

# The Acceptability and Glycemic Index of the Snack Bar From Soybean And Coconut Pulp

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## Abstract

**Background and aims:** People with type 2 diabetes mellitus need a food interlude to help meet the nutritional needs and control blood glucose levels. Soybeans and coconut pulp have a low glycemic index so that making this snack bar is expected to be a dietary interlude with good nutritional value and has a low glycemic index. The purpose of this research is to know the influence of proportion of soybean and coconut pulp on acceptability and glycemic index of snack bar. **Material and method:** The type of this research was experimental one factor with 3 treatment of soybean: coconut pulp P1 92%: 8%, P2 88%: 12%, and P3 84%: 16%. This research uses Completely Randomized Design (RAL). Organoleptic data were analyzed using Friedman's statistical analysis and glycemic index were analyzed using One Way ANOVA test. **Results:** Glycemic index test results obtained the highest IG value at P1 is 6.03, and the lowest in P3 is 3.32. Result of glycemic load got the highest BG value at P1 that is 1,68, and lowest at P3 that is 0,92 **Conclusions:** no effect of proportion of soybean and coconut pulp to acceptability and glycemic index of snack bar.

**Keywords:** glycemic index, acceptability, snack bar, soybean, coconut pulp

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## I. Background and aims

Diabetes Mellitus is a collection of symptoms that arise in a person caused by the increase in blood glucose levels due to the reduction of progressive secretion of insulin<sup>[1]</sup>. The effort to handle patients with diabetes mellitus type 2 is a dietary modification. The recommended diet is a high-fiber diet. Dietary fibre is also useful in reducing calorie intake<sup>[2]</sup>.

A balanced low calorie diet accompanied by a high dietary fiber is beneficial as a strategy facing obesity. A study in America proves that a high fiber diet of 25 g/day is able to improve blood sugar control, lowering the excessive increase in insulin in the blood as well as lowering blood fat levels. Fiber in foods causes glycemic index in foods to be small so as to modulate blood glucose levels by lowering the speed rate of blood glucose enhancement, increase the sensitivity of insulin hormones in the body, and slow the gastric discharge<sup>[3, 4, 5, 6, 7, 8]</sup>. A low glycemic index diet has been shown to improve lipid and glucose levels, keep insulin levels more stable and reduce insulin resistance, which is important in reducing the risk of long-term diabetes-related complications. The example of food ingredients that have a low glycemic index are soy bean 21 dan coconut 45<sup>[9]</sup>.

Soy beans are one of the legumes that are sources of protein, carbohydrates, fats, calcium, phosphorus, iron, vitamin A, and vitamin B1. Soybeans are rich in isoflavones that can help lower cholesterol (acetyl CoA) in the blood so that indirectly also helps lower the blood glucose response. Soybeans also have a low glycemic index, which is 31<sup>[10]</sup>.

Coconut is a commodity that has potential to be utilized, but generally the community uses coconut to take the coconut milk<sup>[11]</sup>. Making coconut milk produces byproducts in the form of coconut pulp. Coconut pulp has been used only as animal feed and Tempe Bongkrek in food<sup>[12]</sup>. Meanwhile, dry coconut pulp contains 13% cellulose and also has a fairly high nutrient content with: water content of 5.60%, protein 4.38%, fat 14.72%, fiber 11.70% and ash 1.13%.

Soy bean snack bar and coconut pulp is expected to have a good nutrient content, does not cause an increase in blood glucose rapidly, and can be consumed as a food distraction patients with type 2 DM without causing hyperglycemia. Based on the fact, there must be modification of food products made from raw with low glycemic index where the food is still able to contribute adequacy of nutrients for people with DM.

The purpose of this research is to know the influence of the proportion of soybeans and coconut pulp toward its acceptability and glycemic index snack bar.

## II. Material And Method

### Study design and patients

This type of research is experimental one factor with 3 treatments and each treatment is done 2 times repetition (replication). This study using complete random draft (RAL) consists of 3 (three) treatments to be tested for glycemic index and its acceptability. The samples taken from the population of soy beans and good quality coconut pulp. The test samples of glycemic index were taken from some populations with a minimum number of subjects required at least 6 people [13].

