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# The Effect of Soy Milk Powder Substitution on Physical and Organoleptic Characteristics of Chocolate Bar for Lactose-Intolerant People

Zainal[a*], Affandi Burhanuddin[b], Mariyati Bilang[c]

[a,c] *Food Science and Technology, Hasanuddin University, Makassar, Indonesia*

[b]*Alumni of Food Science and Technology, Hasanuddin University, Makassar, Indonesia*

**Email: zainal_burhan@yahoo.com*

**Abstract**

Cow milk is commonly used as protein sources in chocolate products. This milk contains lactose which is not suitable to people who suffered from lactose intolerance, however. In fact, cow milk can be substituted to soy milk. The purposes of this research were to determine the ratio between cocoa fat and soy milk powder in the chocolate bar processing and the effect of soy milk substitution on physical and organoleptic properties of chocolate bar. There were three treatments applied, which were A1 (25% cocoa fat and 8% soy milk powder), A2 (20% cocoa fat and 13% soy milk powder), and A3 (15% cocoa fat and 18% soy milk powder). It was evaluated stability, melting point, fat blooming, and organoleptic properties including color, aroma, taste, and texture of chocolate bar. The results showed that the addition of cocoa fat and soy milk powder in chocolate processing gave relatively similar organoleptic properties in terms of color, aroma, taste, and texture. On the other hand, the stability and melting point were affected by the amount of soy milk powder substitution. The best treatment in this research was the treatment with 25% cocoa fat and 8% soy milk powder. Finally, storage of chocolate bar for 30 days at room temperature did not result in the physical feature changes particularly in the form fat blooming for all treatments.

***Keywords***: chocolate bar, cocoa fat, soy milk powder, stability, melting point.

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* Corresponding author.

## 1. Introduction

Chocolate bar is a common food product which is consumed over the world. It is produced from complex ingredients. Some ingredients used in the chocolate bar are cocoa butter, sugar, cocoa powder, and cow milk). Different content in cocoa powder, cocoa butter, and milk used to categorize chocolate into dark, milk, and white chocolate [1].

Milk plays an important role in producing a good texture and taste of chocolate bar. Cow milk is a common ingredient added in chocolate products. The main carbohydrate substances in cow milk is lactose, a specific dissacharide in mammalian milk. This sugar is broken down into glucose and galactose by the activity of lactase enzyme. The enzyme is adhered in the brush border and small intestine mucosa. The enzyme is essential for human in order to metabolize the lactose compounds of mammalian milk. The deficiency or even the absence of the enzyme in human body can lead to gastrointestinal diseases.

Some diseases born from lactase problem is celiac diseases [2], irritable bowel syndrome [3], and osteoporosis [4]. Some unserious problem could also come from lactase disorder are diarrhea, nausea, and sickness.

The diseases caused by lactase disorder is lactose-intolerance. Individuals who suffered from this diseases called lactose-intolerant people. This kind of people could have problem when they consume mammalian milk. Some lactose-intolerant cases has also be found in older adults[5]. This is caused by gradually decrease of lactase production with aging[6].

To avoid people from lactose-intolerant disorder when consuming chocolate bar, it is important to substitute mammalian milk to milk from plant, for instance soy milk. So milk is lactose-free milk, so it is safe to be consumed by lactose-intolerant individuals. Soy milk is already been consumed by Asian people for a long time. Up to now, many researches have conducted and found that there is a strong relationship between good health status and soy food consumption [7].

Replacement of cow milk to soy milk in chocolate bar could help people suffered from lactose-intolerance. However, it has to be considered the physical and organoleptic properties of the chocolate bar.

## 2. Material and Method

Cocoa fat was bought from PT. Mars Symbioscience Indonesia, cocoa powder and some other materials were purchased from local supermarket. Fine sugar was prepared by grinding until the fine reach 80 mesh.

(1) Soy milk powder preparation

- Purchased soy beans were cleaned from dirty material and were soaked in water for 8 hours.
- The beans was unpeeled and then the beans was washed with clean water.
- After that, the beans was boiled in water for one hour
- After removing from boiler, the beans was grinded with adding warm water. The comparison of water and

beans was 1 : 8.

- The soy milk was then dried by using nano spray drier. The dried temperature was 110 oC with a pressure of 30 – 60 mbar. The soy milk powder was collected in order to use in the chocolate bar production.

