ISSN: 2338-1345 – Vol. 8 1&2 (2020) 15-22 Journal online https://ojs.bakrie.ac.id/index.php/APJSAFE

Asia Pacific Journal of Sustainable Agriculture Food and Energy (APJSAFE)

Preference Mapping of Rice Bran Tempe Cookies

Laras Cempaka*, Tiara Indra Saraswati, Nurul Asiah and Wahyudi David

Department of Food Science and Technology, Universitas Bakrie, Jakarta, Indonesia
**Corresponding author's E-mail address: laras.cempaka@bakrie.ac.id*

Abstract— Tempe is a traditional indigenous fermentation food from Indonesia. The addition of rice bran as raw material for soybean mixture aims to improve the functional properties of tempe. The sensory description and sensory mapping of four formulations rice bran tempe were measured. Seventy-five consumers were recruited to participate in the projective mapping of rice bran tempe cookies at the sensory laboratory of Universitas Bakrie, one of the private universities in Indonesia. The test consists of a descriptive evaluation of products with sensory attributes: taste, colour, flavour, texture and aftertaste. Data was used to develop a preference map for rice bran tempe cookies. The cookies formulation consist of rice bran tempe without any addition (RBT1), rice bran tempe with cocoa powder (RBT2), rice bran with dates extract (RBT3), and rice bran tempe with cocoa powder and dates extract (RBT4). Results from preference mapping showed that the position for each rice bran tempe cookies formulation show differently with commercial products. The map shows RBT1 and RBT2 cookies have higher consumer preferences (elevation 40) than RBT3 cookies (elevation 30) or RBT4 cookies (elevation 20). Average overall acceptance scores for the four samples ranged from 4.37 to 4.81 on a 1-9 scale. The consumers have not accepted the addition of rice bran tempe to the cookies due to the sensory attributes of the bitter taste, dark colour, an aroma like animal feed, hard texture and bitter aftertaste. The presence of cocoa powder and dates extract has not been able to increase consumer preference of the tempe rice bran cookies.

***Keywords*—cookies, preference mapping, projective mapping, rice bran, tempe**

INTRODUCTION

Tempe as one of the traditional fermented foods from Indonesia, is a highly nutritious food. This nutrition content is enormously depending on microbial activity and prolonged-time during fermentation (Starzynska-Janiszewaska et al., 2016; Nout and Kiers, 2005). During fermentation digestibility of protein and starch are increased, functional properties and vitamins are formed (Nkhata et al., 2018). Tempe can be produced by fermenting soybean and rice bran with *Rhizopus sp.* to improve nutritional quality (Cempaka et al., 2018; Nuraida, 2015). Rice bran as rich sources of functional ingredient such as vitamins, minerals, dietary fiber and essential fatty acids is potential to be applied in the food industry (Gul et al., 2015; Sharif et al., 2014). Due to it health benefit component, tempe become popular and followed with increasing international interest (Nout & Kiers, 2005). Tempe can be consumed in various practices both in traditional or modern recipes (Astuti et al., 2000). Culinary application of tempe has expanded for new product development. Tempe was successfully used as a flavour ingredient that provides good sensory attributes (Nout & Kiers, 2005)

Various food products can be made from a different ingredient for enrichment quality and nutrition. Cookies is one of the popular and widely consumed all over the world by people of all ages (Okpala et al., 2012). Study of cookies formulation to produce accepted functional, physicochemical and sensory properties was done and has result in the positive change (Reshu et al., 2017). Sensory interaction between each formula plays an important role which influence of consumers perception and acceptance (Yang & Lee, 2019). The success of product development can be seen from the level of consumer preference of the product. The information of preferences of the consumers and sensory food attributes can be obtained by using consumer preference mapping. In the preference mapping technique, the sensory acceptability of new product compared with commercial product (Rodrigues et al., 2015; Gere and Huszar, 2014).

Food product development and consumption of functional food products are increasing. However, the application of functional food to commercial food is still rarely applied due to the constraints of sensory attributes that consumers have not accepted. The information of preference and reason of the consumer's choice is needed to assess food product quality. This study aims to determine consumer

preferences for cookie products formulated using tempeh flour and rice bran compared to commercial cookies.