### Laboratory, anthropometric and clinical data collection

The acceptability test includes research into flavors, aromas, colors and textures. The method used in this organoleptic test is the Hedonic Scale Scoring method with the a questionnaire. This test was conducted using 30 panelist (Nutrition Students of Banjarmasin Poltekkes) that is trained. The stage that is traversed to measure glycemic index snack bar is recruitment and selection of the research subject of the imaging of the sports bar of coconut and soybean pulp for consumption, and analysis of the subject's blood glucose levels. Stages in blood sampling [16]:

- 1) Fasting blood glucose is taken in a prick-test on the first blood sampling.
- 2) The single food that will be determined by its glycemic index (equivalent to 50 g of carbohydrates) is given to the subject, the time-depleted food deadline is determined to be 5-10 minutes. The sample portion determination is calculated with the following formula (Rakhmawati et al, 2011):

Jumlah porsi (g) =

$$\frac{50 \text{ g} \times 100}{\text{carbohydrates by different} - \text{food fiber}}$$

- 3) First blood sampling is calculated after 15 minutes of food-depleted test is eaten as data of the 15th minute blood sugar levels .

- 4) Subsequently blood samples were taken at the 30, 45, 60, 90, and 120th minute.

- 5) Then, data on blood sugar levels are plotted on two axes which were time axis and blood sugar levels. Glycemic index food is determined by comparing the area under the curve between the food measured by its glycemic index with pure glucose. Calculation of the area under the curve using the calculation of building area. The area of the shape is calculated by drawing a horizontal line and drawing a vertical line based on the time of blood drawn so that the curve forms the area of the triangle and trapezoid. The area under the curve is obtained by summing each area up. The area below the curve is calculated by the formula:

Glycemic Index =

$$\frac{\text{area under the food test curve}}{\text{area under the standard food curve}} \times 100$$

- 6) The area of the curve is calculated for each subject so that the glycemic index value of each subject differs. The value of glycemic index food test is obtained from the average outcome of the individual glycemic index value of ten people subject to research.

### Statistical analysis

To know the influence of proportion to the glycemic index snack bar of each treatment is conducted statistic test with One Way Anova analysis and continued to Tukey test using computer program.

## III. Results

### Acceptability of Snack Bar

#### Color

Percentage of the test result for acceptability the snack bar color can be seen in Figure 1.

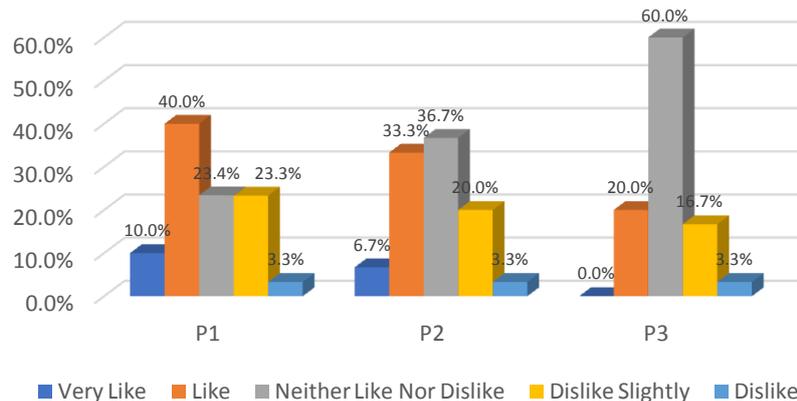
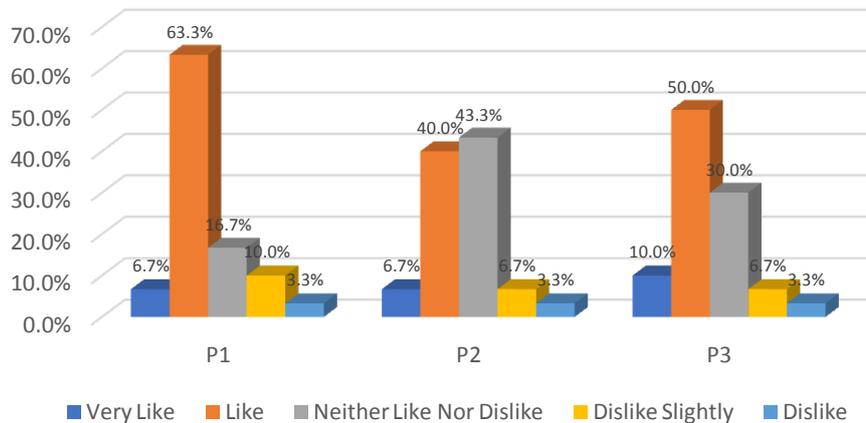


Figure 1. Percentage of test result for acceptability of snack bar color

Based on Figure 1 shows that the acceptability of panelist to the color of the snack bar that is most preferred is the P1 treatment of 50% panelist choose very like and like. The results of the statistical test obtained no influence of the proportion of soy beans and coconut pulp to organoleptic color test of the snack bar.

