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# POTENCY OF INDONESIA NATIVE SPICES AS UNPLEASANT SENSORY REMOVER IN HIGH PROTEIN AND FIBER OKARA-BASED SNACK BAR

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**ABSTRACT**

A snack bar of tofu dregs or okara flour and local Bambara groundnut was the protein and fiber-rich food product; however, it had unpleasant odors. This research aimed to utilize cinnamon, ginger, and pandan leaves to improve snack bar products' sensory profile based on okara and local Bambara groundnut. The method used was Rate-All-That Apply, which included determining sensory attributes through Focus Group Discussion and panelist sensory testing. There were six treatments: the ratio of cinnamon, ginger, and pandan leaf powder of 1% and 2%, respectively, to the formulation. The data analysis used was the Friedman and Nemenyi Test, Principal Component Analysis (PCA), and Preferences Mapping in XLSTAT 2019 software. The results showed that snack bars have 17 sensory attributes, where the attributes of cinnamon taste and aroma, ginger taste and aroma, pandan taste and aroma, and bitter aftertaste have significant differences. In addition, all panelists gave the highest preference for the snack bar by adding 1% pandan leaf powder, which could eliminate unpleasant odors in the snack bar. Its dominant sensory attributes were sweetness, salty taste, nutty flavor, pandan leaf taste and aroma, baked product aroma, and fudgy, crumbly, and starchy textures.

## 1.Introduction

Snack bars can be categorized as healthy snacks because they have balanced nutrition that can be adjusted according to needs. One of the ingredients that have the potential to be developed into a snack bar product is tofu dregs, soy pulp, or okara. Okara flour contains 45.38% and 21.94% of total dietary fiber and protein, respectively (Rachmayani et al., 2017). When making snack bars, ingredients such as nuts, which are high in nutrients, are often used. Bambara nuts are a type of legume that has the potential to be developed as a high-value local commodity because they are rich in nutrients, and their processing is still limited. Bambara groundnut contains an average of 63% carbohydrates, 19% protein, 6.5% fat, 5% crude fiber, calcium, potassium, iron, nitrogen, and vitamins E, C, and A (Temegne et al., 2018; Anhwange & Atoo, 2015).

The manufacture of okara snack bars have been carried out, including snack bars with tofu pulp and purple sweet potato flour (Rachmayani et al., 2017), tofu and pumpkin flour snack bars (Rohmawati et al., 2018), and snacks bar with the addition of Ambon sale bananas (Yudarsi et al., 2017). These snack bar made of okara flour has a good chemical content. However, it tends to have poor distinctive aroma of okara, which is unpleasant. Subsequent research by Purnama et al. (2019) regarding the okara and local Bambara nut snack bars was done by reformulating the ingredients using wheat flour to reduce the unpleasant aroma of okara flour. In addition, Ahaotu et al. (2021) added that snack bars from Bambara nut and maize had a protein

content of 6.32–15.00% and fiber content of 2.60-3.10%; however, sensory studies in this research also produced sensory values that tended to decrease when the proportion of Bambara nut increased. Based on the research of Purnama et al. (2019), the okara flour and local Bambara nut snack bar has pretty good chemical characteristics that meet the 2019 USDA snack bar standards, which contained 57.18% carbohydrates, 14.40% protein, 15.69% fat, 10.34% dietary fiber, and 427 Kcal/100 grams. However, based on the organoleptic test, the snack bar still had an unpleasant aroma and was not liked by the panelists. This problem can be corrected by adding special flavored spices consumers like, such as cinnamon, ginger, and fragrant pandan leaves.

Several studies regarding the potential of Indonesia native spices, such as cinnamon, ginger, and pandan leaves, as ingredients to increase sensory value in food products. Cardoso-Ugarte et al. (2016) reported that cinnamon usually was used as a flavoring and aroma enhancer in the food industry. Shobur et al. (2021) explained that increasing cinnamon extract in soy milk ice cream could cover the unpleasant aroma of soy milk. Pramitasari et al. (2011) also reported that adding ginger extract to instant powdered soy milk could reduce the unpleasant odor of soy milk. This report was supported by Karseno et al. (2021) and Safitri et al. (2019), who claimed that panelists like adding ginger extract into syrup coconut sap, and mayonnaise products, respectively. Roihanah & Ismawati (2014) also explained that adding pandan leaf extract could increase the preference value of Moringa leaf jelly drink, where it could reduce the unpleasant aroma and bitter taste. Laohakunjit & Kerdchoechuen (2007) also successfully enriched the aroma of non-aromatic rice using natural pandan extract. Utilize cinnamon, ginger, and pandan leaves to improve the sensory profile of an okara flour-based snack bar, which has yet to be previously studied.