MATERIALS AND METHODS

Source of Raw Material

The research materials used consist of soybean obtained from Traditional Market Mangun Jaya Tambun Selatan, Raprima yeast produced by PT. Aneka Fermentasi Indonesia (AFI), Bandung, Rice bran used has a brand dr. Liem Rice Bran from Bandung, chitosan from shrimp obtained from Faculty of Fisheries and Marine Sciences, Bogor Agricultural University (IPB), GDL, Cocoa Pure Cocoa Premium Product Powder, and Dates extract. Other ingredients in the manufacture of the cookies are wheat flour, margarine, rice bran tempe flour, refined sugar and egg yolks.

Rice Bran Tempe Fermentation using Raprima culture (Rhizopus oligosporus)

As much as 700 grams of soybeans washed and soaked for approximately 24 hours in the water. After that, soybeans were washed and peeled. Then, soybean boiled for 30 minutes at a temperature of 100ºC. Soybean then drained and aerated. After that, the soybean was added with 2% chitosan solution (4 gram), GDL 0.4% (4 gram), and yeast tempe 0.1 gram. GDL is used to speed up fermentation time.

According to the FDA (2016), GDL was a food supplement that is Generally Recognized as Safe (GRAS). The technology for making tempe with GDL acidification was developed by Wijaya et al. (2015). The resulting tempe product is known as "Quick Tempe" or also known as "Fast Tempe". As much as 30% of rice bran was added to the formulation. There was no addition in the Tempe Bran Rice 1 (RBT1), while for RBT2, RBT3, RBT4 added cocoa powder, date extract, and a combination of cocoa powder and date extract, respectively. The formula used is shown in **Table 1**. Furthermore, all formulations of rice bran tempe are packed in plastic and given holes. Incubation was carried out for 24 hours at room temperature.

Table 1. Formulation of rice bran tempe.

Ingredients	RBT1 (%)	RBT2 (%)	RBT3 (%)	RBT4 (%)
Soybean	68.32	67.06	67.62	66.36
Rice Bran	29.28	28.74	28.98	28.44
Chitosan	2.0	2.0	2.0	2.0
Glucono Delta Lactone	0.4	0.4	0.4	0.4
Cacao Powder	0.0	1.8	0.0	1.8
Dates extract	0.0	0.0	1.0	1.0

Production of rice bran tempe flour

Production of rice bran tempe flour begins with slicing of rice bran tempe with a thickness of ± 0.5-1 cm. The next stage, rice bran tempe dried with oven for 1 hour at 130ºC. Furthermore, rice bran tempe was crushed using a blender machine until become powder.

Preparation of cookies

The ingredients used are as follows: 70 grams of wheat flour, 30 grams of tempe rice bran flour, 40 grams of refined sugar, 30 grams of margarine, 1 egg yolks, and baking soda. The dry matter is stirred until homogeneous. Then the solid ingredients are mixed with wet ingredients such as margarine and egg yolks. After all mixed, then stirred to form the dough. The dough was then rolled and baked in the oven at 160ºC. The cookies were cooled at 27ºC for 30 minutes.

Fig. 3 Rice Bran Tempe Cookies

Physicochemical analysis

Measurement of moisture content, solubility and crude fiber by using a gravimetric method (Vera et al., 2019; AOAC, 1995).

Sensory evaluation

Seventy-five consumers participated in the projective mapping of rice bran tempe cookies at the sensory laboratory of Universitas Bakrie. Consumers were recruited from among the students of the Universitas Bakrie. The panellists of the preference mapping test are 42 females and 32 males with ages of 18-21 years old. The test consisted of a descriptive evaluation of products and one commercial product as a comparison product without additional information given. The sensory analysis was performed in individual booths, under daylight and room temperature of 25ºC. The cookies were presented on plastic plates coded with trivial numbers. Projective Mapping is a simple and fast technique by connecting consumer ratings and the characteristics of a product (Gere & Huszar, 2014).

The sensory attributes testing step begins with the consumer sampling all the samples and arranging them on paper in such a way that similar samples are near each other and different samples are placed far apart. Once completed, the consumer is required to mark the location of each sample with the appropriate sample code. Preference was

determined concerning overall liking using a nine scale. The subjects were instructed to rinse their mouths with distilled water between samples.

