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Formulation of Onggok Composite Flour Snack Bar (Manihot Esculenta) as Emergency Food Source of Protein

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ABSTRACT

This study aimed to develop a snack bar product made from composite flour of Onggok and tapioca as an alternative emergency food and protein source. Additionally, to analyze the chemistry of a snack bar product made from Onggok composite flour. The study was arranged in a Completely Randomized Design (CRD) with 6 treatments and was repeated 3 times, that was the ratio of onggok composite flour and wheat flour. The ratio of onggok composite flour and wheat flour composition consisted of six levels, they were F1 (50%:50%), F2 (60%:40%), F3 (70%:30%), F4 (80%:20%), F5 (90%:10%), F6 (100%:0%). Then the data was processed by using ANOVA (Analysis of Variance) and continued with the LSD test (Least Significant Difference) at a significant level of 5%. The results of the proximate analysis showed that the protein of the snack bar was 11.06%, the dietary fiber was 8.23%, the ash content was 1.24%, and the moisture content was 3.27%. Based on the organoleptic test, it showed that the preferred level of consumer satisfaction was F1 with a ratio of 50%:50%. Therefore, the Onggok composite flour snack bar is good to use as an alternative high protein emergency food that deserves to be developed.

Keywords*:* Onggok Composite Flour, Snack bar, Emergency foo

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INTRODUCTION

Indonesia is an agricultural country that produces a lot of food crops, one of which is cassava. As the 4th largest cassava-producing country in the world, Indonesia certainly has good potential in its cultivation. Therefore, cassava is one of the main food ingredients mostly consumed by the community in Indonesia (Handayani, Affandi, & Irawati, 2019). Lampung Province is the main producer of cassava in Indonesia. According to Badan Pusat Statistik (2019), Indonesia's cassava production in 2018 was 19.341.233 tons, and Lampung Province with a production of 6.683.758 tons was the main producer of cassava in Indonesia (34.5%) spreading across several regencies, including Tulang Bawang Regency, Central Lampung, and East Lampung. By-products in the form of Onggok are also abundant due to a large number of processed products from cassava. Onggok is a solid waste of the tapioca industry with a percentage of 60% of the cassava raw material. Another product from the tapioca industry which is available in abundance and its main use until now is as animal feed (Kaewwongsa, Traiyakun, Yuangklang, Wachirapakorn, & Paengkoum, 2011). Through the solid-state fermentation process, Hidayat et al. (2020) have developed fermented Onggok flour products that have the potential to be used as food raw materials. This potential was mainly reflected in the increase in protein content (0.92% to 6.98%) and the decrease in cyanide acid content to a safe consumption level (8.87 ppm). Food and Agriculture Organization/World Health Organization recommended a safe limit for cyanide intake from foodstuffs of 10 mg HCN/kg (Codex Alimentarius, 1989).

The high protein content of fermented Onggok flour (6.98%) is one solution for the development of gluten-free food products. In line with Gobbetti et al. (2018), he stated that the development of gluten-free products is currently directed at improving the nutritional quality of the product. Onggok flour is made from Onggok as a by-product of processing fermented tapioca and is used as a protein source that is currently being developed. This product can be an alternative to emergency food that can fulfill 20% of the nutritional needs of the elderly. Emergency food is a food product that can fulfill human energy needs in certain circumstances and has a nutritional value that is specially designed based on the needs in an emergency situation. The product to be developed is a snack bar, which is one of the dry-processed products and has a long shelf life and low production costs.

The snack bar is a snack product that can be consumed in between activities and also can be used as a hunger delay food when people are facing busy hours at certain times. Snack bars that are classified as low-calorie snacks must meet the criteria of delectable, easy to get, and fast food, besides that snack bars must contain sufficient nutritional ingredients and are safe for consumption (Pradipta, 2011). Snack bars are also a suitable product that can provide energy and other nutrients for people who live healthy lifestyles and people from hungry regions of the world. One of the efforts to suffice the nutritional needs of nutritionally vulnerable groups is supplementary food. The nutritional value of snack bars as emergency food must have a high value. The lifestyle of today's society pays less attention to the nutritional content contained in the food consumed. Therefore, designs of special food are needed for emergencies that can be consumed immediately (ready to eat), practical to distribute, and nutritious. Consequently, food diversification is needed to complement the increasing needs by considering

health and practicality. One of the practical food products that have complete nutritional content and have a long shelf life is the snack bar.