(2) Chocolate bar production

- Cocoa fat was melted at 50 oC and cocoa powder was added into the melted cocoa fat.
- All ingredients were mixed thoroughly included soy milk powder in different portion.
- The ingredients were then mixed together with liquid cocoa fat at room temperature by using mixer for 15 minutes. The mixture became pasta.
- The pasta was couching until very fine. After that, the pasta was tempered. The tempering process was conducted in some temperature setting. Firstly, the pasta was tempered at 30 $^{o}$C for 10 minutes, then the temperature was increased to 50 $^{o}$C for 20 minutes. After that, the temperature was decreased to 30 $^{o}$C for 10 minutes. Later on, it was risen up to 35 $^{o}$C for 10 minutes. Lastly, the temperature brought to 40 $^{o}$C.
- The chocolate was then molded and stored for analysis.

(3) Research treatment

There were three treatment was applied in this research

A1; 25% cocoa fat and 8% soy milk powder

A2; 20% cocoa fat and 13% soy milk powder

A3; 15% cocoa fat and 18% soy milk powder

## 3. Results

### *3.1 Physical Characteristics*

***Stability***

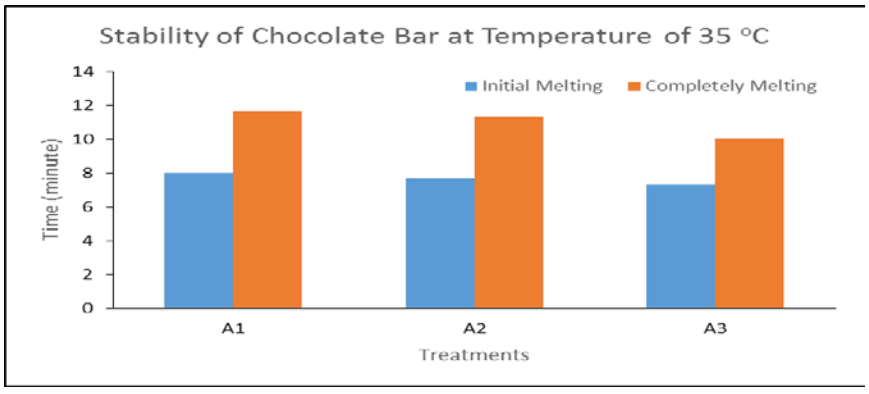


**Figure 1:** Stability of Chocolate Bar at Temperature of 35 $^{o}$C.

***Melting Point***

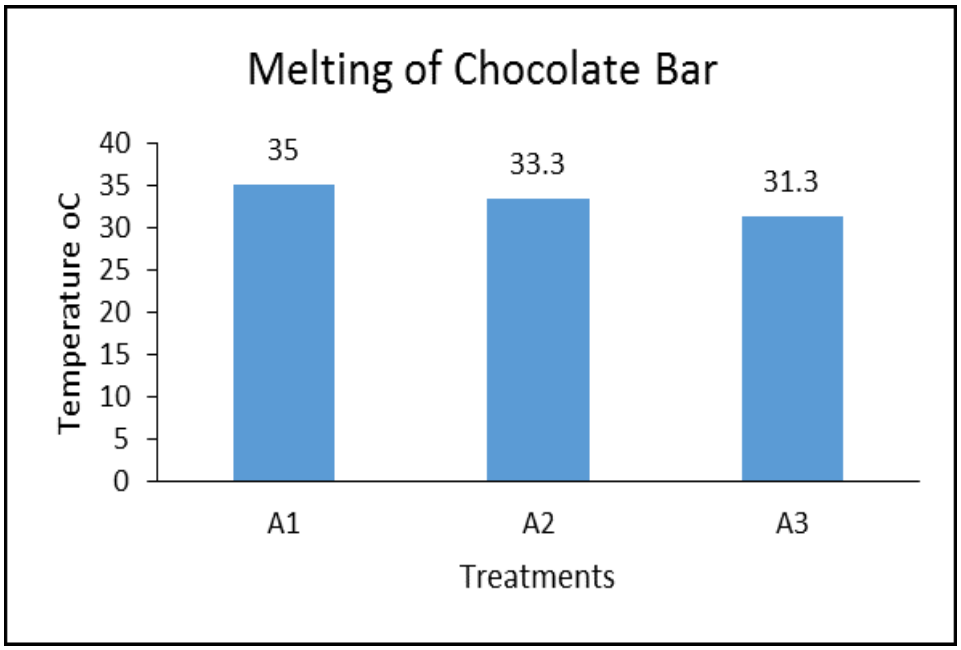


**Figure 2:** Melting Point of Chocolate Bar.

***3.2 Organoleptic Characteristics***

***Color***

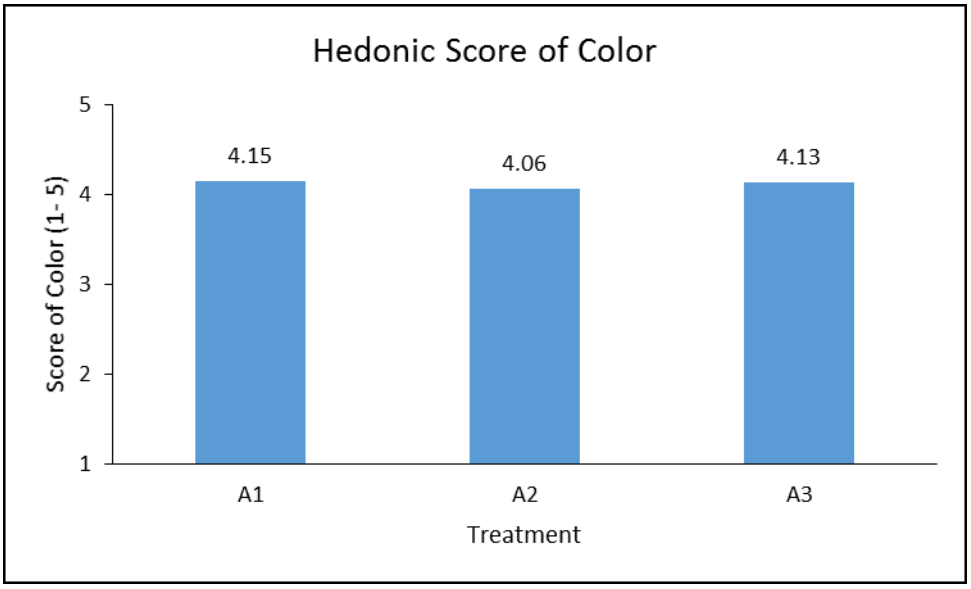


**Figure 3:** Color Score of Chocolate Bar.

***Aroma***

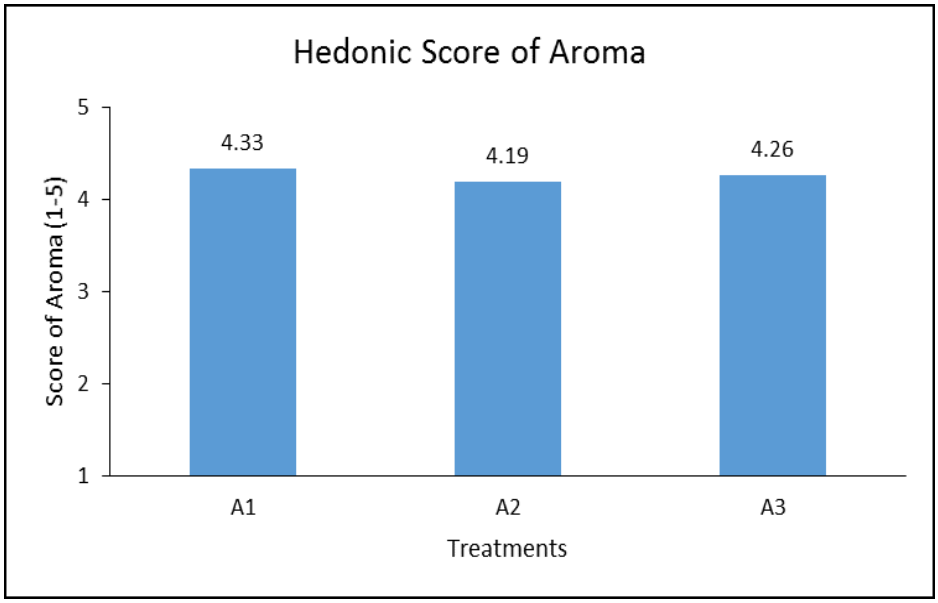


**Figure 4:** Aroma of Chocolate Bar.

***Taste***

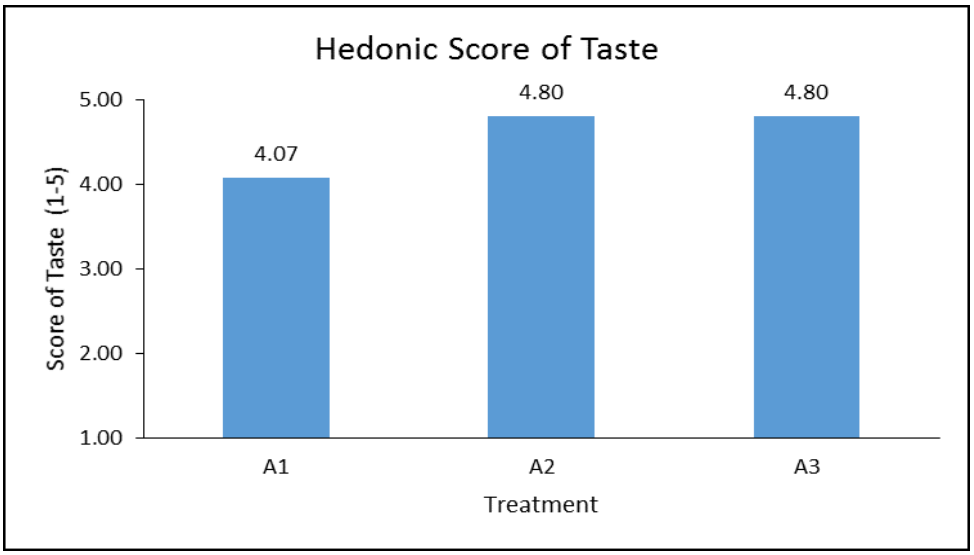


**Figure 5:** Taste of Chocolate Bar.

## 4. Discussion

### *4.1 Stability and melting point*

Stability is one of parameters which determines the quality of chocolate bar product. A good quality of