In this study, sensory profile analysis was performed using the Rate-All-That-Apply (RATA) method. Ares et al. (2014) stated that the RATA method is a consumer-based sensory evaluation method that provides an intensity rating on sensory attributes that describe the product than CATA (Check-All-That-Apply). Adawiyah et al. (2020) used the RATA method to obtain the sensory profile of table-top sweeteners specifically. While Nurazizah et al. (2021) used the CATA for obtaining sensory profile of black pepper coffee. The research objective was to improve sensory profile of okara based snack bar using cinnamon, ginger, and pandan leaves.

## 2. Materials and methods

### 2.1. Sample preparation

Research on making snack bars consisted of three main stages, namely the manufacture of okara flour refers to Yustina & Farid (2012), the manufacture of chopped local Bambara groundnut, and the manufacture of snack bars based on Purnama et al. (2019).

The okara flour was started with a draining or pressing process by manually squeezing it using a filter cloth to separate the water content from speeding up the drying process—furthermore, the steaming okara for 15 minutes at 100 °C. They were then dried in the oven at 60-70 °C for 5 hours. The dried okara was ground using a blender and sifted through 100 mesh to make a uniform size. In addition, the local Bambara groundnut was sorted, washed using clean water, and boiled at 100 °C for 30 minutes. After that, the Bambara groundnut was drained, and the peel was separated. The local Bambara groundnut was then chopped.

Making snack bars starts with weighing the ingredients according to the treatment. The first mixing process was started by mixing the dry ingredients according to the formulation, which consisted of wheat flour, okara flour, chopped Bambara groundnut, cinnamon powder, ginger powder, and pandan leaves powder. The second mixing process was the manufacture of the binder. Caster sugar was added to the margarine and then stirred using a mixer. Then, eggs were mixed at high speed for 5 minutes. Then, the dry ingredients from the first mixing were added and stirred until evenly distributed, and the dough

was molded. Snack bar dough was printed with a size of 7 cm × 2 cm × 1 cm, put in a baking dish, and baked in an oven at 150 °C for 20 minutes. The snack bar formulation can be seen in Table 1.

**Table 1**. Snack bar formulation (flour base 100 g)*

| Ingridients (g) | Formulation | | | | | |
|---|---|---|---|---|---|---|
| | A | B | C | D | E | F |
| Wheat flour | 80 | 80 | 80 | 80 | 80 | 80 |
| Okara flour | 20 | 20 | 20 | 20 | 20 | 20 |
| Local Bambara groundnut | 20 | 20 | 20 | 20 | 20 | 20 |
| Cinnamon powder | 1 | 2 | - | - | - | - |
| Ginger powder | - | - | 1 | 2 | - | - |
| Pandan leaf powder | - | - | - | - | 1 | 2 |
| Caster sugar | 45 | 45 | 45 | 45 | 45 | 45 |
| Margarine | 30 | 30 | 30 | 30 | 30 | 30 |
| Egg | 30 | 30 | 30 | 30 | 30 | 30 |
| Salt | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |

*Purnama et al. (2019)
A: snack bar with addition of 1% cinnamon powder
B: snack bar with addition of 2% cinnamon powder added
C: snack bar with addition of 1% ginger powder
D: snack bar with addition of 2% ginger powder
E: snack bar with addition of 1% pandan leaf powder
F: snack bar with addition of 2% pandan leaf powder

## 2.2. Determination of sensory attributes

In this study, the determination of sensory attributes was carried out by Focus Group Discussion (FGD) (Dooley et al., 2010). FGDs were conducted to determine snack bar products' sensory attributes and the appropriate lay equivalent in describing sensory attributes to untrained panelists (consumers). The FGD was conducted with six participants who were trained panelists at snack companies and researchers who became moderators. The FGD was conducted online through the Google Meet application to adjust to the Covid-19 pandemic. The FGD activity began with panelists describing each sensory attribute: taste, aftertaste, aroma, and texture of snack bar products. All panelists discussed the overall sensory attributes of the product. After obtaining the results of the sensory attributes, the panelists then discussed the appropriate equivalents that could explain the sensory attributes to consumers as untrained panelists.