A snack bar is one of the dry-processed food products in the form of a rod and square which has a low aw value (Aini et al., 2018). Snack bars can be categorized as emergency foods and must have high nutritional value. Emergency food is food that has high energy and nutrient density to be consumed immediately in an exigency. The lifestyle of today's society pays less attention to the nutritional content contained in the food. Snack bars that are classified as low-calorie snacks must meet the criteria as delectable, easy to get, and fast food, besides that snack bars must contain sufficient nutritional ingredients and are safe for consumption, Pradipta (2011). Currently, most of the food ingredients used in making snack bars are made from cereals such as wheat, corn, and rice. Whereas snack bars can also be made from other ingredients, one of which is Onggok flour.

Additional wheat flour is used in making snack bars. Wheat flour is one of the ingredients that form the structural framework of snack bars because it contains glutenin and gliadin proteins which make the dough elastic, form sheets, flat, and can hold CO2 from yeast fermentation (Afianti & Indrayani, 2015). Several experiments have been carried out to substitute wheat flour with Gayam flour (Jariyah, Mulyani, & Setya, 2013), soybean flour (Sulistyowati, Wijaningsih, & Mintarsih, 2015), and Suweg flour (Khatarina, 2018). The results showed that the substitution with Suweg tuber flour was 10%, as well as soy flour and wheat flour was 10%. Therefore, the substitution of Onggok composite flour as a result of research by Hidayat et al. (2020) also has the potential to be applied in making snack bars.

LITERATURE REVIEW

Onggok Flour

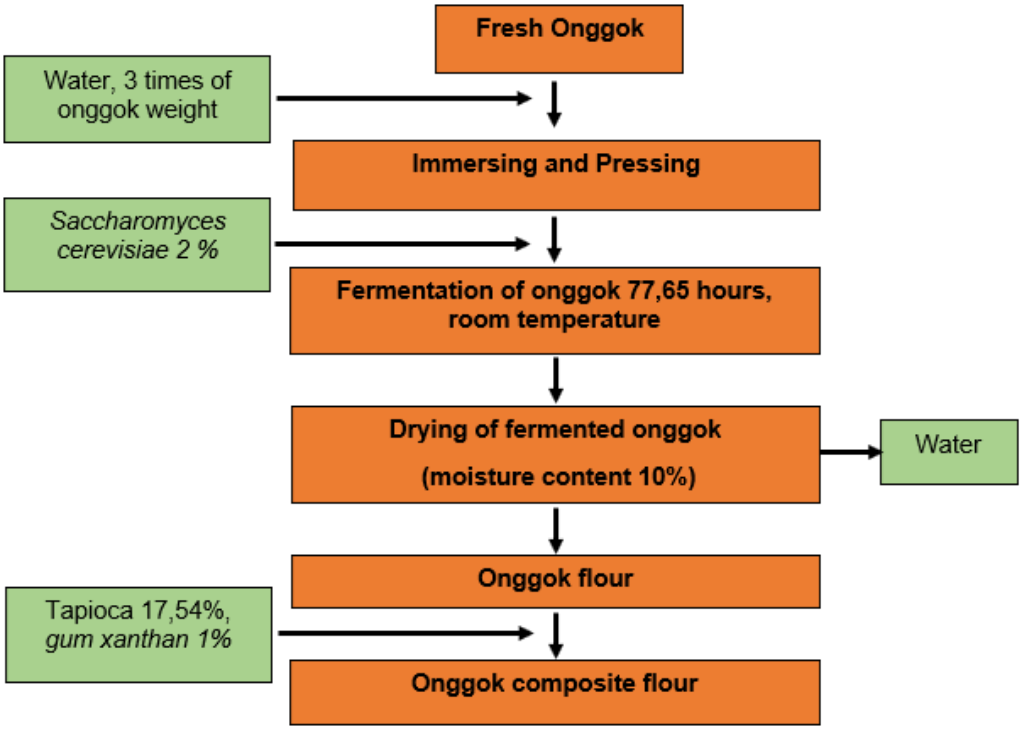
Onggok is a solid waste of the tapioca industry with a percentage of about 60% of the raw material for cassava and goes through a solid-state fermentation process. Previous researchers (Hidayat et al., 2018) have developed fermented onggok flour products that have the potential to be used as food raw materials. Onggok can be used as raw material for making flour because the remaining carbohydrate content in the onggok is still quite a lot (Retnowati & Susanti, 2009). The carbohydrate content in cassava is 65.9% (Kurniadi, 2010). Onggok is a source of functional food because it contains high fiber. Onggok has the potential to be developed.