Statistical Analysis

External preference mapping was conducted by first using principal component analysis (PCA) on the descriptive sensory analysis data and then relating each of the consumers to this PCA space by regression analysis. Consumers are usually represented as points or arrows on the sample map as in the internal analysis (Kaaki et al., 2020). The vector model, which implies a direct relationship between one or more characteristics that are increasing or decreasing across the stimulus space, was used. Thus, the more a characteristic was present, the more it was liked; alternatively, if it was a negative characteristic, the less the characteristic was present, the less it was liked (Bølling et al., 2010). The PREFMAP was carried out using software R 3.4.1, which aims to show specific visual and hedonic assessment. The resulting data is tested measurement of water content, solubility and crude fiber with Analysis of Variance (ANOVA) using software SPSS 16.0 which aims to determine the real difference between treatments. If the results of the analysis indicate a real effect then proceed with the test duncan which aims to know which treatment has a significant different effect on the parameters analyzed.

RESULTS AND DISCUSSIONS

Descriptive and correlation analysis

The physiological activity of the fungus in the fermentation process of tempe starts from the inoculation of the soybean that is ready for fermentation. **Fig.1** shows that the rice bran tempe surface is covered by a white mycelia that is a hyphae of *Rhizopus oligosporus*. In physical sight, RBT1 and RBT2 have a wider size compared to RBT3 and RBT4.

The spores of the fungus begin to grow by forming hyphal threads that grow longer and more elongated, bind and penetrate the soybean cotyledon seeds. The threads are getting denser, forming a compact and distinctive aroma of rice bran tempe. Even though the tempe rice bran formed is compact, at the time of cutting, the structure is easily destroyed. This can be due to the presence of rice bran and cocoa powder which hinders the penetration of hyphae threads to wrap and penetrate the soybean cotyledon seeds freely.

Fig. 1 RBT1 (rice bran tempe), RBT2 (rice bran tempe with cocoa), RBT3 (rice bran tempe with dates extract), RBT4 (rice bran tempe with cocoa and dates extract)

The penetration process of *Rhizopus oligosporus* in soybeans, namely hyphae softens soybeans mechanically by pushing soy cells and entering together with the occurrence of enzymatic degradation. Then, the penetration will deepen, and the enzymatic activity will continue and increase (Jurus & Sundberg, 1976).

Fig. 2 Rice bran tempe slices

There is no significant different for all variables except the moisture content of RBT flour (**Table 2**). Nevertheless, the hedonic level for overall liking does not show any significant difference, overall indicating a relatively low hedonic level that is disliked slightly. The addition of dates extract can reduce the moisture content. This can be seen from the water content in RBT3 and RBT4, which is lower and significantly different from RBT 1 or RBT2. In addition to the flour, moisture content on cookies with the addition of dates extract also provides a lower value than other formulations but did not significantly different.

Table 2. Mean for each rice bran tempe flour and cookies formulation of instrumental quality variables and overall liking score.

Rice Bran Tempe Sample	RBT1	RBT2	RBT3	RBT4
Moisture flour	10.18±0.05[b]	10.33±0.02[b]	8.29±0.61[a]	7.89±0.93[a]
The solubility flour test	22.41±5.16[a]	20.10±0.85[a]	22.57±0.76[a]	17.78±1.42[a]
Moisture cookies	3.79±0.49[a]	4.39±1.42[a]	2.80±2.43[a]	3.86±0.43[a]
Crude Fiber cookies test	1.31 ± 0.05[a]	1.33 ± 0.36[a]	1.27 ± 0.04[a]	1.44 ± 0.22[a]

Overall Liking	4.37[a]	4.43[a]	4.54[a]	4.81[a]

After the fermentation process is complete, the texture of the rice bran is drier than before. The cementation of the rice bran in a certain time causes a decrease in the moisture content associated with the loss of dry matter in the bran. In the flour formulation, RBT3 and RBT4 have lower moisture content compared to RBT1 and RBT2. A decrease in high water content is associated with a high sugar component. According to Giyatmo (2013), dates extract has sugar substances (a mixture of glucose, sucrose, and fructose). According to Kartika (2015), sugar has hygroscopic properties, which is the ability to bind water. The more sugar concentration is used, the more water is bound and causes the moisture content of the product to decrease. Based on the solubility of tempe rice bran flour (**Table 2**), it has water solubility ranging from 17.78-22.57%, indicating a high dispersibility value. The solubility of tempe flour produced an average of only 0.5%. High dispersibility values indicate that flour is more soluble in water. Due to the less water-insoluble particles will be dispersed (Jonathan, 2007). Tempe rice bran flour has high water solubility, so it can also be applied to beverage products.