## 2.3. Data retrieval

The consumer panelist selection stage was conducted to get panelists according to the snack bar consumer target. The panelist categories were adolescent panelists with an age range of 13-19 years and adult panelists with an age range of 20-49 years. Locations for data collection were carried out around Bogor, with a total of 50 panelists. Panelists involved in the test must not have a history of allergy to nuts and have previously tried consuming snack bar products. Panelists were selected by filling out questionnaires, which were distributed directly. The questionnaire was designed to determine the background of the panelists to obtain the desired panelist criteria consisting of gender, age, and occupation.

Snack bar products were served in ziplock plastic coded with three-digit random numbers and presented in random order to avoid bias. Panelists tasted each product without comparing it with other products. The serving was equipped with a glass of mineral water to neutralize the mouth during product change. The first test carried out by the panelists was hedonic testing. Panelists tasted the product and carried out hedonic testing with a scale of six levels of preference, namely 1 (disliked very much), 2 (disliked), 3 (did not like it a little), 4 (somewhat liked), 5 (liked), and 6 (liked very much). The next test was the RATA test. Panelists tasted the product again and answered the RATA question, which contained the sensory attributes resulting from the FGD discussion. Panelists evaluated and determined the sensory attributes contained in the product by giving a tick on the intensity level. The intensity level of the sensory attribute used six levels, namely 1 (very weak), 2 (somewhat weak), 3 (moderate), 4 (somewhat strong), 5 (slightly strong), and 6 (very strong). If the attribute was not perceived, then the attribute was left blank and given a score of 0.

### 2.3. Data analysis

The data was analyzed using the XLSTAT 2019 program, which included several analyses: the Friedman Test, Principal Component Analysis (PCA), and Preference Mapping. The Friedman Test was carried out to identify differences between products on each sensory attribute; if the p-value was less than 5% or there were significantly different attributes in each treatment, it was continued with Nemenyi's post hoc test. PCA analysis was conducted to explain the relationship and correlation between one variable and another observed variable based on several dimensions. Preference Mapping analysis was conducted to understand the direction of the sensory attributes favored by consumers and to obtain product characteristics following consumer preferences in the form of a 2-dimensional contour plot.

## 3.Results and discussions

### 3.1. Sensory attributes of snack bar

The description of sensory attributes using an effective qualitative method can be done using the focus group discussion (FGD) method, a systematic and focused group discussion system (Bisjoe, 2018). This discussion focuses on describing the product's sensory attributes, and if there is a different language, then an agreement is made using the same language (Setyaningsih et al., 2010). The results of the discussion on the sensory attributes of snack bar products can be seen in Table 2.

**Table 2**. Sensory attributes of okara flour snack bar products

| Attribute type | Attribute sensory | Note |
|---|---|---|
| Taste | Sweet taste | - |
| | Salt taste | - |
| | Nutty taste | Peanut taste from local Bambara nut |
| | Cinnamon taste | typical Cinnamon taste |
| | Ginger taste | typical Ginger taste |
| | Pandan leaf taste | typical Pandan leaf taste |
| | Unpleasant taste | There is an impression of a distinctive taste of okara |
| Aftertaste | Bitter aftertaste | Bitter taste that lingers in the mouth after being swallowed |
| Aroma | Baked product aroma | Typical aroma of bakery products |
| | Unpleleaasant aroma | Typical unpleasant smell of okara |
| | Cinnamon aroma | Typical Cinnamon spice aroma |
| | Ginger aroma | Typical ginger aroma |
| | Pandan leaf aroma | Typical Pandan leaf aroma |
| Texture | Hard texture | Hard texture when chewed |
| | Fudgy texture | Wet and soft texture on the inside of the snack bar |
| | Starchy texture | Texture of full of floury taste in every bite |
| | Crumbly texture | Crumb texture in the mouth when chewed |

### 3.2. Panelist profile

The consumer panelists involved in this study were 50 people, with a ratio of 70% women and 30% men living in the Bogor area. Agriculture and Agri-Food Canada (2014) stated that women under 35 living in large households and those with children recorded the highest cereal or snack bars consumption. In addition, the distribution of the panelists' ages and professions can be seen in Figure 1.