**Aroma**

Percentage of the test result for acceptability the snack bar aroma can be seen in Figure 2.

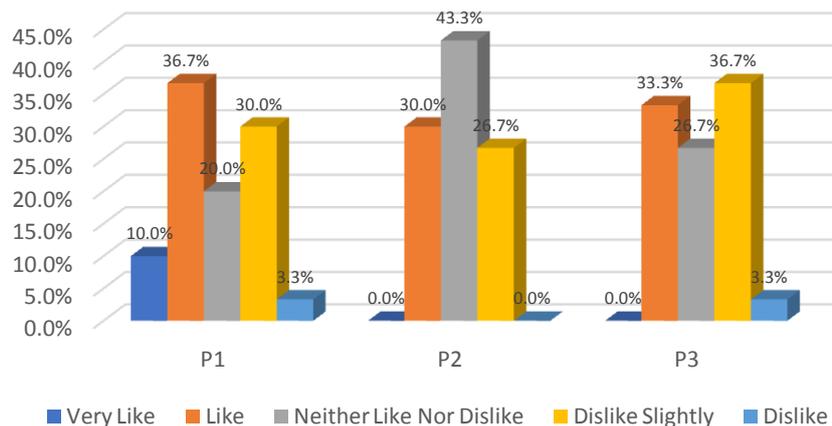


**Figure 2. Percentage of test result for acceptability of snack bar aroma**

Based on Figure 2 shows that the acceptability of panelist to the aroma of the snack bar is the most preferred treatment P1 is 70% panelist choose very like and like. The results of the statistical test obtained no influence of the proportion of soy beans and coconut pulp to organoleptic aroma test of the snack bar.

**Texture**

Percentage of the test result for acceptability the snack bar texture can be seen in Figure 3.



**Figure 3 Percentage of test result for acceptability of snack bar texture**

Based on Figure 3 shows that the acceptability of panelists to the texture of the most preferred snack bar is P1 treatment of 46.7% panelist chooses to be very like and like. The results of the statistical test obtained no influence of the proportion of soy beans and coconut pulp of organoleptic test texture of the snack bar.

**Taste**

Percentage of the test result for acceptability the snack bar taste can be seen in Figure 4.

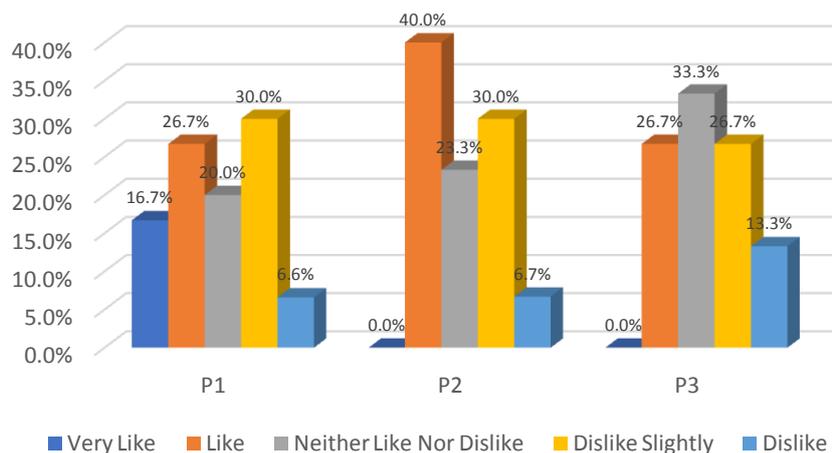


Figure 4 Percentage of test result for acceptability of snack bar taste

Based on Figure 4 shows that the acceptability of a panelist on the taste of the snack bar is the most preferred treatment P1 is 43.4% panelist choose like and really like. The results of statistical test obtained no influence proportion of soy beans and coconut pulp to organoleptic taste test of the snack bar.

#### Nutrient Composition of the Snack Bar

Table 5.1 Nutrient Composition of the Snack Bar Analysis

Test Parameters	Treatment		
	P1	P2	P3
Moisture Content (%)	46,33	46,1	48,1
Ash Content (%)	1,15	1,15	1,02
Proteins (%)	13,57	13,02	12,64
Fats (%)	4,21	4,05	3,65
Carbohydrates by different (%)	34,74	35,68	34,59
Food Fiber (%)	13,86	17,39	21,18

Based on the analysis results P1, P2, and P3 have moisture content, ash content, proteins, fats and carbohydrates with a difference that is not large.

