Physicochemical characteristics of food bar from composite flour (modified breadfruit, purple sweet potato, mocaf, and saga seeds)

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Abstract. Food bars are food products that can be solid and are classified as semi-wet products or intermediate moisture food and can be developed while still paying attention to adequate calories, nutrients needed by the body, practical, can reduce hunger, and is in the form of solid food. Our concern was looking for the flour from local resource plants, like composite flour from modified breadfruit flour, purple sweet potato flour, mocaf flour, and saga seed flour. The analysis was carried out using a non factorial complete randomized design, food bars with composite flour formulations (modified breadfruit flour, purple sweet potato flour, mocaf flour, and saga seed flour) (P); (40:30:30:0, 35:35:25:5, 30:40:20:10, 25:45:15:15, 100% modified breadfruit flour, 100% purple sweet potato flour, 100% mocaf flour, and 100% wheat flour). The final results of the study showed that food bar with composite flour formulations (35:35:25:5) produced the best quality food bar in terms of colour (brightness), protein content, fibre content, fat content, carbohydrate content, and de-Gamo method.

1. Introduction

One of the food products that can be developed while still paying attention to adequate calories, nutrients needed by the body, practical, can reduce hunger, and is in the form of solid food is a food bar. This one food product can also be used as an alternative to emergency food (emergency food product) which is processed and specially designed for consumption in conditions that make it difficult for humans to meet their food needs, such as post-disaster conditions [1].

Food bars are food products that are solid and are classified as semi-wet products or moisture food intermediates (IMF). The food product is high-calorie food made from a mixture of food ingredients (blended food), enriched with nutrients, then formed into a solid and compact form (a food bar form) [2]. The food bar is packaged in a small form to make distribution easier. The majority of existing food bars are made using wheat flour as the main ingredient.

The use of wheat flour in food processing causes the level of dependence to increase, on the other hand, the level of domestic wheat production has not been able to meet the needs of wheat flour, resulting in increasing imports [3]. One way to reduce the habit of importing wheat flour is to provide a solution by utilizing local food ingredients. For example, saga seeds which have high protein and fat content [4], purple sweet potato are the colour givers [5]. Some examples of the use of other local foodstuffs include
cassava into potato processing [6], jackfruit seeds being the newest alternative to starch with different characteristics [7], and the utilization of durian seeds with raw material supplies which are often ignored by the community [8].

2. Materials and methods

The raw materials used in this study were mocaf flour obtained from Bakery Innovations, purple sweet potato obtained from Pasaraya MMTC, saga seeds obtained from the University of North Sumatra love garden and bread fruits obtained from Setia Budi, Medan.

The food bar uses modified breadfruit flour, purple sweet potato flour, mocaf flour and saga seed flour. Making a food bar is done by mixing the flour according to the predetermined treatment. Other ingredients are prepared and weighed accurately, namely 30% margarine, 30% sugar, 60% egg, 10% skim milk, and 0.1% salt, stirring until homogeneous using a low speed mixer for 20 minutes. Then the flour mixture and additional ingredients are stirred until evenly distributed, then put the dough into the pan. After that, put the baking sheet in the oven at 120°C for 20 minutes which results in the dough being half cooked. The dough is cut to a size of 10 cm x 1.5 cm x 3 cm and roasted again at 120°C for 30 minutes. After that, the food bar cooled at room temperature for 30 minutes and put in an airtight packaging for 24 hours.

This research was conducted using a non-factorial completely randomized design in the form of a mixture of modified breadfruit flour, purple sweet potato flour, mocaf flour, and saga seeds consisting of 4 controls and 4 comparative treatments, namely:

P1 = 40 : 30 : 30 : 0
P2 = 35 : 35 : 25 : 5
P3 = 30 : 40 : 20 : 10
P4 = 25 : 45 : 15 : 15
P5 = 100% modified breadfruit flour (control 1)
P6 = 100% purple sweet potato flour (control 2)
P7 = 100% mocaf (control 3)
P8 = 100% wheat flour (control 4)

Each treatment was made in 3 replications, so that the total sample size was 24 samples.

Analysis of colour (brightness) using a minolta chromameter (type CR 200, Japan) [9], protein content was carried out using K-Jeldahl [10], fibre content was carried out using the crude fibre method [11], fat content was carried out by boiling flask [10], carbohydrate content using the method by difference, de-Garmo method is used to determine the best food bar [12].