Figure 1 shows the age distribution of panelists, consisting of 98% adults (20-49 years) and 2% adolescents (13-19 years), and the distribution of panelists' professions consists of 48% students or students, 38% employees, 8% self-employed and 6% housewife. The selection of panelists is targeted at snack bar consumers with busy activities, such as students and employee workers. This selection follows Agriculture and Agri-Food Canada (2014),

which reported that the age range of 16-24 years and 35-44 years was the age range that consumes the most snack bars in the UK. People with busy activities more often consume snack bars classified as healthy snacks. These healthy snack products were more nutritious and practical, so they were suitable for consumption on the sidelines of busy daily activities (Taulabi et al., 2021).

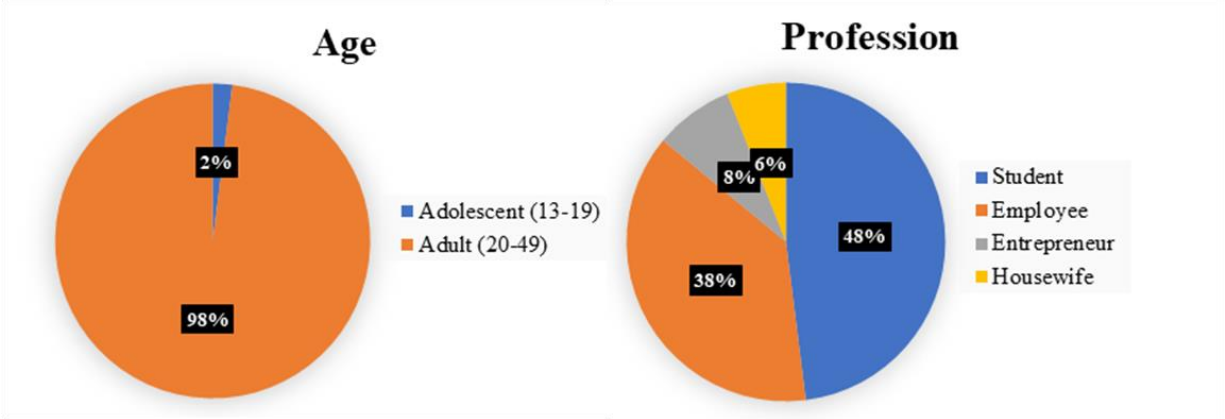



**Figure 1**. Distribution of panelists' ages and professions

### 3.3. Sensory profile of snack bar

Sensory profiles and attribute correlations on snack bar products evaluated by panelists were presented with a Principal Component Analysis (PCA) biplot graph and analyzed using the Friedman test at a significant level of 5%. The PCA biplot graph groups the tested products based on their sensory attributes, and the Friedman test shows that the comparison of each attribute for each product is significantly different. Friedman test results can be seen in Table 3.

**Table 3**. Friedman test of snack bar sensory attribute

| **Sensory attribute** | ***p-value*** |
|---|---|
| Sweet taste | 0.316 |
| Salt taste | 0.405 |
| Nutty taste | 0.619 |
| **Cinnamon taste** | **< 0.0001** |
| **Ginger taste** | **<0.0001** |
| **Pandan leaf taste** | **< 0.0001** |
| Unpleasant taste | 0.851 |
| Bitter aftertaste | **0.045** |
| Baked product aroma | 0.260 |
| Unpleasant aroma | 0.634 |
| **Cinnamon aroma** | **< 0.0001** |
| **Ginger aroma** | **< 0.0001** |
| **Pandan leaf aroma** | **< 0.0001** |
| Hard texture | 0.155 |
| Fudgy texture | 0.465 |
| Starchy texture | 0.771 |
| Crumbly texture | 0.287 |

Note: Numbers in bold print indicate a significant difference between snack bar products on each attribute at a significant level of 5%

Table 3 shows that the attributes of cinnamon taste, ginger taste, pandan taste, bitter aftertaste, cinnamon aroma, ginger aroma, and pandan aroma have significant differences. The comparative treatment of adding cinnamon, ginger, and pandan leaves causes the taste and aroma to be significantly different in snack bar products. The difference in the intensity of adding these spices can affect the bitter aftertaste attributes so that the bitter aftertaste attributes are significantly different for each product.

Meanwhile, the sensory attributes of sweet taste, salty taste, nutty taste, unpleasant taste, the aroma of baked products, unpleasant aroma, hard texture, fudgy texture, starchy texture, and crumbly texture are not significantly different for each product. The attributes are then further tested by Nemenyi post hoc. The results of Nemenyi post hoc test analysis can be seen in Table 4.

