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Study of the Preference Value of High-Fiber Crackers

Berta Patrisiya[1], Dedin Finatsiyatull Rosida[1], Luqman Agung Wicaksono[1]*

[1] *Food Science and Technology Department, Faculty of Engineering. Universitas Pembangunan Nasional "Veteran" Jawa Timur. Surabaya. Indonesia,*

ARTICLE INFO

CORRESPONDING AUTHOR

* E-mail: dedintp@upnjatim.ac.id

A B S T R A C T

Crackers are a type of biscuit made from hard dough that has been fermented. They are flat, have a salty taste, have a crunchy texture, and have layers when broken. Fermentation time influences the product's appearance, aroma, and nutritional quality. The Indonesian population does not consume enough fiber, which can increase obesity rates. Dietary fiber is contained in mocaf flour, red bean flour, and rice bran. The research aims to determine the proportion of wheat flour, mocaf flour, red bean flour, and rice bran with variations in fermentation time on the preference value of crackers. This research used a Completely Randomized Design (CRD), arranged factorially with 2 factors. Factor I is the ratio of wheat flour, mocaf flour, red bean flour, and rice bran 70:21:4.5:4.5; 70:15:7.5:7.5; and 70:9:10.5:10.5. Factor II fermentation time 20 minutes; 40 minutes; and 60 minutes. The best treatment is crackers with a ratio of 70:21:4.5:4.5 with 40 minutes of fermentation. It has a color score of 3.38 (brownish yellow), an aroma score of 3.36 (normal), a taste score of 3.40 (normal), and a texture score of 3.36 (normal).

1. INTRODUCTION

1.1. Research Background

The level of pastry consumption in Indonesia 2020 reached 1.83 kg/capita/year [1]. The types of pastries on the market, such as biscuits, cookies, wafers, and crackers, are very diverse. Crackers are a type of biscuit made from hard dough that has gone through a fermentation process, is flat, has a salty taste, has a crunchy texture, and if it is broken across, it has a layered [2]. Crackers on the market generally have a sweet taste with the addition of jam topping. Consuming too many simple carbohydrates and low fiber causes an increase in obesity rates [3]. Health research data in 2018 reported that 95.5% of the Indonesian population didn't consume enough fiber; this figure increased from 2013 with a prevalence of 93.5% [4]. Dietary fiber is obtained from fruit, vegetables, mocaf flour, red beans, rice bran, and others. The fermentation process in making crackers aims to ripen some of the dough and provide the texture and taste of the crackers so the dough is easy to handle and produces products of good quality [5]. Fermentation time influences the quality of the product's appearance, aroma, and nutrition [6]. Based on the explanation above, this research aims to determine the proportion of wheat flour, mocaf flour, red bean flour, and rice bran with variations in fermentation time on the preference value of crackers.

1.2. Literature Review

Crackers are a type of pastry that has a crunchy texture and low water content, so they have a long shelf life ranging from several weeks to several months [7]. The materials used to make crackers can be divided into materials that function as a binder and texture-softening materials. The binding or dense dough-forming ingredients are wheat flour, water, and salt. Meanwhile, the ingredients that function to soften the texture are butter or margarine and baking soda [8]. Making crackers is divided into several stages: preparation and weighing of ingredients, mixing, fermentation, sheet formation, lamination, shaping, and baking [8].

In the fermentation process, starch from wheat flour and sucrose. The enzymes α and β amylase, naturally found in wheat flour, will break down starch into maltose, which will be used in yeast fermentation. Yeast cells produce the enzyme maltase, which converts maltose into glucose. At the same time, the yeast will break down a small amount of sucrose from the added sugar into glucose and fructose, and a group of enzymes called zymase is broken down to produce CO_2 gas and ethanol [9]. The development of this gas causes the dough to expand and makes the dough lighter and bigger [10]. Fermentation time influences the quality of the product's appearance, aroma, and nutrition [6]. The longer the fermentation takes, the more opportunity the yeast will have to increase gas and develop the dough further. Yeast

will produce CO_2 gas and form pores in the dough if the yeast gets sugar and carbohydrates as a source of nutrition during the fermentation process [5].

Dietary fiber is a component of plant tissue resistant to hydrolysis by enzymes in the stomach and small intestine. Total dietary fiber consists of soluble and insoluble dietary fiber [11]. Dietary fiber can influence insulin sensitivity independently and impact appetite [12]. Consuming dietary fiber, mastication takes longer, and this will stimulate more secretion of saliva (saliva) and gastric fluid. This excessive secretion causes the stomach to feel full. In addition, with the presence of fiber, the absorption of nutrients (starch, sugar, protein, fat) will be hampered, so fat will be oxidized, and energy will be reduced [13].

