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## Study of snack bar combination of banana flour (*Musa paradisiaca*) and mung bean flour blending as emergency food

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**Abstract.** The condition where refugees cannot fulfilling their food needs increases the need for emergency food production which is ready to consume. Emergency food can be design as a snack bar that can be produced using blended flour of banana, mung beans, and mung bean sprouts. The purposes of this study were to determine the best formulation of the snack bar and to determine the adequacy of snack bar nutrition content with nutritional adequacy rates per day. This study consists of two stages, first, the determination of the three best formulations from five formulations that have been made through organoleptic testing. The second stage was to determine the nutritional profile from the results of the first phase of research with observational parameters. Based on the organoleptic test results, and make the nutritional profile test results from 3 treatments were respectively water content (5.1%, 5.26%, 5.07%), ash content (2.53%, 2.59%, 2.69%), protein content (9.49%, 9.14%, 8.99%), fat content (19.56%, 19.38%, 19.34%) carbohydrate levels (63.33%, 63.62%, 63.92%), fiber content (1.35%, 1.44%, 1.48%), while for consecutive calorie calculation results (707.99 Cal, 708.59 Cal and 710.6 Cal).The conclusion is Snack bar can fulfill nutritional adequacy rates per day.

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### 1. Introduction

Indonesia is one of the countries that a natural disaster happens frequently. This is happening due to the geographical position of Indonesia is at the confluence of three tectonic plates, the Indo-Australian plate at the south, the Eurasian at northern and the Pacific plate at southern. According to data BNPB disasters that occurred as much as 1,567 incidents, 568 missing victims, victims who were displaced as much 2.680.133 [1]. It contributes to tremendous physical destruction, injury, loss of life and economic damage. The natural disaster can cause serious damage to health facilities, water, and food supply. The refugee distress to fulfilling their food needs. These conditions increase the need for emergency food production that ready to eat.

Emergency food should be nutritionally adequate in fulfilling the food needs of the refugees; emergency food should contain calories according to the Nutrition Adequacy Score at 2100 Kcal/day. The total calories total macronutrient recommended that protein by 10-15%, 35-45% fat and carbohydrates at 40-15%. Another critical thing about emergency foods is moisture. The water content of emergency food should be no more than 10% by the water activity of 0.65 to 0.70 [2]. This is because the low water levels can extend the shelf life of a food emergency. Distribution of emergency food takes a long time to get the location so it can be last longer.

One food product that can be used as emergency food is a snack bar, the snack bar is made using a material enriched with nutrients which are formed into a compact and hard. Snack bar including food



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resistant to pressure, more resistant than dry food because it is a type for intermediate moisture food. this kind of food can be produced by means of traditional and modern.

A snack bar can be produced using bananas, mung beans, and mung bean sprouts. Bananas are used as a source of carbohydrates and mung beans and mung bean sprouts are used as a source of protein and fat in the snack bar. Banana is a fruit that is preferred by the citizens of Indonesia. Based on Data and Information Center for Agriculture in 2016, banana production in Indonesia reached 80,000 tons in 2015 at an annual percentage of banana production increased by 4.5% [3]. The mung beans are types of beans that are rich in protein. Mung bean production in Indonesia can be categorized as a high but not yet optimized processing of mung beans as a food source of vegetable protein. The mung beans have great potential to be developed into food diversification program, processed mung beans will not be inferior to the other processed materials. Extra flour mung bean sprouts can also be a raw material for making innovation snack bar, as well as content owned mung bean sprouts, can improve the nutritional value snack bar. Based on this background, the necessary research to determine the best formulation snack bar with a combination of banana flour and mung beans and measure the nutritional profile of the snack bar.

## 2. Materials and methods

This research was conducted at the Laboratory of Food Processing and Analysis Laboratory and Quality Control of Food, Study Program Food Science and Technology, Department of Agricultural Technology, Faculty of Agriculture, Universitas Hasanuddin. The snack bar is produced in various treatments.