**Table 4**. The intensity value of the sensory attributes of snack bar

| Attribute | Product sample | | | | | |
|---|---|---|---|---|---|---|
| | A | B | C | D | E | F |
| Sweet taste | 2.78[a] | 2.82[a] | 2.72[a] | 2.66[a] | 2.90[a] | 2.74[a] |
| Salt taste | 2.40[a] | 2.32[a] | 2.42[a] | 2.20[a] | 2.36[a] | 2.34[a] |
| Nutty taste | 3.00[a] | 2.94[a] | 3.00[a] | 3.14[a] | 3.14[a] | 3.24[a] |
| **Cinnamon taste** | **3.16[b]** | **3.78[b]** | **0.92[a]** | **1.06[a]** | **0.60[a]** | **0.74[a]** |
| **Ginger taste** | **0.94[a]** | **0.82[a]** | **3.14[b]** | **3.74[b]** | **0.50[a]** | **0.72[a]** |
| **Pandan leaf taste** | **0.60[a]** | **0.60[a]** | **0.60[a]** | **0.56[a]** | **2.88[b]** | **3.76[b]** |
| Unpleasant taste | 1.66[a] | 1.66[a] | 1.66[a] | 1.64[a] | 1.50[a] | 1.66[a] |
| **Bitter aftertaste** | **1.12[a]** | **1.18[b]** | **0.90[a]** | **1.16[b]** | **0.88[a]** | **1.00[a]** |
| Baked product aroma | 2.76[a] | 2.68[a] | 2.74[a] | 2.62[a] | 2.86[a] | 2.78[a] |
| Unpleasant aroma | 1.54[a] | 1.58[a] | 1.72[a] | 1.64[a] | 1.54[a] | 1.48[a] |
| **Cinnamon aroma** | **3.10[b]** | **3.38[b]** | **0.92[a]** | **1.08[a]** | **0.76[a]** | **0.80[a]** |
| **Ginger aroma** | **0.82[a]** | **0.84[a]** | **2.82[b]** | **3.34[b]** | **0.62[a]** | **0.64[a]** |
| **Pandan leaf aroma** | **0.56[a]** | **0.60[a]** | **0.68[a]** | **0.56[a]** | **2.84[b]** | **3.62[b]** |
| Hard texture | 2.52[a] | 2.64[a] | 2.40[a] | 2.38[a] | 2.62[a] | 2.42[a] |
| Fudgy texture | 2.30[a] | 2.40[a] | 2.48[a] | 2.28[a] | 2.36[a] | 2.46[a] |
| Starchy texture | 2.86[a] | 2.82[a] | 2.84[a] | 2.76[a] | 2.86[a] | 2.84[a] |
| Crumbly texture | 2.62[a] | 2.68[a] | 2.54[a] | 2.60[a] | 2.86[a] | 2.64[a] |

Note: different superscript letters in the same line show a significant difference at the 5% level
A: snack bar with addition of 1% cinnamon powder
B: snack bar with addition of 2% cinnamon powder
C: snack bar with addition of 1% ginger powder
D: snack bar with addition of 2% ginger powder
E: snack bar with addition of 1% pandan leaf powder
F: snack bar with addition of 2% pandan leaf powder

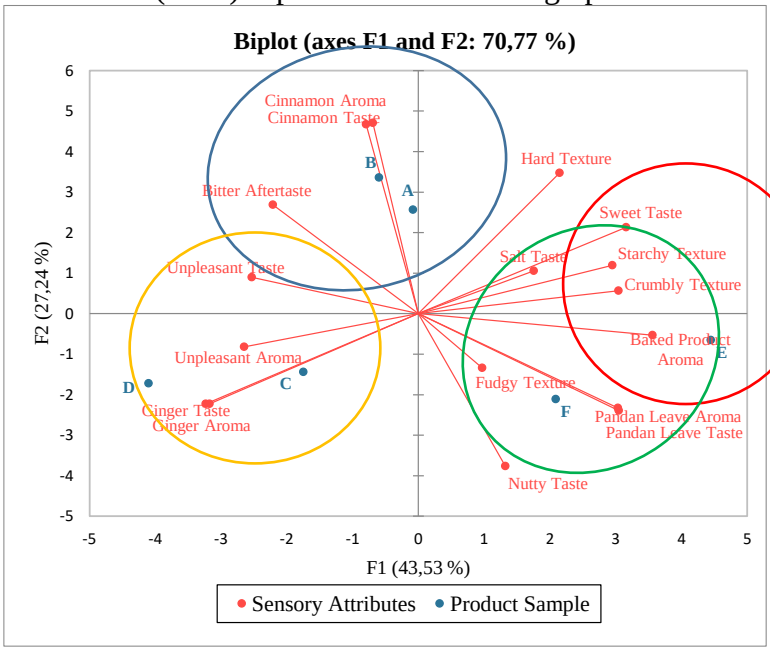
Table 4 shows a tendency for snack bar products added with spices with a higher concentration (2% concentration) to have a higher intensity of bitter aftertaste. Drewnowski & Gomez-Carneros (2000) explained that phenolic compounds are responsible for the bitterness and astringency of many foods and beverages. Muchuweti et al. (2007) and Aravind et al. (2012) reported that cinnamon has a relatively high phenolic component. Prasad & Tyagi (2015) reported that ginger has large amounts of phenolic compounds such as gingerols, shogaols, paradols, and flavonoids. Quyen et al. (2020) also reported that pandan leaves contain many phenolic compounds, such as alkaloids, flavonoids, and terpenoids. However, according to Yan & Asmah (2010), the content of phenolic compounds in pandan leaves is lower than in ginger.