#### Glycemic Index Value

The value of the snack bar P1, P2 and P3 glycemic index based on the calculation of the area below the curve, obtained from the average value of the glycemic index value of eight research subjects was obtained that the value of IG P1 amounted to 6.03, P2 of 4.39, and P3 to 3.32. The test results of statistical analysis obtained no influence of the proportion of soybeans and coconut pulp to the glycemic index snack bar.

#### Glycemic Load

Based on the results of the calculation obtained that the load of P1 glycemic index amounted to 1.68, P2 by 1.25, and P3 by 0.92. The highest glycemic index is P1 is 1.68, and the lowest of P3 is 0.92.

### IV. Discussion

Color is a physical attribute that is assessed first in the determination of food quality and can sometimes be used as a measure to determine taste, texture, nutritional value and microbiological properties<sup>[17]</sup>. The results showed no influence in the proportion of soy beans and coconut pulp to the color of favorite tests. Colors are influenced by natural pigment content of ingredients or are the result of degradation of natural dyestuffs.

The color produced in the snack bar with the proportion of soy beans and coconut pulp is yellowish light brown. The yellowish light brown color in the snack bar is dominated by banana Saba and soy beans caused by the roasting process. Where the baking process occurred Maillard reaction so that the color of the snack bar turned into yellowish brown. The tanned color of the snack bar can be produced by Maillard reaction between the reducing sugars with amino acids, especially the lysine that is high in soybeans. Lysine contains two groups of Amin so that it is more reactive to reducing sugar and produces a more concentrated color of

tanned<sup>[18]</sup>. Carbohydrate and protein levels in each snack bar treatment have relatively the same value. So that the color of the snack bar on all treatments there is no influence because the color of the snack bar produced almost the same which is yellowish light brown.

The aroma of food determines the delicacy of the food, so aroma is one of the factors in quality determination<sup>[19]</sup>. Smell or aroma is the most difficult sensory properties to be classified and explained, because the variety is so large, because there are many types of aroma that can be recognized by the five senses of smell that is about 17,000 volatile compounds, with a higher level of sensitivity than the tasting senses (10,000 times)<sup>[20]</sup>.

The results showed that there was no proportion influence of soy beans and coconut pulp to the aroma of snack bar, this is because the aroma of the snack bar produced is almost the same, which is a sweet flavor and sweetness in general. More coconut pulp does not affect the aroma of snack bars. The Aroma of snack bar products is the result of the combination of soy beans, coconut pulp, banana kepok, chicken eggs and margarine, so that the smell of soybeans in soybean is covered by these ingredients. Sensory properties of smell or aroma are usually associated with the smell of certain products or compounds that have been commonly known as butter smell, vanilla and wheat flour<sup>[20]</sup>. It is also influenced by the warming process when roasting the snack bar causing caramelization. Caramelization is caused by a reducing sugar reaction with a primary amine group or high temperature application of sucrose. If heated at high temperatures, carbohydrates will turn into caramel which gives special aroma, because the cooperation between carbohydrates and certain proteins in flour<sup>[21]</sup>. The carbohydrate and fat levels in each snack bar treatment have relatively the same value. So the aroma of snack bar in all treatment is no influence because it produced almost the same which is a special aroma of banana and sweet.

Food texture or consistency is a component that determines the flavor of the food because of the sensitivity of the sense of taste influenced by food consistency<sup>[22]</sup>. The texture of a foodstuff is one of the physical properties of it. The texture of the food bar can be influenced by the base material, mold thickness and oven temperature is too high.

The results showed that there was no proportion influence of soy beans and coconut pulp to the texture of snack bar, this is because the texture of snack bar in general is sticky and crispy<sup>[23]</sup>. The texture of the snack bar on this research is tender. The soft nature can be influenced by the water content that will make the texture soft<sup>[18]</sup>.

A Snack bar that has a proportion of coconut pulp tends to have a more easily destroyed and lint-less texture. This is because the coconut pulp has a higher fiber content<sup>[24]</sup>. This leads to the snack bars that use a proportion of coconut pulp more requiring more adhesive dough.

Temperature and cooking time of the same snack bar as well as the same amount of quantity of margarine in each treatment cause the value of water content is relatively the same in each treatment. So there is no influence texture of snack bar in all treatment because the texture of it produced almost the same thing which is tender.

Taste is a sensation that arises and is caused by volatile and non-volatile chemical components derived from nature or synthesis and arise when eating or drinking. More taste involves the five senses of tongue. Foodstuffs that have the properties of stimulating the taste nerves will pose a certain feeling. The texture or consistency of a material affects the taste posed by the material itself<sup>[25]</sup>.