**Table 1.** Various treatments banana flour and mung bean flour of snack bar.

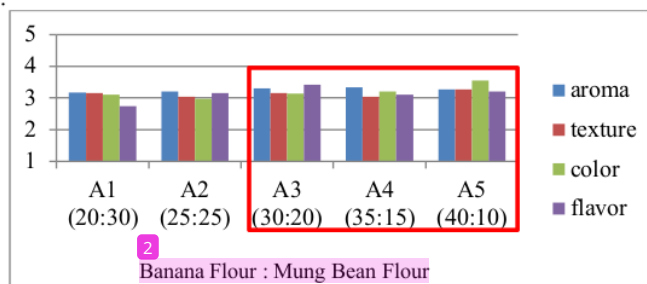
Symbol	Banana Flour	Mung Bean Flour
A1	10	40
A2	15	35
A3	30	20
A4	35	15
A5	40	10

The snack bar is produced with this various treatment after making sprout a mungbean and dried it. Making snack bar using additional ingredients like butter, dried sprout mung bean, sugar, honey, powder milk, after producing snack bar with various treatment, then we did an organoleptic testing to get three best treatment and do some analysis for nutritional profile of snack bar like water content, ash content, protein content, fat content, carbohydrate content, calories, and fiber content.

## 3. Results and discussion

### 3.1. Organoleptic

Organoleptic testing in this study conducted by the hedonic method, based on a panelist then given ratings preferred not to heavily favored by the headwind 1-5 by four main points are aroma, texture, color, and flavor.



**Figure 1.** The result of organoleptic.

Based on figure 1, three best treatments based on panelists namely A3 (35% Banana Flour and 15% Mung Bean Flour), A4 (35% Banana Flour and 15% Mung Bean Flour), A5 (40% Banana Flour and 10% Mung Bean Flour). Aroma, texture, color, flavor caused by the content of the main ingredient, banana flour can affect the aroma, color, and texture that is caused by sugar content or the starch of the banana flour. Also, the mung bean flour can affect aroma and flavor and texture as it contains fat. Besides, special aroma from mung bean also affects the snack bar's aroma [4–6].

### 3.2. Water content

The water content is one of the important components in food products because water content can affect the organoleptic quality and shelf life of the product produced snack bar. Results of analysis of water content in a variety of treatments against the snack bar presented in table 2.

**Table 2.** The water content of the three best treatment snack bar.

Treatment	Water Content
30:20	5.1a
35:15	5.26a
40:10	5.07a

As can be seen in table 2, the results of the analysis of variance ( $p > 0.05$ ) showed that comparison of banana flour and mung bean flour had no real effect on the level of 5% of the water content of the resulting product snack bar, so we did not perform a further test. This is caused by the content of the water levels, which are not significantly different. The staple banana flour moisture content of 3% and mung bean flour amounted to 5.07%. Water content in the snack bar product is affected by the raw materials used. Banana flour and mung bean flour contain high starch content so it can affect moisture reduction. This is in accordance with Aristawati (2013) which states that the starch has water-binding properties, the higher the starch content, the more water is absorbed so that the water content increases [7].

### 3.3. Ash content

The ash content is a mixture of inorganic and mineral levels in the material, the ash content of a material determines the mineral content of a product is presented, the ash content can be influenced by the materials used. Results of analysis of ash content on a variety of treatments against snack bar presented in table 3.

**Table 3.** Ash content of three best treatment snack bar.

Treatment	Ash Content
30:20	2.53a
35:15	2.59a
40:10	2.69 a

As presented in table 3, the results of the analysis of variance ( $p > 0.05$ ) showed that the comparison of banana flour and mung bean flour had no real effect on the level of 5% of the ash content of the resulting snack bar product. It can be caused by the ash content of the two main ingredients of banana flour and mung bean flour which have no significant ash content. Ash content in snack bar products is affected by the raw materials used. The ash content is influenced by the mineral content of the raw materials used. This related to USDA (2014) said that the mineral content of banana flour had higher levels because of potassium content is high enough in bananas than mung bean flour [8].

### 3.4. Protein content

Protein-containing compounds C, H, O, and N. The nitrogen contained in the protein to be held on carbohydrates or fat. Protein is one part of the macromolecule needed by the body. Protein serves as one of the main substances in the human body. Protein is composed of amino acids essentially complete. The complete amino acid has the ability to keep up growth and tissue in the body. The method used for testing for protein content is the Kjhedal method. Results of the analysis of protein content in various treatments of the snack bar is presented in table 4.