However, the addition of rice bran, chitosan, GDL, and cocoa powder or dates extract in each formulation did not significantly influence the solubility of tempe, water content and the crude fiber content of cookies ($p > 0.05$). Preference mapping approaches could be applied to understand consumer preference patterns, together with sensory data, to look for underlying dimensions that drive consumer preferences (Carrillo et al., 2014).

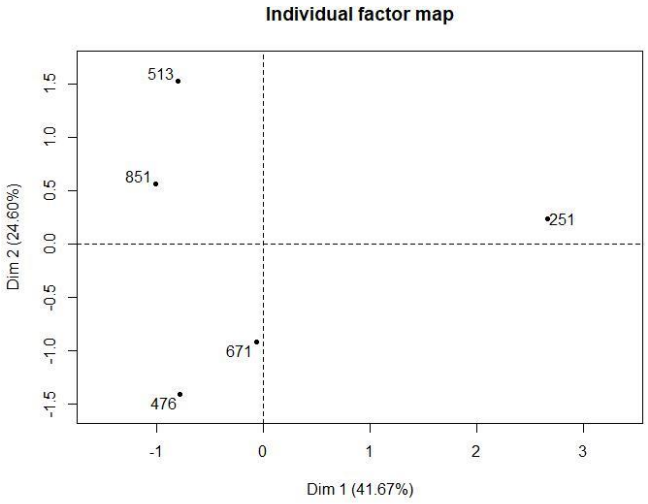
Table 3. List of sensory attributes of rice bran tempe cookies based on consumer perception.

Sub-Attributes	Description
Sweet taste	Sweet taste, delicious, sweet sugar/ honey
Sour taste	Sour taste comes from tempe
Bitter taste	Bitter taste, not tasty comes from rice bran
Nut/nutty taste	Nuts taste
Bland taste	No flavour, tasteless
Bitter taste	Bitter taste caused by tissue damage to the food due to long exposure to heat
Butter taste	Butter taste, salt taste
Creamy taste	Like cream, bit oily
Astringent taste	The taste of rough
Caramel taste	Sugar taste formed from caramelization process
Yellow color	Bright colors that attract attention
Gold color	Bright and shimmering colors
Chocolate color	Dark yellow
Pale color	Yellow pale
Nutty aroma	The aroma of nuts
Bran aroma	Feed the livestock
Typical cookies	The aroma of butter, eggs, and baking dough
Burnt aroma	The smells that arise due to tissue damage to the food due to long exposure to heat
Rancid aroma	Smelling or tasteless
Hard texture	The texture is too hard
Medium texture	Medium texture
Fragile texture	Easily damaged or broken
Hollow texture	There is space (the hole), not solid
Bitter sweet *Aftertaste*	Sweet taste mixed with bitter left in mouth after swallowed
Nut/*nutty*	Nuts taste

Table 3 shows the sensory attributes used in the sensory evaluation as well as their definitions. This definition is useful for providing equalization of panellists' perceptions in constructing the characteristics of the sensory attributes of each sample.

Sensory map

Fig.4 shows the sensory maps obtained by sensory techniques of napping. Projective mapping resulted in a more different configuration. That is a correlation loadings plot for PCA of the significant sensory descriptive data from the four formulations of rice bran tempe cookies product. From the result of Principal Component Analysis, It can be observed that the first two principal components accounted for approximately 77.3% of the variation (55.21% and 22.09%). As can be seen from the plot, a strong correlation for descriptive RBT1 and RBT 3, placing RBT2 close to RBT4. In the preference mapping, the comparison product already on the market is compared with the sample. We call it a commercial product as a bench mark. The commercial product has the following sensory attributes light brown, scented eggs and butter, have a crispy texture, brittle and hollow, have a sweet and creamy taste and have a sweet aftertaste.



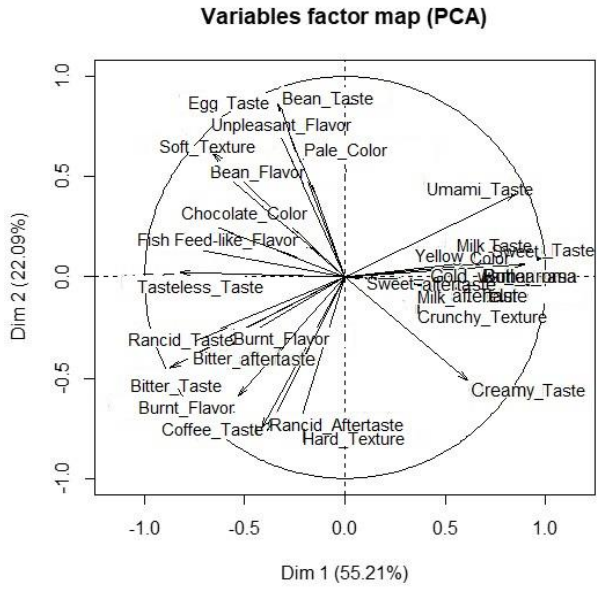


Fig. 4. *Variable Factor Map* (PCA)