chocolate bar does not melt easily in a room temperature but it melts rapidly when chewed in a mouth. The room temperature setting in this research was $31^0$ C and the temperature in the mouth was simulated at $35^0$ C. It was observed the form of the chocolate bar until it became soft. Stability evaluation at temperature of $31^0$ C was conducted every day for two weeks. It resulted that the chocolate bars did not perform any changes in two weeks room temperature storage. On the other side, at temperature of $35^0$ C showed different results with treatments. The chocolate bar is more stable with increase of fat cocoa. The treatment of A3 (25% cocoa fat) started melting at 8 minutes and melted thoroughly after 12 minutes. At ambient temperature, chocolates are solid and it melt at oral temperature producing a smooth suspension of solid components in cocoa butter and milk fat [8].

### *4.2 Organoleptic Characteristics*

Organoleptic properties distinguish the acceptance of food product. Organoleptic characteristics of products are evaluated by means of sensory evaluation. Sensory evaluation is a scientific method to measure and interpret responses to product through the senses of sight, smell, touch, taste, and hearing[9]. One method that can be used in sensory evaluation is hedonic scaling. The scale was set to describe the acceptance level of consumer on food products. The chocolate bar in this research was organoleptically evaluated by using hedonic scale on color, aroma, and taste.

#### *Color*

Color plays an important role in product acceptance. In the chocolate bar, high percentage of fat from cocoa fat, milk, and lipid oxidation could also be involved in color of product [10]. The change of cow milk to soy powder milk did not affect the color of the chocolate. Hedonic evaluation showed that panelists gave an almost similar in color perception of the chocolate bar. The scale of all treatment was over 4 (Figure 3). It means the chocolate bar is still preferred by panelists.