3. Results and discussion

3.1. L* value (brightness)

The results showed food bar P7 and P8 have the highest L* value where these two materials have the highest level of bright white colour compared to other treatments due to the use of 100% ingredients. Meanwhile, P3 has the lowest L* value due to the use of purple sweet potato which has a dark colour. The brighter the colour of the material, the higher the L* value, while the darker the colour of the material, the lower the L* value [13].
3.2. Protein content

The results showed that P4 food bar had protein content with the highest value, namely 15.55%, while P8 food bar had protein content with the lowest value, namely 8.15%. The results showed that there was an increase in protein content from P1-P4 where this increase was caused by the use of saga seed flour which had a protein content value of 36.14%, the protein content in saga seeds is higher than the soy protein content [14].
3.3. Fat content
The results showed the food bar with the highest fat content was found in P3, namely 14.30%, while the lowest fat content was in P1, namely 12.36%. The highest food bar fat content in P3 is due to the treatment that the food bar is made of 30% modified breadfruit flour, 40% purple sweet potato flour, 20% mocaf flour, and 10% saga seed flour where the results of research on raw materials show that the fat content saga seed flour of 13.94% and purple sweet potato flour of 1.75% so that the greater the use of the added raw materials, the higher the fat content of the food bar obtained. While the P1 food bar with the lowest fat content has saga seed flour by 0% so that the fat content obtained is also low.

![Figure 3](image.png)

**Figure 3.** Relationship of composite flour formulation (modified breadfruit, purple sweet potato, mocaf, and saga seeds) with fat content of food bar (Error bar).

Description:  
P1 = 40% : 30% : 30% : 0%  
P5 = 100% breadfruit flour  
P2 = 35% : 35% : 25% : 5%  
P6 = 100% purple sweet potato flour  
P3 = 30% : 40% : 20% : 10%  
P7 = 100% mocaf flour  
P4 = 25% : 45% : 15% : 15%  
P8 = 100% wheat flour

3.4. Crude fibre content
The results showed that the food bar with the highest crude fibre content was at P4 which was 3.73% and the food bar with the lowest value was at P8 which was 1.85%. This is in accordance with the results of the research on raw materials which showed that the fibre content of saga seed flour was 12.74% and mocaf flour was 3.26% with the formulation of 25% modified breadfruit flour, 45% purple sweet potato flour, 15% mocaf flour and 15% saga seed flour. where the increasing use of saga seed flour and mocaf flour will result in an increase in the fibre content of the resulting food bar. The wheat flour has a low fibre content value, this is because when wheat flour is made, crude fibre is a part that must be separated and disposed [15].
3.5. Carbohydrate content

The results showed the food bar with the highest level value was found at P8, namely 53.02%, while the food bar with the lowest level was at P3, namely 46.41%. The carbohydrate content of food bars in this study is determined by the by difference method where the carbohydrate content will be determined by nutritional components such as fibre content, fat content, and protein content from the food bar. The higher the water content, ash content, fat content, and protein content, the lower the carbohydrate content value. The level of carbohydrates determined by the by difference method will affect the size of the carbohydrate content, where the lower the other nutritional components, the higher the carbohydrate content [16].

Figure 4. Relationship of composite flour formulation (modified breadfruit, purple sweet potato, mocaf, and saga seeds) with fibre content of food bar (Error bar).

Description:

- P1 = 40% : 30% : 30% : 0%  P5 = 100% breadfruit flour
- P2 = 35% : 35% : 25% : 5%  P6 = 100% purple sweet potato flour
- P3 = 30% : 40% : 20% : 10%  P7 = 100% mocaf flour
- P4 = 25% : 45% : 15% : 15%  P8 = 100% wheat flour

Figure 5. Relationship of composite flour formulation (modified breadfruit, purple sweet potato, mocaf, and saga seeds) with carbohydrate content of food bar (Error bar).

Description:

- P1 = 40% : 30% : 30% : 0%  P5 = 100% breadfruit flour
- P2 = 35% : 35% : 25% : 5%  P6 = 100% purple sweet potato flour
- P3 = 30% : 40% : 20% : 10%  P7 = 100% mocaf flour
- P4 = 25% : 45% : 15% : 15%  P8 = 100% wheat flour
4. Conclusions

The final results of the food bar research (modified breadfruit, purple sweet potato, mocaf, saga seeds) were obtained from various parameters which were determined including colour (brightness), fat content, fibre content, protein content, carbohydrate content and with the de Garmo method, the results showed that food bar at P2 (35:35:25:5) is the best product from various treatments.

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