Onggok composite flour with *Saccharomyces cerevisiae* 1.67% (b/b) for 4 days produces flour characteristics with whiteness 52.70%, starch content 46.69%, dietary fiber 13.49%, fat 0.59%, protein 6.98%, and HCN content of 8.87 ppm. In this study, wheat flour was substituted with onggok composite flour. According to Hidayat et al. (2020), onggok composite flour contains 46.69% starch, 13.49% dietary fiber, and 6.98% protein so if it is substituted in making snack bars, it is expected to produce high protein snack bars.

Composite flour is defined as a mixture of onggok flour, tapioca starch, and other components which aims to replace wheat partially or completely (Shittu, Raji, &

Sanni, 2007). One of the prospective materials to be used as raw material for composite flour is fermented onggok flour. According to Hidayat et al. (2018), to improve the pasting characteristics and functional characteristics of fermented onggok flour, it is necessary to add other ingredients, especially in the form of starch and hydrocolloid compounds. The addition of tapioca can improve the swelling ability, meanwhile the addition of hydrocolloids can improve the viscoelastic characteristics (Mir, Shah, Naik, & Zargar, 2016). According to Yano (2019), the addition of hydrocolloids can increase the viscosity of the liquid phase and keep starch granules, yeast, and gas bubbles suspended during the fermentation process. The process of making onggok into onggok composite flour is shown figure 1.

Figure 1. Flowchart of Making Onggok Flour



Source: Hidayat (2018).**Snack Bar**

The principle of making snack bars is basically mixing, baking, cooling, and cutting. Mixing in the snack bar making process has a function for all ingredients get perfect hydration of carbohydrates and proteins, form and soften gluten, and hold gas in gluten (Amalia, 2011). The nutritional content is an important part of the snack bar where the snack bar must meet the reference for the nutritional content. The most important characteristic of a snack bar is its protein content of at least 9.38%, because it is a ready-to-eat food so it must have a good intake for the body. Snack bar quality requirements are contained in the SNI 01-4216-1996, the data shown in Table 1.

Table 1. The Characteristics of Snack bar

No	Observation	Commercial *	USDA **	SNI 01-4216-1996 ***	Synbiotic of Snack Bar ****
1	Moisture Content (%)	11,40	11,26	-	6,64
2	Fat Level (%)	20	10,91	1,4-14	5,44
3	Protein (%)	16,70	9,3%	25-50	11,60
4	Calorie Value (kcal)	140	120,93	120	141,39
5	Hardness Test (gF)	5466,53	-	-	6557,34

Source : Triyanutama (2020)

The basic ingredients and baking time in making snack bars have been modified, but the use of the number of ingredients and the process of making snack bars have not been modified. The steps of making snack bars were weighing raw materials, mixing process step one and step two. Mixing in step one included coconut dregs flour, soybean flour, salt, honey, jam, and eggs. Mixing in step two was adding margarine and sugar. Then mixed stages one and two, and added cashew nuts and rice crispies. The dough was molded and then baked in an oven at a temperature of 110 ^{o}C for 40 minutes. According to Janah (2017) after being cooked, the snack bar was cooled at room temperature ± 28-30 ^{o}C for 20 minutes (as cited in Indrawan, 2018).