Table 4 also shows that the sensory attributes of taste and aroma of snack bars are significantly different. However, it was also seen that the concentrations of 1% and 2% did not differ significantly based on the panelists' assessment of the aroma and taste parameters of both spices on the snack bar, with cinnamon, ginger, and pandan leaves added. The distinctive aroma and taste of cinnamon come from the components of essential oils and oleoresin, which can give cinnamon a distinctive aroma and taste. The cinnamaldehyde compound gives a slightly spicy-sweet taste and aroma, typical of cinnamon (Prasetyaningrum et al., 2012). The aroma of ginger rhizome comes from the content of essential oils, while the spicy taste of ginger

is caused by gingerol compounds (Setyaningrum & Saparinto, 2013). Meanwhile, the distinctive aroma of pandan leaves is caused by the volatile oil content derived from the chemical compound 2-Acetyl-1-Pyrroline (ACPY) (Murtini et al., 2020).

The PCA biplot can describe the interaction on each sensory attribute more clearly, which shows the close relationship between each sensory attribute assessed. The PCA biplot of the cinnamon, ginger, and pandan leaf spice snack bars can be seen in Figure 2.

Figure 2 shows the total diversity of 70.77%. McPherson (2011) explained that the PCA graph with a diversity of 70% was considered good enough and valid to explain the data variables well. In addition, there are four groups (quadrants) for attributes, namely 1) Quadrant I: attributes of hard texture, sweet taste, salty taste, starchy texture, and crumbly texture; 2) Quadrant II: attributes of cinnamon taste, unpleasant taste, bitter aftertaste, and cinnamon aroma; 3) Quadrant III: attributes of ginger taste, ginger aroma and unpleasant aroma; and 4) Quadrant IV: attributes of pandan leaf taste, peanut flavor, baked product aroma, pandan leaf aroma, and fudgy texture.




A: snack bar with addition of 1% cinnamon powder
B: snack bar with addition of 2% cinnamon powder
C: snack bar with addition of 1% ginger powder
D: snack bar with addition of 2% ginger powder
E: snack bar with addition of 1% pandan leaf powder
F: snack bar with addition of 2% pandan leaf powder

**Figure 2**. PCA biplot graph of sensory attributes and snack bar sample

Gower et al. (2011) explained that a slight angle (less than 90°) indicates the variables were positively correlated. So, suppose attributes are positively correlated with other attributes when these attributes experience an increase in intensity. In that case, it can be perceived that one of the other attributes will experience an increase in intensity. On the other hand, points not in a different quadrant or far from each other and do not form an angle of less than 90º from the center point indicate that the attribute has a negative correlation or does not have a correlation. Variable points that form small vector angles show a positive correlation, and product points in a close position or the same quadrant have the same characteristics (Apandi et al., 2016).

Cinnamon, ginger, and pandan leaf taste attributes increase when cinnamon, ginger, and pandan leaf aroma attributes increase, respectively. The bitter aftertaste and the unpleasant taste attributes positively correlate with the cinnamon and ginger taste and aroma attributes. It can be perceived that the bitter aftertaste and the unpleasant taste attributes will increase if the intensity of the cinnamon and the ginger taste and aroma attributes increase. This is related to cinnamon and ginger, which have

cinnamaldehyde and shogaol compounds that could cause off-flavors such as a bitter aftertaste (Dwijatmoko et al., 2016; Widiantoko & Yunianta, 2014).