#### *Aroma*

Attractive aroma of chocolate make it as a unique food[11]. Aroma in chocolate bar is usually produced from cocoa powder and cow milk. Cow milk generates a typical aroma for the chocolate. Substituting cow milk to soy milk powder could contribute to severe aroma of chocolate bar. Soy milk product generates aroma which is not so good for customer acceptance.

The results of this results exhibits that there was no significant difference of aroma up to 18% of soy milk powder. This results is valuable for lactose-intolerant people. Some products sometimes suits to people in terms of nutrition or anti-allergic compounds but it is organoleptically unacceptance. Figure 4 reveals that the resulted chocolate bar can be accepted by consumer through sensory test.

#### *Taste*

A good taste of chocolate bar is still determinant for quality and notify the selection of chocolate product. Figure

6 shows the results of taste-sensory evaluation on the produced chocolate bar. Interestingly, the panelists preferred the chocolate bar with more soy milk powder. The treatment of A3 with 13% and 18% soy milk powder more favored by panelists that treatment A1 with 8% soy milk powder. This indicates that there was no complaint of the panelists to the strange taste of soy-milk powder.

## 5. Conclusion

It can be concluded that the change of cow milk powder to soy milk powder did not affect the physical and organoleptic properties of chocolate bar. Moreover, the new formula of chocolate bar could help lactose-intolerant people.

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