RESEARCH METHOD

The research was conducted at the Agricultural Product Technology Laboratory and the Lampung State Polytechnic Analysis Laboratory. Food and Nutrition Laboratory of PAU UGM. This research was carried out from January to March 2022. In this research, the material used was Onggok composite flour. Ingredients for the manufacture of snack bar products: Kunci Biru wheat flour, Blue Band margarine, Ratu fine sugar, eggs, Dancow milk powder, Daun fine salt, Koepoe-koepoe vanilla powder, Koepoe-koepoe baking soda, and chemicals for testing product characteristics such as KL, I_2, NaOH, concentrated H_2SO_4 (95%), starch, filter paper, petroleum ether, anthrone reagent, 80% alcohol, nelson, Arsenomolybdate, PP indicator, methyl red and concentrated HCL (37%). The tools used in this research were the tools for making cakes (snacks) and analysis equipment.

Research Procedure

The treatment was carried out using a concentration of Onggok composite flour, aiming to obtain a formulation with the best characteristics and nutrient content in snack bar products. The snack bar formulation can be seen in table 2.

Table 2. The formulation of Onggok composite flour and wheat flour

Ingredients	Unit	F1	F2	F3	F4	F5	F6
Onggok composite Flour	gram	50	60	70	80	90	100
Wheat Flour	gram	50	40	30	20	10	0
Fine sugar	gram	100	100	100	100	100	100
Milk Powder	gram	25	25	25	25	25	25
Blue band	gram	100	100	100	100	100	100

Vanili	gram	0,5	0,5	0,5	0,5	0,5	0,5
Baking soda	gram	0,5	0,5	0,5	0,5	0,5	0,5

Note:
F1: Composition of 50% Onggok composite flour, 50% wheat flour
F2: Composition of 60% Onggok composite flour, 40% wheat flour
F3: Composition of 70% Onggok composite flour, 30% wheat flour
F4: Composition of 80% Onggok composite flour, 20% wheat flour
F5: Composition of 90% Onggok composite flour, 10% wheat flour
F6: Composition of 100% Onggok composite flour, 0% wheat flour

The procedure for making Onggok composite flour snack bars referred to the study by Janah (2017) that had been modified. In step one, Onggok composite flour was mixed with wheat flour, full cream milk powder, and salt. Step two, beat eggs, margarine, fine sugar, vanilla, and baking soda. Step three, mixed Steps one and two, then homogenized using a low-speed mixer until the dough was well mixed, then it was shaped in a rectangular (2 x 6 x 0.5 cm), and arranged on a cake pan and then baked using an electric oven at a temperature of 120 C for 30 minutes.

Methods of Data Analysis and Hypothesis Testing
The study was arranged in a Completely Randomized Design (CRD) with 6 treatments and was repeated 3 times, that was the ratio of Onggok composite flour and wheat flour. The ratio of Onggok composite flour and wheat flour composition consisted of six levels, they were F1 (50%:50%), F2 (60%:40%), F3 (70%:30%), F4 (80%:20%), F5 (90%:10%), F6 (100%:0%).

The results of the Onggok composite flour snack bar were chemically analyzed. The data obtained are presented in the form of mean ± standard deviation. Each analysis was carried out with three repetitions, and then the data was processed by using ANOVA (Analysis of Variance) and continued with the LSD test (Least Significant Difference) at a significant level of 5%.

Proximate Analysis
Snack bar moisture content analysis was done by using the oven/gravimetric method (AOAC 925.10-1995), snack bar ash content analysis was done by using the dry ashing method (AOAC 942.05-1995), snack bar protein content analysis was done based on Association of Official Analytical Chemists (AOAC) 960.52-1995 in the form of crude protein (N x 6.25), analysis of dietary fiber content was determined by enzymatic method using enzymes termamyl, pepsin, and pancreatin (Association of Official Analytical Chemists, 1995).