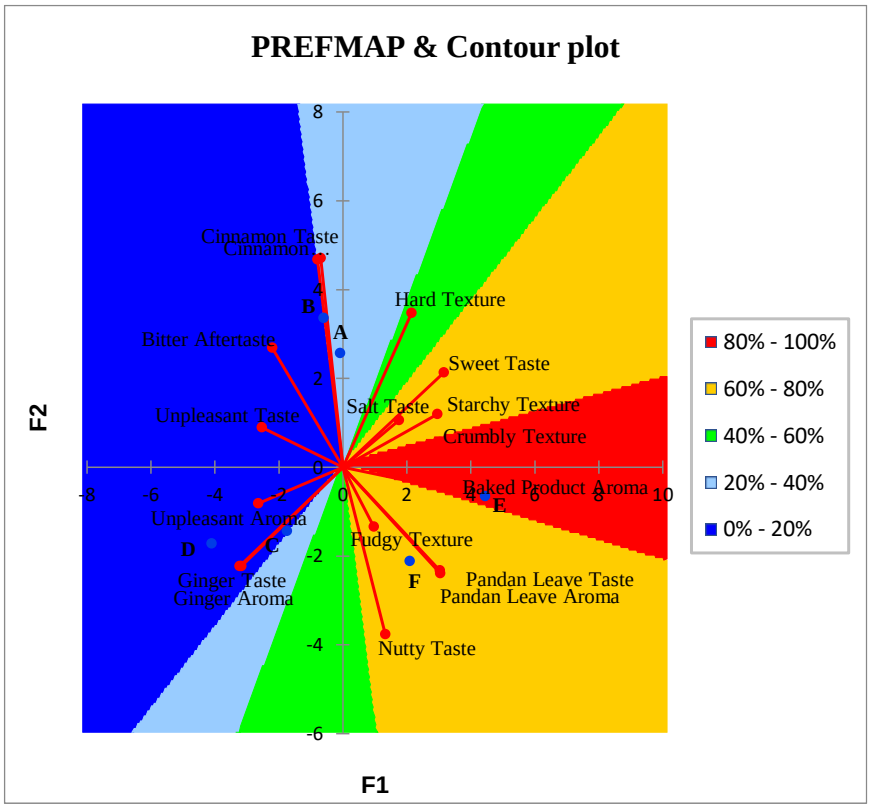
There is a positive correlation between the unpleasant taste attributes and the taste and aroma attributes of cinnamon and ginger. Adding cinnamon powder and ginger powder from okara flour to the snack bar still does not entirely cover the unpleasant taste of okara. The unpleasant aroma attribute is also related to ginger taste and aroma attributes, which are positively correlated. This relation implies that adding ginger powder to the okara snack bar has not been effective in reducing the unpleasant aroma of okara. However, the unpleasant aroma attribute with the cinnamon taste and aroma attributes are negatively correlated, so it can be perceived that adding cinnamon powder to the okara snack bar effectively reduces the unpleasant aroma of okara flour. This correlation also applies to the taste and aroma of pandan leaves, where Figure 2 shows that pandan leaf taste and aroma have negatively correlated to the unpleasant taste and aroma.

In addition, Figure 2 shows that sweetness positively correlates with the aroma and taste of pandan leaves and cinnamon aroma and taste. They can support the sweet taste of the snack bar. USDA (2019) reported that cinnamon had a sugar content of 2.17 g/100 g ingredients, so adding this spice can increase the sweetness level of snack bar products. In addition, Cheetangdee & Chaiseri (2006) reported that fresh pandan leaves contained 2.38 mg/g fructose and 1.77 mg/g glucose. While the attributes of ginger aroma and taste have a negative correlation with the sweet taste attribute, it can be perceived that the higher the intensity of the ginger taste and aroma attributes, the lower the intensity of the sweet taste attribute. The spicy taste created by the phenolic compounds in ginger will reduce the sweet taste. This reduction is also confirmed by Karseno et al. (2021), who stated that adding ginger extract could reduce the product's sweetness.