The results showed that there was no proportion influence of soy beans and coconut pulp to taste snack bar, this is because the taste of the snack bar produced almost the same, namely sweet flavor. Bananas have a sweet flavor. The riper the bananas, the sweetness is increasing due to the high content of sucrose. During the maturation of the banana fruit, starch is converted into sugar through the enzymatic process where there is a decrease in starch content from 20-30% to 1-2% followed by an increase in the amount of sugar especially sucrose up to more than 10% fresh fruit weight<sup>[26]</sup>.

Taste in snack bar products are the result of the combination of soy beans, coconut pulp, banana kepok, chicken eggs and margarine. The sweetness of the snack bar is found in the ingredients of the snack bar itself, namely the sweet taste of bananas. While the savory flavor that exists in the snack bar products of all treatment comes from one of the ingredients which is margarine. It has at least contains 80% of the fat from the total weight so that the product tends to be savory<sup>[27]</sup>.

Taste can be influenced by warming or processing done resulting in the degradation of the composition of the taste and physical properties of food ingredients<sup>[28]</sup>. Heating affects the taste of food that tends to be better. It is in accordance with Winarno<sup>[29]</sup> which states that warming processing techniques are capable of producing products that have a remarkable taste compared to other techniques.

Additionally because the value of carbohydrates on each treatment is relatively the same. So the taste of snack bar in all treatment is no influence because it produced almost the same which is sweet and savory.

Available carbohydrates describe the total content of carbohydrates available to the body so that it is easily digestible, absorbed, and metabolized by the body. Glycemic index is a way to give an overview of the relationship between carbohydrates in foods with a blood glucose response. Food that has low glycemic index

can optimize glycemic control in patients with type 2 DM by slowing down the carbohydrate absorption. Dietary glycemic index can be grouped into low (<55), medium (55-75) and high (>75) [16].

Snack Bar with P3 (soy beans 84% and coconut pulp 16%) has the lowest glycemic index which is 3.32 and snack bar with P1 (soy beans 92% and coconut pulp 8%) has the highest glycemic index which is 6.03. Glycemic index values of all three treatments have a low glycemic index value. This shows that the more proportion of coconut pulp will decrease the glycemic index of snack bar. The results of this research is in accordance with the results of other research that has been done before, namely on bread with the substitution of coconut flour. It was found that the more the addition of the given coconut flour, the food had lower the glycemic index in it [30].

The decrease in the value of glycemic index may be due to the high content of coconut pulp fiber, the more proportion of coconut pulp in the snack bar then the fiber content of the snack bar will be higher. In accordance with the results of food fiber snack bar at P1 13.86%, P2 17.39%, and P3 21.18%. So the more proportion of coconut pulp is the higher food fiber snack bar products. The higher content of fiber snack bar then glycemic index of snack bar will be lower. Dietary fiber plays a role in inhibition of food absorption in the digestive tract that results in the higher content of a food fiber, the lower glycemic index in the food will be [16]. Foods without food fiber content leads to rapid release of glucose so it requires a lot of insulin to convert the glucose into energy. Food fibers are able to slow down the absorption of glucose in the intestines and thereby reduce insulin requirements [31].

Glycemic Load provides more complete information about the effect of actual food consumption on increasing blood sugar levels. If using glycemic index, the information only describes the speed of the carbohydrate change to blood sugar, but does not give an overview of how much carbohydrate is in the food. Glycemic loads are categorized into there, i.e. low ( $\leq 10$ ), medium (11-19), and high ( $\geq 20$ ) [32].

Based on the research results, glycemic loads snack bar with the proportion of soy beans and coconut pulp of P1, P2, and P3 respectively, namely 1.68, 1.25, and 0.92. The more proportion of coconut pulp then glycemic loads is decreasing, this is because fiber content is increasing and causing glycemic index is decreasing. Nonetheless, the three formulations of snack bars still belong to the low glycemic loads category (low glycemic loads and glycemic loads diet have shown improvements in glycemic control, decreased serum lipid, cardiovascular risk and diabetes [33].

## V. Conclusions

The acceptability of the color, aroma, texture and taste of the snack bar in the proportion of soy beans and the highest coconut pulp is found in the P1 treatment (92%: 8%). The higher proportion of coconut pulp, the lower glycemic index snack bar of the products. The glycemic index snack bar at P1 amounted to 6.03, P2 at 4.39, and P3 by 3.32. Glycemic loads of snack bar at P1 amounting to 1.68, P2 at 1.25, and P3 by 0.92. No influence of the proportion of soybeans and coconut pulp to glycemic index of the snack bar.

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## Conflict of Interest

The authors declare no conflict of interest.

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