Consumers describe and divide the sample according to the attributes that have similarities. According to Kaaki et al. (2020), residing in the same quadrant have similar attribute similarity levels, whereas in different quadrants have different attribute similarities. Consumers rate RBT2 and RBT4 have similarities, while RBT1 and RBT3 also have in common. Consumers assess the RBT2 and RBT4 samples are dark brown and declare less like.

Based on the taste attribute, the comparative sample has a very different flavor. In addition to this sample which does not contain rice bran, the sensory attributes in this commercial product are dominated by the taste of butter, vanilla, sweet and egg. Although all consumers prefer commercial sample because they are sweet and familiar with taste, samples containing rice bran tempe also have a taste favored by consumers.

Fig. 4 shows the distribution of cookies rice bran tempe attributes based on variable factor map (PCA). Commercial products have taste of tasty, sweet, bread and butter-like. Consumers described that it has yellow, gold, pale, bright, and faded chocolate in colour, also egg and butter in flavour. Furthermore, Its textures are crunchy, fragile, and hollow. In aftertaste attributes, it produces sweet aftertaste. According to the **Table 4**, RBT1 cookies have a variety of bitter flavors, nuts, astringent, tasteless, sweet, chocolate, egg, and caramel. RBT1 cookies have a pale brown colour, flavorful fish feed, have a rough and crisp texture, and leave a sense of nuts and bitter after swallowing. According to the consumer, RBT2 cookies have a mixture of bland, sweet, nut, soy, bitter, milk, creamy, and caramel taste. cookies RBT2 has a pale brown color, flavorful fish and rancid, textured hard, crunchy, and dry, and has a nut, bitter, and slightly sweet aftertaste. According to consumers, RBT3 cookies have a mixture of bland, sweet, nut, soy, bitter, milk, creamy, and caramel taste. RBT3 cookies has a pale brown color, flavorful fish and rancid, textured crunchy and a little stiff, and has a nut aftertaste, bitter, and slightly sweet. According to consumers, cookies F4 has a combination of sweet, bitter, tasteless, nuts, and caramel taste. RBT4 cookies have a pale brown colour, flavorful fish feed and charred, crispy textured and have a nut and bitter aftertaste.

Table 4. The Attributes Profile of Cookies Samples

Cookies sample	Taste	Colour	Flavour	Texture	Aftertaste
Commercial product	Tasty, sweet, bread, butter	Yellow, Gold, Pale, Bright, Chocolate, Faded	Egg, Butter	Crunchy, Fragile, Hollow	Sweet
RBT1	Bitter, Beans, Astringent, Tasteless, Sweet, Chocolate, Egg, Caramel	Chocolate, Pale	Fish feed	Rude Crunchy	Nut, Bitter
RBT2	Sweet, Bitter, Tasteless,Beans, Caramel	Pale Chocolate	Fish feed Burnt	Crunchy	Nut, Bitter
RBT3	Tasteless, Sweet, Beans, Soy, Bitter, Milk, Creamy, Caramel	Pale, Chocolate	Fish feed, Rancid	Hard Crunchy	Beans, Bitter, Sweet
RBT4	Sweet, Bitter, Tasteless, Beans, Caramel	Pale, Chocolate	Fish feed, Burnt	Hard Crunchy	Nut Bitter

Preference map

Average preferences for each formulation were modelled using PREFMAP method included in R software. In fig. 5, bi-dimensional Preference Map can be observed. These map include the position of the ideal point. Bi-dimensional representations of preference map show also contour area of the estimated percentage of samples with above-average preference. Observing the figures, it can be noticed an area of maximum percentage (80-100%) of samples with a preference above average. This area covers all positive range of attributes sensory. Based on **Fig 5**, commercial product (251) fall into the area of maximum acceptance with an elevation of 90, which can be seen in a red field with the most familiar characteristics of sweet, bread-like, butter-coloured, yellow-browned, and sweet aftertaste. The thing

that affects the consumer's high rating on this product is the presence of sweet attribute on the product.