RESULTS

Proximate Analysis
Table 2, showed that the F1 formula was the chosen formula from the other 6 formulas with a ratio of 50% Onggok composite flour and 50% wheat flour, protein 11.06%, a total of dietary fiber 8.21%, ash content of 1.24%, and moisture content 3.27%. The results of the CRD proximate snack bar formulation of Onggok composite flour and wheat flour on the chemical analysis of the snack bar included protein, total dietary fiber, ash content, and moisture content.

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Table 3. Proximate analysis test of snack bar product

Component	Formulation of Onggok composite flour					
	50%	40%	30%	20%	10%	0%
Protein (%)	11.06	10.65	10.52	10.42	9.85	8.93
Dietary Fiber (%)	8.21	7.76	7.20	6.24	5.90	4.08
Ash (%)	1.24	1.41	1.60	1.67	1.63	1.77
Moisture (%)	3.27	3.05	3.07	3.63	3.45	3.40

The results of the LSD test (Least Significant Difference) at a level of 5% are in table 3. The result in table 3 showed that the Onggok composite flour formulation ($P<0.05$) had a significant effect on protein, dietary fiber, moisture content, and ash content. The highest increase of protein content was in the formulation of 50% Onggok composite flour and 50% wheat flour, which was 11.06%. Also, the dietary fiber content in that formulation was 8.21% and the smallest ash content was 1.24%.

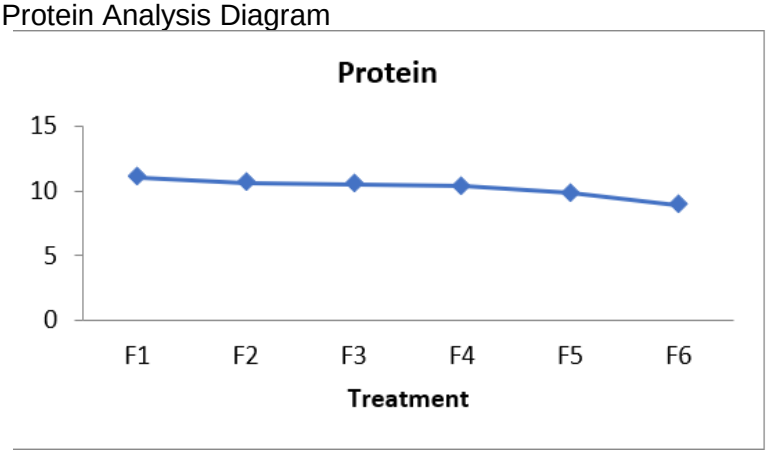
Table 4. Test Results of the chemical composition of snack bar products on various formulations of Onggok composite flour

Treatment / Variable	Protein (%)	Dietary Fiber (%)	Ash (%)	Moisture (%)
F1	11,06 a	8.21 a	1.24 a	3.27 a
F2	10,65 b	7.76 b	1.41 a b	3.05 a
F3	10,52 b c	7.20 b c	1.60 a b	3.07 a
F4	10,42 b c	6.24 c	1.67 b	3.63 a
F5	9,85 c	5.90 d	1.69 b	3.45 a
F6	8,93 c	4.08 e	1.77 b	3.40 a
LSD (0,05)	**0.76**	**0.23**	**0.31**	**1.90**

Notes: The mean value followed by the same letter in the same row showed no significant difference in the LSD test at the level of 5% (P 0.05).

DISCUSSION

Figure 2. Protein Analysis Diagram

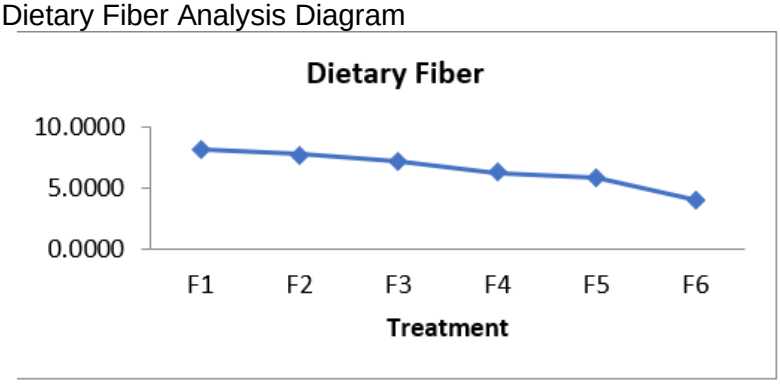


Note:
F1: Composition of 50% Onggok composite flour, 50% wheat flour
F2: Composition of 60% Onggok composite flour, 40% wheat flour
F3: Composition of 70% Onggok composite flour, 30% wheat flour
F4: Composition of 80% Onggok composite flour, 20% wheat flour