In addition to the relationship between one attribute and another, Figure 2 shows that the snack bar adding 1% and 2% cinnamon has dominant sensory attributes of cinnamon aroma and taste, bitter aftertaste, and unpleasant taste. At the same time, the sensory attributes of ginger aroma and taste, as well as unpleasant aroma and taste, are the dominant attributes of the snack bar, with the addition of 1% and 2% ginger. Figure 2 also shows that snack bars with 1% pandan leaf powder have sensory attributes of pandan leaf aroma and taste, baked product aroma, starchy texture, crumbly texture, sweet taste, and salty taste. The snack bar with 2% pandan leaf powder added has pandan leaf aroma and taste, fudgy texture, baked product aroma, nutty flavor, crumbly texture, and salty taste.

The panelist's preference map is obtained from the preference mapping analysis. The preference mapping analysis results are described in the form of a contour plot. The contour plot positions the product based on the panelist's preference value above the average. The contour plot is divided into five color areas, each giving a different interpretation of the above-average preference value. The results of the preference mapping analysis are shown in Figure 3.

Based on Figure 3, the panelist's preference map can be seen as the attributes that affect the panelist's preference for the product. The attribute highly favored by panelists with a preference value percentage above the average of 80-100% was in the red area, namely the aroma attribute of the baked product. Preferred attributes with a preference value percentage above an average of 60-80% are in the yellow area, namely the attributes of sweet taste, salty taste, nutty taste, pandan taste, pandan aroma, starchy texture, crumbly texture, and fudgy texture.




A: snack bar with addition of 1% cinnamon powder
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C: snack bar with addition of 1% ginger powder
D: snack bar with addition of 2% ginger powder
E: snack bar with addition of 1% pandan leaf powder
F: snack bar with addition of 2% pandan leaf powder

**Figure 3**. Panelists' preferences map of snack bars

Attributes with a preference value percentage above the average of 40-60% are in the green area, namely the hard texture attribute. Attributes not favored by panelists with a percentage of preference values above an average of 0-20% are in the dark blue area, namely the attributes of cinnamon taste, ginger taste, unpleasant taste, cinnamon aroma, ginger aroma, unpleasant aroma, and bitter aftertaste.

In addition, Figure 3 shows that snack bar products with the addition of 1% and 2% pandan leaf powder are located in red and yellow areas, respectively. This result shows that adding pandan leaf powder can increase consumer acceptance of snack bars based on okara flour and local Bambara nuts. These data are also supported by PCA analysis data that snack bars of 1% and 2% pandan leaf powder can remove the unpleasant taste and aroma, which, in the research of Purnama et al. (2019), became a problem for snack bar products from okara flour. In addition, this snack bar, with pandan leaf powder, tends not to leave a bitter aftertaste when consumed. The snack bar, with the addition of 1% cinnamon powder, is in the light blue area, which means that 40% of the panelists gave a preference value above the average. The snack bar, with the addition of 2% cinnamon powder, 1% ginger powder, and 2% ginger powder, is in the dark blue area, which means that as many as 20% of the panelists gave a preference value above the average. Based on the percentage of panelists' acceptance that gives a preference value above the average, it can be perceived that the higher the intensity of adding spices, the lower the preference level of the panelists. Also, the panelists' acceptance value of snack bar products, with the addition of 1%

pandan leaf powder, is the highest percentage. It has been selected based on the panelists' preference values. This snack bar has a sensory profile of sweet taste, salty taste, pandan leaf, peanut flavor, baked aroma product, pandan leaf aroma, fudgy texture, crumbly texture, and starchy texture.

## 4. Conclusions

Based on the results of research that has been carried out, it was known that from the Friedman test at the 5% test level, the effect of adding cinnamon, ginger, and pandan leaves powder was significantly different on the sensory characteristics of cinnamon taste and aroma, ginger taste and aroma, pandan leaf taste and aroma, and bitter aftertaste. However, the addition was not significantly different in the attributes of sweet taste, salt taste, nutty taste, unpleasant taste, aroma of baked products, unpleasant aroma, hard texture, fudgy texture, starchy texture, and crumbly texture. PCA analysis and preference mapping showed that adding pandan leaf powder to the okara flour snack bar was better than adding cinnamon and ginger. As many as 80-100% of panelists gave a preference value above the average on the snack bar, adding 1% pandan leaf powder, which has dominant sensory attributes of sweet taste, salty taste, peanut taste, pandan leaf taste, pandan leaf aroma, baked product aroma, fudgy texture, crumbly texture, and starchy texture. Attributes that affected panelists' preferences were the aroma of baked products, sweetness, salty taste, peanut flavor, pandan taste, pandan aroma, starchy texture, crumbly texture, and fudgy texture.

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