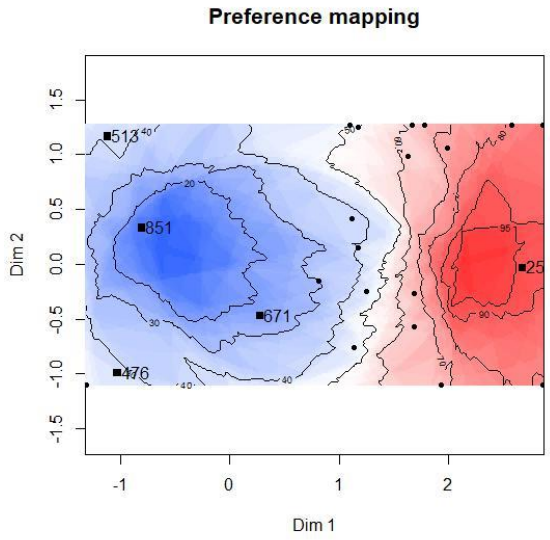


Fig. 5. Bidimensional preference map of Rice Bran Tempe product.

RBT1 and RBT 2 cookies have the same level of consumer ratings as they relate to the elevation, which is 40, while F3 with 30 elevations, and F4 with elevation 20. Based on **Table 4,** RBT1 and RBT2 have the same 11 attributes and 5 different attributes. RBT1 and RBT2 have the most significant elevation compared to RBT3 and RBT4 indicating that RBT1 and RBT2 are close to the commercial product.

This indicates that the smaller the elevation, the greater the sample distance to the commercial product, and the higher the elevation, the closer the sample to the comparison product. The possibility that affects the low consumer rating of both products is the bitterness attribute on the cookies. The bitter taste is thought to come from rice bran.

Preference mapping shows the position rice bran tempe cookies and comercial cookies in consumers preference.. The modification of the materials used in the sample gives an attribute the consumers may accept it. Sivamaruthi et al. (2018) have conducted research on fermented rice bran and unfermented rice bran. The fermented rice bran is experiencing an increase in total phenolic content compared with unfermented rice bran. In general, rice bran fermentation using yeast tempe produces more phenolics. Harti et al. (2014) has researched the addition of rice bran and chitosan to tempe. It turned out to make tempe has new functional properties. The addition of rice bran and chitosan serves as a useful prebiotic as antihypercholesterolemia. Results from the preference mappings showed that the reference, sweet, nut and caramel samples were preferred by majority of the consumers while the bitter, dark color, unpleasant aroma, hard texture were less preferred. This corresponded well with the results for the hedonic liking scores shown in **Table 3**. The thing that affects the consumer's high rating on this product is the presence of sweet attribute on the product.

Sweetness in cookies is the taste favored by consumers in Indonesia (Vermeulen et al, 2019). Some consumers can identify a sweet source not only derived from sugar, but rather a sweet taste derived from honey. The RBT4 sample has a bitter-sweet taste (tends to be bitter). Overall, consumers are not able to describe the tempe or rice bran is contained in the formulation. In terms of aroma, some consumers describe the smell of cookies such as animal feed that does indicate the presence of rice bran in the sample.

In terms of color and aroma, the four tempe formulations do not have a significant difference, because the presence of rice bran causes the dominant brown color. In terms of aroma, these four tempe formulations also have the same aroma, which is dominated by the typical aroma of rice bran. Sample with brown color and dark brown has a color that consumers do not like because it is very different from comparative samples that are relatively brighter. Although most consumers are very fond of the color of the commercial sample, consumers consider the color of the commercial sample to be less attractive to mature consumers, because they think it is more like baby biscuits.

The smell of bran like animal feed in rice bran tempe is influenced by the fermentation process and the raw materials used. As the process of fermentation progresses, the rice bran tempe temperature gradually increases and that is improve the hydrolysis process of a compound that produces the aroma of rice bran in tempe. Soy aroma in soybeans is produced by the presence of lipoxygenase enzyme mixed with soybean.

In terms of aroma, the four samples of cookies almost did not have a noticeable difference that is typical of peanuts and rice bran. However, each of these formulations has a different ability to evaporate the aroma This can be seen in the formulations with the addition of cocoa powder and dates extract tend to be more stinging and longer than other formulations.