F5: Composition of 90% Onggok composite flour, 10% wheat flour
F6: Composition of 100% Onggok composite flour, 0% wheat flour

Based on the protein snack bar test with the formulation of Onggok composite flour and wheat flour, the selected snack bar was 11.06%. According to Winarno (2004), Protein is a nutrient that is very important for the body, because this substance in addition to functioning as a producer of energy in the body also functions as a building block and regulator. The results of Damardjati's (1995) research, the protein content contained in Kepok banana pulp flour is higher than in Kepok banana peel flour. Snack bar made from banana flour and green beans with the addition of Torbagun has 7.61% protein (Janah, 2017). The protein content contained in coconut pulp is relatively low, around 4.91%, and is suitable for making biscuits (Rousmaliana & Septiani, 2019) for patients with kidney failure who cannot consume a lot of protein (Nurhidayati, 2015). According to Pardede (2013), fruit generally contains relatively low protein and amino acids so it cannot be used as a protein source for humans.

Figure 3. Dietary Fiber Analysis Diagram



Note:
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F3: Composition of 70% Onggok composite flour, 30% wheat flour
F4: Composition of 80% Onggok composite flour, 20% wheat flour
F5: Composition of 90% Onggok composite flour, 10% wheat flour
F6: Composition of 100% Onggok composite flour, 0% wheat flour

Based on the snack bar dietary fiber test with the formulation of Onggok composite flour and wheat flour, the selected result was 8.21%, it can be said that the product is a high source of dietary fiber. The benefits of dietary fiber can reduce cholesterol by binding fat in the intestine, controlling weight, and providing a feeling of fullness for longer. If it is consumed, soluble fiber will have a full effect and reduce the speed of gastric emptying so that the stomach is not easily hungry. This condition can reduce a person's desire to eat so that sugar levels in the body can be maintained and reduce the risk of diabetes and obesity. In accordance with this reason, fiber foods are often recommended at diet consultation sessions and nutrition consultations.

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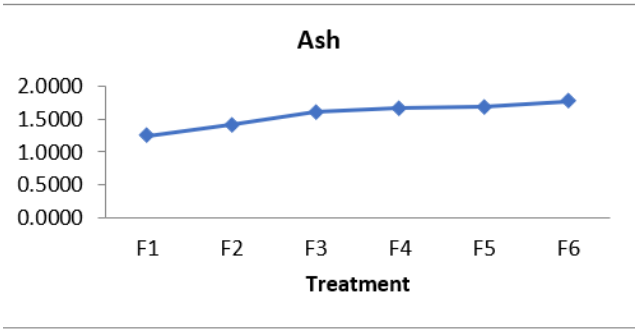
Figure 4. Ash Content Analysis Diagram



Note:
F1: Composition of 50% Onggok composite flour, 50% wheat flour
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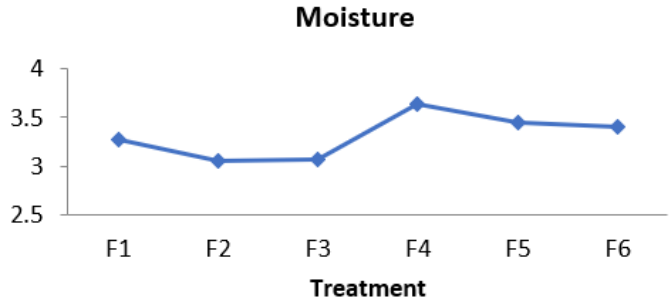
F3: Composition of 70% Onggok composite flour, 30% wheat flour
F4: Composition of 80% Onggok composite flour, 20% wheat flour
F5: Composition of 90% Onggok composite flour, 10% wheat flour
F6: Composition of 100% Onggok composite flour, 0% wheat flour