**Table 4.** The protein content of the three best treatment snack bar.

Treatment	Protein content
30:20	9.49b
35:15	9.14a
40:10	8.99a

Based on table 4, the results of the analysis of variance on the show ( $p < 0.05$ ) that the comparison of banana flour and mung bean flour had a real effect on the level of 5% of the protein content in snack bar products produced, so we performed a further test (Duncan). The test results further show treatment concentration of banana flour 30%: mung bean flour 20% was much different to the treatment concentration of banana flour: mung bean flour ie (35%: 15%) and (20%: 30%). It can be caused by the comparison of the protein content of the raw materials used to differ significantly. The protein content in each treatment decreased the proportion of this is because the mung bean flour is used less and less. Snack bar protein content generated is affected by the protein content of the raw materials used, Based Silfia (2012) states that the banana flour has proteins at 3:36% -4.12% gram. Andriani (2012) states that the mung bean flour has 19.48 grams of protein. In addition to the raw materials used source of protein produced Snack bar can also be of added ingredients used are bean sprouts, sprout mung beans results from protein-containing 2.9% [11].

### 3.5. Fat content

Fat is an organic component has hydrophobic properties and can serve as shortening, at also plays a role in improving the texture and the formation of the soft texture of the snack bar. The results of the analysis of the fat content are presented in table 5.

**Table 5.** The fat content of the three best treatment snack bar.

Treatment	Fat Content
30:20	19.56a
35:15	19.38a
40:10	19.34a

Fat is an organic component has hydrophobic properties and can serve as shortening. Fat also plays a role in improving the texture and the formation of the soft texture of the snack bar. Based on table 5, the results of the analysis of variance ( $p > 0.05$ ) showed that the comparison of banana flour and mung bean flour had no real effect on the level of 5% of the fat content of the resulted snack bar, so we do not perform a further test. This is due to the content of the main raw materials that did not differ significantly. The fat content of 0.8% banana flour at mung bean flour 0.009% fat content on product Snack bar is affected by the levels of raw material banana flour and mung bean flour. According to Musita, the banana flour contains a total fat content of 0.18 grams [12] and by Andriani, mung bean flour containing 0.009 g of fat [10]. In addition to raw materials, auxiliary materials in the manufacture of butter snack bar which plays an important role in the fat content of products produced Snack bar. butter contains high levels of fat which contain a number of lipids and a portion of the lipids are bound from lipoproteins and when margarine was added to the dough, then the dough will

have high-fat content. This is in accordance with Farida et al (2008) which states that the butterfat content of 82% with the dispersed water content of 16% [13].

### 3.6. Carbohydrates content

Carbohydrate is the main source of energy needed by the body. Carbohydrates are the nutrients contained in foods composed of the elements C, H, and O. The function of carbohydrates as well for the digestive system because of carbohydrates foods high in fiber. The method used in the testing of carbohydrates is by difference. Carbohydrate content analysis results are presented in table 6.

**Table 6.** The carbohydrates content of three best treatment snack bar.

Treatment	Carbohydrate Content
30:20	63.33a
35:15	63.62a
40:10	63.92a

Carbohydrate is the main source of energy needed by the body. Carbohydrates are the nutrients contained in foods composed of the elements C, H and O. Based on table 6, the results of calculations of carbohydrate levels in snack bar differences resulted from the 3 treatments ranged from 63.33 to 63.92%. Table 6 shows that the levels of carbohydrates in each treatment has increased, treatment comparison of banana flour and mung bean flour 30%: 20% amounting to 63.33%, the treatment with a ratio of 35%: 15% at 63.62% and for treatment ratio of 40%: 10% at 63.92%. Results of analysis of variance ( $p > 0.05$ ) showed that the comparison of banana flour and mung bean flour had no real effect on the level of 5% of the carbohydrate content of the resulted product, so further test was not performed. Snack bar-carb products have increased. This is due to the carbohydrate content of banana flour and mung bean flour is quite high. According to research, the number of carbohydrates contained banana flour amounted to 88.6 grams and according to Andriani (2012) carbohydrate content of the mung bean flour for 72.85 grams [10]

### 5.7. Calories

A calorie is a unit used to measure the energy value obtained by the body when consuming food/drinks. The calorie content of foods may be determined by the contents of nutrients such as carbohydrates proteins and fats. The method used calorie calculation results in the treatment of a variety of snack bars presented in table 7.