Textures correlate with moisture content. After the fermentation process is complete, rice bran texture on tempe is drier than before. Fermentation of rice bran in a particular time causes a decrease in moisture content associated with the loss of dry matter in rice bran. According to Mangunwidjaja et al (2011), dry matter loss occurs due to the conversion of materials by mold activity to its growth. The converted dry matter will be converted into energy and

other products (CO_2 and H_2O) are then evaporated. RBT3 and RBT4 have lower moisture content than RBT1 and RBT2; it can be caused by the addition of palm juice in RBT3 and RBT4. Decreased moisture content associated with high sugar components. According Giyatmo (2013), dates extract has sugar substances (a mixture of glucose, sucrose, and fructose). According to Kartika (2015), sugar has a hygroscopic nature; it means having the ability to bind water. The more sugar concentrations are used, the more water is bound and causes the water content of the product to decrease.

For the preference mapping, high intensity of sweetness, creaminess and nut were identified as the main drivers of liking. In addition to bitterness, the main drivers of disliking were related to the high intensity of the dark colour, unpleasant aroma, hard texture.

The possibility that affects low consumer ratings of rice bran tempe cookies is the presence of bitter taste and the aroma of animal feed. It comes from the added rice bran. The consumers have not accepted the addition of rice bran tempe to the cookies formulation because of the sensory attributes of the bitter taste, dark color, aroma of animal feed, hard texture and bitter aftertaste. with the presence of chocolate powder and dates extract The presence of cocoa powder and dates has not been able to increase consumer acceptance of the tempe rice bran.

CONCLUSIONS

The addition of rice bran, chitosan, GDL, and cocoa powder or date palm juice in each treatment significantly affected the moisture content of the rice bran flour ($p < 0.05$), while the solubility of tempeh bran flour, moisture content, and crude fiber of tempe bran cookies did not significant effect ($p > 0.05$). Tempe cookies with the addition of rice bran only and cocoa powder give the highest level of preference compared to other formulas (elevation of 40). while the tempeh cookie with the addition of dates and a mixture of dates and chocolate) had a lower preference (elevation of 30 and 20, respectively). however, the tempe cookies with the addition of rice bran are still not acceptable to consumers, so further research is needed to increase consumer preference.

REFERENCES

AOAC. (1995). Official Methods of Analysis, 16th ed. Gaithersbug, Maryland: AOAC International.

Astuti, M., Eng, B., Meliala, A., & Med, B. (2000). Tempe , a nutritious and healthy food from Indonesia. 9(May), 322–325.

Bølling, S., Hersleth, M., & Tormod, N. (2010). Food Quality and Preference. 21, 188–196. https://doi.org/10.1016/j.foodqual.2009.05.007

Carrillo, E., Fiszman, S., Lähteenmäki, L., & Varela, P. (2014). Consumers' perception of symbols and health claims as health-related label messages. A cross-cultural study. *Food Research International*, *62*, 653–661.

Cempaka, L., Eliza, N., Ardiansyah, A., Handoko, D. D., & Astuti, R. M. (2018). Proximate Composition, Total Phenolic Content, and Sensory Analysis of Rice Bran Tempeh. Makara Journal of Science, 22(2), 89–94. https://doi.org/10.7454/mss.v22i2.9616

Gere, A., & Huszar, K. P. (2014). Comparison of preference mapping methods : a case study on flavored kefirs. December 2017. https://doi.org/10.1002/cem.2594

Giyatmo. (2013). Efektifitas Pemberian Jus Kurma Dalam Meningkatkan Trombosit Pada Pasien Demam Berdarah Dengue Di Rsu Bunda Purwokerto. Jurnal Keperawatan Soedirman (The Soedirman Journal of Nursing), Volume 8, No.1

Gul, K., Yousuf, B., Singh, A. K., Singh, P., & Wani, A. A. (2015). Author ' s Accepted Manuscript. Bioactive Carbohydrates and Dietary Fibre. https://doi.org/10.1016/j.bcdf.2015.06.002

Harti, A. S., Nurhidayati, A., Handayani, D., Estuningsih, Kusumawati, H. N., & Haryati, D. S. (2014). The fortification tempeh of rice bran chitosan as functional foodantihypercholesterolemia in indonesia. International Journal of Bioscience, Biochemistry and Bioinformatics, Vol. 4, No.5

Jurus, A. M., & Sundberg, W. J. (1976). Penetration of Rhizopus oligosporus into Soybeans in Tempeh. 32(2), 284–287.