Based on the test results of a CRD analysis, the ash content in the selected formula F1 50%:50% was 1.24%. The tapioca processing process that is carried out carefully will produce clean dregs, not easily contaminated so that the Onggok has low ash content. Ash content is the result that remains from food samples that are completely burned in the ashing process. Ash content is a mineral that cannot be burned into a substance that can easily evaporate. The higher the ash content in a product, the less good the product is for consumption (Richana & Sunarti, 2004).

Figure 5. Moisture Content Analysis Diagram

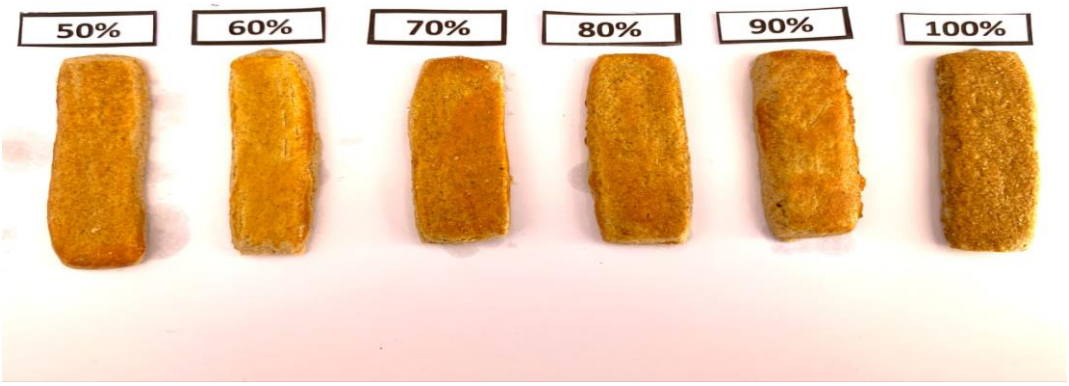


Note:
F1: Composition of 50% Onggok composite flour, 50% wheat flour
F2: Composition of 60% Onggok composite flour, 40% wheat flour
F3: Composition of 70% Onggok composite flour, 30% wheat flour
F4: Composition of 80% Onggok composite flour, 20% wheat flour
F5: Composition of 90% Onggok composite flour, 10% wheat flour
F6: Composition of 100% Onggok composite flour, 0% wheat flour

Based on the result of a CRD analysis of Onggok composite flour and wheat flour formulations on the chemical analysis of the snack bar with a ratio of F1 50%:50%, the water content was 3.27% as the selected formula. The water content produced is still within the SNI-23-2012 standard. According to Mustafidah and Widjanarko

(2015), the water content will affect the shelf life, if the water content increases it can accelerate the product degradation process. Degradation is a chemical change reaction or the gradual breakdown of a simpler compound or molecule. The low water content will inhibit microbial activity and determine the shelf life of a product. The results of research by Arwin, Tamrin, and Baco (2018) that the water content of snack bar products is influenced by the availability of starch, fiber, sugar, and additional ingredients. Meanwhile, research by Andriani, Ansharullah, and Asyik (2018) reported that the high water content in snack bars can be influenced by raw materials, shape, size, thickness, time, and temperature of snack bar baking.

Figure 6. Snack Bar results in various formulations of Onggok composite flour



Based on the results of the organoleptic test of the snack bar with the formulation of Onggok composite flour and wheat flour, F1 was chosen with a ratio of 50%: 50%, which was preferred.

CONCLUSION

The results of the proximate analysis showed that the protein of the snack bar was 11.06%, the dietary fiber was 8.23%, the ash content was 1.24%, and the moisture content was 3.27. Ratio of 50% Onggok composite flour and: 50% wheat flour, showed the best results according to SNI SNI-23-2012. Therefore, the Onggok composite flour snack bar is good to use as an alternative high protein emergency food that deserves to be developed.

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