**Table 7.** Calories of three best treatment snack bar.

Treatment	Calories
30:20	707.99a
35:15	708.59a
40:10	710.60a

A calorie is a unit used to measure the energy value obtained by the body when consuming food/drinks. The calorie content of foods may be determined by the contents of nutrients such as carbohydrates proteins and fats. Based on table 7, results of the analysis of variance ( $p > 0.05$ ) showed that the comparison of banana flour and mung bean flour had no real effect on the level of 5% of the total calorie of Snack bar products produced. The more the use of banana flour causes an increase in the value of the products calorie Snack bar. This is because of the nutritional components that affect each treatment, where treatment 40:10 has a value of fat and carbohydrates were higher compared with the treatment of 30:20 and 40:10. Calory value is obtained from the conversion of proteins, fats, and carbohydrates into energy. The energy source for fat is 9 kcal of energy per gram, while carbohydrates and protein generate the energy of 4 kcal per g [14] In this research, nutritional components that

provide the greatest energy is carbohydrates and fats which implies quite high. Snack bar high in calories caused by the materials used in fat high enough to produce a high-calorie similarly, in 100g each ingredient, butter contains 720 kcal [13].

### 3.8. Fiber content

Fiber is not a starch plant polysaccharides plus lignin waste materials of plant origin commonly eaten remaining after successive extracted with solvents, dilute acids and alkalis. The fiber content can be influenced by the levels of carbohydrates. Fiber is the part of the plant that can not be absorbed and digested by the human body. Although it does not contain nutrients fiber has an important function for the body. Fiber helps to release the intestinal hormone, binds calcium, iron, zinc, and other minerals. Dietary fiber, also known as dietary fiber or dietary fiber, is part of a plant that can be consumed and composed of carbohydrates that have properties resistant to digestion and absorption in the human small intestine and fermented in whole or part of the large intestine. The fiber testing method used is the gravimetric method. Results of analysis of the fiber content on a variety of treatments against the snack bar presented in table 8.

**Table 8.** The fiber content of the three best treatment snack bar.

Treatment	Fiber content
30:20	1.35a
35:15	1.44a
40:10	1.48a

Based on table 8, results of the analysis of variance ( $p > 0.05$ ) showed that the comparison of banana flour and mung bean flour had no real effect on the level of 5% of the fiber content of the resulted product. The snack bar's fiber content was affected by the fiber raw material used. A comparison of the proportion of the treatment of banana flour and mung bean flour does not provide a comparison with the fiber content. The fiber content of 2.39 grams of banana flour [10] and fiber content contained mung bean flour by 2.76 grams [15].

### 3.9. Emergency food

Emergency food consumed to provide energy and nutrients needed for refugees. Emergency food designed to have a total energy content of 2100 kcal per day consisting of 35-45% fat, 10-15% protein, and 40-50% carbohydrate [16]. The content of 2100 kcal per day divided into 3 meals a staple, so assumed a meal containing 700 kcal. The results of calculation of the largest amount of product Snack bar that can be consumed and total calories per bar in accordance with Appendix 3 and 4 are in treatment 30%: 20% as much as 106.20g (6.59 bar  $\approx$  7 bar), 35%: 15% as much as 106.29g (6.59 bar  $\approx$  7 bar) and 40%: 10% as much as 106.59g (6.56 bar  $\approx$  7 bar) in accordance with the adequacy of calorie snack per day. Based on the criteria for emergency food is made, 40%: 10% selected as the best treatment due to a higher calorie content compared with other treatments. This is in accordance with Zoumas et al. [16].

## 4. Conclusions

Based on the aforementioned finding, we conclude as the follow

1. The best formulation of this research is by Banana flour ratio of 40%: 10% mung bean flour with a total of 710.6 kcal Calories.
2. The calorific content of the three best treatment comparison of banana flour and mung bean flour produced snack bar (30%: 20%) (35%: 15%) and (40%: 10%) is 707.99 kcal; 708.59 kcal; 710.6 kcal that have met the nutritional content of food for one meal.

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