material its compiler. Energy on substitute biscuits pumpkin and leaves katuk experienced a decrease of 2.2% in F3 compared to F0, as the substitution of pumpkin increased. This is because the energy from the wheat flour in the original biscuits will be replaced with less energy from pumpkin (51 Cal/100 g) compared to the energy from wheat flour (333 Cal/100 g) according to the 2017 Indonesian food composition table. *One-Way Test results Anova* for biscuit energy, substitution of pumpkin and katuk leaves proved to have no significant effect ($\rho=0.189$) towards the substitution of pumpkin and katuk leaves in biscuits in the three existing formulas.

The energy of biscuits is influenced by the amount of macronutrients contained in the ingredients for making biscuits, such as carbohydrates, fat, and protein. The results of this research show that the energy content of biscuits has exceeded the SNI No. standard. 01-2973-1992, namely a minimum of 400 Cal/100 g biscuits. In line with the research by Roifah, Razak, and Suwita (2019), it shows that the energy value of biscuits substituted for green bean flour and tuna fish flour for PMT for pregnant women has decreased (Roifah et al., 2019). The research results of Latifah, Rahmawaty, and Rauf (2019) show that there is no effect of tempeh flour substitution on the energy value of arrowroot flour biscuits.

The increase in protein content in biscuits substituted with pumpkin and katuk leaves compared to original biscuits occurred due to the substitution of katuk leaves and the use of milk. Katuk leaves have a protein content of 6.4 g/100 g and this protein content is significantly contributed to the biscuits substituted with katuk leaves in accordance with the 2017 Indonesian food composition table. The protein content in these biscuits is in accordance with SNI 2973:2011 concerning biscuits, which requires a minimum protein content in biscuits of 5%. As research by Sariani (2019) shows the same thing, namely the protein content of selected biscuits is K1 k because the addition of katuk leaf flour in making sago biscuits, can increase the protein content in sago biscuits (Sariani, 2019).

The fat and carbohydrate content in the substitute biscuits for pumpkin and katuk leaves is in the range of 10.40 g/100 g to 11.83 g/100 g and this fat content decreases when compared with the original biscuits (Figure 1). *One-way* test results *Anova* also shows There is no significant effect on the fat and carbohydrate content of biscuits rate fat ($\rho=0.058$) and carbohydrates ($\rho=0.166$). The low fat content in biscuits substituted for pumpkin and katuk leaves is caused by the fat content in pumpkin (0.5 g/100 g) being less than in wheat flour (1.0 g/100 g). Likewise with levels carbohydrates in yellow pumpkin are lower If compared to levels of carbohydrates in flour wheat. Research by Saputri, et al., (2021) proves that levels of carbohydrate product influenced by type materials used ie Substituted carrots for fish pempek have rate lower carbohydrates compared to pempek control (Saputri, Hidayah, & Muttalib, 2021). The results of this research are in line with research by Ambarwati (2020), which shows that the more substitutions there are for pumpkin flour and banana flour, the lower the fat content of *the cookies* (Ambarwati, 2020). The research results of Saputra, Ibrahim, and Faradilla, 2018, also showed the same thing, namely the highest average carbohydrate content of *cookies* in treatment A (100% wheat flour) with an average carbohydrate content of 70.19% and the lowest in treatment B (80% rice bran flour: corn flour 20%) with an average carbohydrate content of 54.73%.

The calcium levels in the biscuits showed that there was a significant effect ($\rho=0.000$) of the substitution of pumpkin and katuk leaves on the calcium levels of the biscuits. This is caused by the high levels of calcium in katuk leaves, namely 233 mg /100 g. In line with research by Suhartini et al. 2018, stated that the addition of Moringa leaf flour increased the calcium value of tempeh formula biscuits with the addition of 9% Moringa leaf flour (13.5 g), namely 38.297 mg, when compared with 21.356 mg without the addition of Moringa flour. Study Lestari, et al., (2020) stated Calcium levels in cookies with substitution of katuk leaves and oatmeal (120 mg) increased compared to cookies without substitution (91 mg).

Zinc levels in biscuits increase and are present substitution Yellow pumpkin and katuk leaves apparently have an effect to rate zinc in biscuits (Figure 2). The increase in zinc levels in biscuits is caused by the zinc levels contained in the biscuit ingredients, namely wheat flour, butter, milk, egg yolk, pumpkin and katuk leaves. In line with the research by Mumpuni and Khasanah, (2021) which states that the greater the proportion of haruan fish meal and pumpkin seed flour, the greater the zinc content in the biscuits (Mumpuni & Khasanah, 2021). The zinc content in biscuit products is also influenced by the *cookie baking process* (Mileiva, Palupi, & Kusnandar, 2017). Biscuits substituted for pumpkin and katuk leaves were baked at 120°C for ± 27 minutes and this process also affected the zinc content of the biscuits which increased as the substitution for pumpkin and katuk leaves increased.

Fe content in the biscuits is clearly visible in Figure 2, Fe increases to 272.8% when seen from the original biscuits. The results of the analysis also show that there is a significant effect of substitution of pumpkin and katuk leaves in biscuits ($\rho=0.000$) on the Fe content of biscuit products. Increased Fe levels This biscuit is caused by the contribution of Fe levels in katuk leaves, namely as much as 3.5 mg /100 g of material. Putri Research, et al. (2021) stated that the iron content of katuk leaf *cookies is 1,308 mg /100g* (Putri, Almasyhuri, & Mirani, 2021). Likewise, research by Lestari, et al (2020) shows the average value of iron *in cookies* with the substitution of katuk leaves and oatmeal at a concentration of 0%:0%, namely 0.12 mg, and a concentration of 5%:5%, namely 0.14 mg (Lestari, 2020). Other similar research results showed that there were significant differences in iron levels in each treatment formulation of haruan fish flour biscuits, pumpkin seed flour, and pumpkin fruit flour ($p=0.001$). (Mumpuni & Khasanah, 2021).