Kaaki, D., Baghdadi, O. K., Najm, N. E., & Olabi, A. (2020). Preference mapping of commercial Labneh (strained yogurt) products in the Lebanese market. Journal of Dairy Science, 95(2), 521–532. https://doi.org/10.3168/jds.2011-4409

Kartika, Priska Nur dan Fithri Choirun Nisa. (2015). Studi Pembuatan Osmodehidrat Buah Nanas (Ananas comosus L. Merr): Kajian Konsentrasi Gula dalam Larutan Osmosis dan Lama Perendaman. Jurnal Pangan dan Argoindustri Vol. 3 No. 4. Diakses tanggal 9 Oktober 2016.

Mangunwidjaja, D., Sukmaratri T.E., dan C. Setiyarto. (2011). Peningkatan Kadar Protein Kasar Ampas Kulit Nanas Melalui Fermentasi Media Padat. Skripsi. Bogor: Institut Pertanian Bogor.

Nkhata, S. G., Ayua, E., Kamau, E. H., & Shingiro, J. B. (2018). Fermentation and germination improve nutritional value of cereals and legumes through activation of endogenous enzymes. Food Science and Nutrition, 6(8), 2446–2458. https://doi.org/10.1002/fsn3.846

Nout, M. J. R., & Kiers, J. L. (2005). Tempe fermentation, innovation and functionality: Update into the third millenium. Journal of Applied Microbiology, 98(4), 789–805. https://doi.org/10.1111/j.1365-2672.2004.02471.x

Nuraida, L. (2015). A review: Health promoting lactic acid bacteria in traditional Indonesian fermented foods. Food Science and Human Wellness, 4(2), 47–55. https://doi.org/10.1016/j.fshw.2015.06.001

Okpala, L., Okoli, E., & Udensi, E. (2012). Physico-chemical and sensory properties of cookies made from blends of germinated pigeon pea , fermented sorghum , and cocoyam flours. https://doi.org/10.1002/fsn3.2

Reshu, M. S., Chagam, R., Reddy, K., & Haripriya, S. (2017). Functional and physicochemical characteristics of cookies prepared from Amorphophallus paeoniifolius flour. Journal of Food Science and Technology, 54(7), 2156–2165. https://doi.org/10.1007/s13197-017-2656-y

Rodrigues, S., Oliveira, F., Leite, A., Pereira, E., & Teixeira, A. (2015). Sensory Characterization and Consumer Preference Mapping of Fresh Sausages Manufactured with Goat and Sheep Meat. 80(7). https://doi.org/10.1111/1750-3841.12927

Sharif, M. K., Butt, M. S., Anjum, F. M., & Khan, S. H. (2014). Rice Bran: A Novel Functional Ingredient. Critical Reviews in Food Science and Nutrition, 54(6), 807–816. https://doi.org/10.1080/10408398.2011.608586

Sivamaruthi, B.S., Kesika, P., and Chaiyasut, C. (2018). A Comprehesive Review on Functional Properties of Fermented Rice Bran: A review. Pharmacognosy Reviews 12:218-24

Starzyńska-Janiszewska, A., Stodolak, B., Duliński, R., Baczkowicz, M., Mickowska, B., Wikiera, A., & Byczyński, L. (2016). Effect of Solid-State Fermentation Tempe Type on Antioxidant and Nutritional Parameters of Buckwheat Groats as Compared with Hydrothermal Processing. Journal of Food Processing and Preservation, 40(2), 298–305. https://doi.org/10.1111/jfpp.12607

Yang, J., & Lee, J. (2019). Application of Sensory Descriptive Analysis and Consumer Studies to Investigate Traditional and Authentic Foods : A Review. 1–17. https://doi.org/10.3390/foods8020054

Vera, M., Dutta, B., Mercer, D. G., Maclean, H. L., & Touchie, M. F. (2019). Trends in Food Science & Technology Assessment of moisture content measurement methods of dried food products in small-scale operations in developing countries : A review. Trends in Food Science & Technology, 88(July 2018), 484–496. https://doi.org/10.1016/j.tifs.2019.04.006

Vermeulen, S., Wellesley, L., Airey, S., & Singh, S. (n.d.). Healthy Diets from Sustainable Production : Indonesia Healthy Diets from Sustainable Production : Indonesia.

Yang, J., & Lee, J. (2019). Application of Sensory Descriptive Analysis and Consumer Studies to Investigate Traditional and Authentic Foods : A Review. 1–17. https://doi.org/10.3390/foods8020054