Beta-carotene (β - carotene) is an organic compound and is classified as a terpenoid and is the most active provitamin A found in plant foods. Foods containing beta-carotene can increase the body's

immunity, because of the antioxidant properties contained in beta-carotene (Parwata, Ratnayani, & Listya, 2010). Meanwhile, vitamin A is only found in animal tissue and not in plants. However, many plants contain the pigment carotene which can be converted into vitamin A in the body. Therefore, carotene is called pro-vitamin A because it can be converted into vitamin A (Sanif & Nurwany, 2017). The results showed that the levels of β - carotene and vitamin A were inversely related. β - carotene levels increased with increasing presentation of yellow pumpkin and katuk leaf substitutions, whereas vitamin A levels decreased with increasing substitution of yellow pumpkin and katuk leaves. If seen from the *one-way* test results *Anova*, then There is a significant effect of substitution of pumpkin and katuk leaves in biscuits ($p=0.000$) on β - carotene levels biscuit products. On the other hand, there was no significant effect of substitution of pumpkin and katuk leaves in biscuits ($p=0.061$) on the vitamin A levels of biscuit products. The ingredients used in making these biscuits are very influential in contributing to the vitamin A and β - carotene content in biscuit products. This also happened in Kusumawardani et al ., (2018) which showed that increasing the amount of composite flour causes the vitamin A content in biscuits to increase along with increasing the amount of composite flour, which uses banana flour with a high vitamin A content (Kusumawardani et al., 2018).

Substitution of pumpkin and katuk leaves in the biscuits had no effect real ($p=0.519$) against Vitamin C levels in biscuits. This is due to the easy nature of vitamin C Water soluble, though Vitamin C levels in yellow pumpkin (2 mg /100 g) and katuk leaves (164 mg /100 g) are quite high(RI, 2017). Apart from that, vitamin C is a vitamin that is not heat resistant. In line with research by Yudhistira B, Sari TR, Affandi (2019) which states that the process of roasting and crushing spinach and tomatoes with a blender is a factor that causes vitamin C levels in *cookies* to decrease (Yudhistira, Sari, & Affandi, 2019).

Quality Physique

Quality physique from biscuits substitution pumpkin and leaves cough show exists change characteristic physique biscuits seen from average size diameter, thickness and ratio spread (*spread ratio*). The diameter and thickness of the biscuit pieces decreased with increasing substitution of pumpkin and katuk leaves. Baljeet, Ritika, and Roshan (2010) stated that the diameter and thickness of biscuits are two parameters that always move in opposite directions (Baljeet et al., 2010).

Spread ratio (*spread ratio*) is the most important parameter for assessing biscuit quality (Bose & Shams-Ud-Din, 2010). *Spreads The ratio* is calculated by dividing the diameter by the thickness of the biscuit. Thicker biscuits will have *spread lower ratio* compared to thinner biscuits, provided that the diameter of the biscuits is not significantly different. If the diameter of the biscuits differs significantly, then the thicker biscuit has a *spread higher ratio*. Nonetheless, biscuits with *spread The high ratio* in F1 (9.54) was apparently more accepted by the panelists. Research by Hussein *et al .*, (2011) and stated that *cookies* that have a higher spread ratio are considered the most desirable or most acceptable. Eissa, Hussein, and Mostafa, 2007 and Niaba, et. al ., 2013 also said that biscuits with *spread value A high ratio* is best.

Biscuits in this study were substituted with yellow pumpkin in *puree form* and katuk leaves which had been blanched *and* crushed (blended). The replacement of wheat flour with pumpkin and katuk leaves causes the diameter and thickness of the biscuits to decrease as the percentage of substitution for pumpkin and katuk leaves in the biscuit dough increases. This condition is what causes the *spread value The ratio* increases further, as a result of using pumpkin *puree and crushed katuk leaves which still* contain water. This is in accordance with the results of the analysis show The percentage of water content in biscuits substituted for pumpkin and katuk leaves is between 3.48% -9.58% .

The physical quality of biscuits substituted with pumpkin and katuk leaves is indeed different from biscuits substituted with other composite flours. This is caused by the substitution of pumpkin *puree* in the form of paste and katuk leaves which are blended in a crushed form, not in the form of flour, so it has a lower swelling power compared to composite flour or other flours. Apart from that, the amount of gluten in the dough decreases with the increasing number of substitutions of pumpkin *puree* and crushed katuk leaves, which causes interaction between water and gluten to form a gluten network so that it can withstand gases that expand during the baking process. This is different from the results of research by Pratama, Mitha, and Nendra (2017), which found that the addition of banana flour had

no real effect on the diameter, thickness and volume of cookie expansion (Pratama, Mitha & Nendra, 2017).

4. CONCLUSION

Biscuits substitution pumpkin and leaves cough reviewed from quality chemical and physical, in part big nutrition and size show exists enhancement quality, if compared to original biscuits. For further research, it is recommended to carry out shelf life tests on biscuit products so that the safety of biscuit products can be guaranteed and to test the effect of giving substitute biscuits for pumpkin and katuk leaves to pregnant women.

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