Wheat flour is made by grinding the inner wheat grain or endosperm without involving the bran and bran, the outer layer [14]. The wheat flour compound that can bind dough is gluten. Gluten is elastic and chewy, which can increase dough expansion [15]. Mocaf flour is known as an alternative cassava flour substitute for wheat. The word mocaf itself is an abbreviation of Modified Cassava Flour, which has a different character from ordinary cassava flour, and mocaf has a degree of viscosity, gelation ability, rehydration power, and ease of dissolving that is better than ordinary cassava flour [16]. The dietary fiber content in mocaf flour is 6.0% [17]. Red beans are a functional food with low fat content and a low glycemic index 26 [18]. Red bean flour has a dietary fiber content of 3.53% [19]. Rice bran is waste in the process of milling grain and polishing rice. Milling and polishing rice will produce 16 – 28% husk, 6 – 11% bran, 2 – 4% rice bran, and around 60% endosperm [20]. Rice bran contains more than 20% dietary fiber [21].

There are supporting ingredients used to add functional content and strengthen the taste and texture of crackers. Sunflower seeds contain 1% fiber [22]. Chia seeds contain 30% dietary fiber [23]. Moringa leaves contain 7.92% fiber [24]. Canola oil can be used as a substitute for butter [25]. Stevia is low in sugar but provides a sweeter taste that is higher than regular sugar, low in calories, suitable for diabetics, and safe for long-term use; stevia sugar has 4.5% reducing sugar [26].

1.3. Research Objective

The study aims to determine the proportion of wheat flour, mocaf flour, red bean flour, and rice bran with variations in fermentation time on the crackers' preference value and determine the best crackers' dietary fiber content.

2. MATERIALS AND METHODS

2.1. Materials and Tools

The raw materials used in the research consisted of wheat flour (from PT. Bogasari Flour Mills), mocaf flour (from CV. Agung Bumi Agro), red bean flour (from PT. Lingkar Organik), and rice bran (from CV. Raissa Beauty). The equipment used in the research consisted of a Digipounds digital scale, a Rinai oven, and a Miyako mixer.

2.2. Design of Experiment and Analysis

This research used a Completely Randomized Design (CRD) arranged factorially with two factors. Factor I is the proportion of wheat flour, mocaf flour, red bean flour, and rice bran, and factor II is fermentation time. The data obtained were analyzed using Analysis of Variance (ANOVA) at the 5% level. If there is a real difference, a further test using Duncan's Multiple Range Test (DMRT) 5% method is carried out—data analysis using the SPSS 26 for Windows program.

Table 1. *The treatment* combination of crackers

Factor I	Factor II		
	B1	B2	B3
A1	A1B1	A1B2	A1B3
A2	A2B1	A2B2	A2B3
A3	A3B1	A3B2	A3B3

Wheat Flour: Mocaf Flour: Red Bean Flour: Rice Bran (%): Fermentation time

A1B1 = 70: 21: 4.5: 4.5: 20 minute
A1B2 = 70: 21: 4.5: 4.5: 40 minute
A1B3 = 70: 21: 4.5: 4.5: 60 minute
A2B1 = 70: 15: 7.5: 7.5: 20 minute
A2B2 = 70: 15: 7.5: 7.5: 40 minute
A2B3 = 70: 15: 7.5: 7.5: 60 minute
A3B1 = 70: 9: 10.5: 10.5: 20 minute
A3B2 = 70: 9: 10.5: 10.5: 40 minute
A3B3 = 70: 9: 10.5: 10.5: 60 minute

2.3. Research Produce

This study's process of making crackers is based on modifying the previous research method [27] by mixing all the ingredients and fermenting at room temperature ($\pm 30°C$). Bake at 160°C for 18 minutes.

2.4. Observation

Sensory attributes selected to assess the quality of crackers are aroma, taste, color, taste, and texture. There were 25 panelists giving scores on each parameter.

Colour :
1 = very brown
2 = brown
3 = brownish yellow
4 = yellow
5 = very yellow

Aroma :
1 = pleasant
2 = quite pleasant
3 = normal
4 = quite typical crackers
5 = typical crackers

Taste :
1 = bitter
2 = quite bitter
3 = normal
4 = quite savory
5 = savory

Texture :
1 = hard
2 = quite hard
3 = normal
4 = quite crispy
5 = crispy

3. RESULT AND DISCUSSION

Sensory scores of crackers from various treatments can be seen in Table 2. The sensory attributes analyzed are color, aroma, taste, and texture.

Table 2. Sensory Analysis of Crackers

Treatment	Sensory Attributes			
	Color	Aroma	Taste	Texture
A1B1	3.52	3.44	3.28	3.00
A1B2	3.38	3.36	3.40	3.36
A1B3	2.96	3.08	3.64	3.56
A2B1	3.44	3.40	3.16	2.64
A2B2	2.92	3.16	3.36	2.84
A2B3	2.76	2.88	3.44	3.48
A3B1	2.72	3.32	2.88	2.60
A3B2	2.60	3.12	2.96	2.88
A3B3	2.36	2.84	3.32	3.44

A1B1   A1B2   A1B3

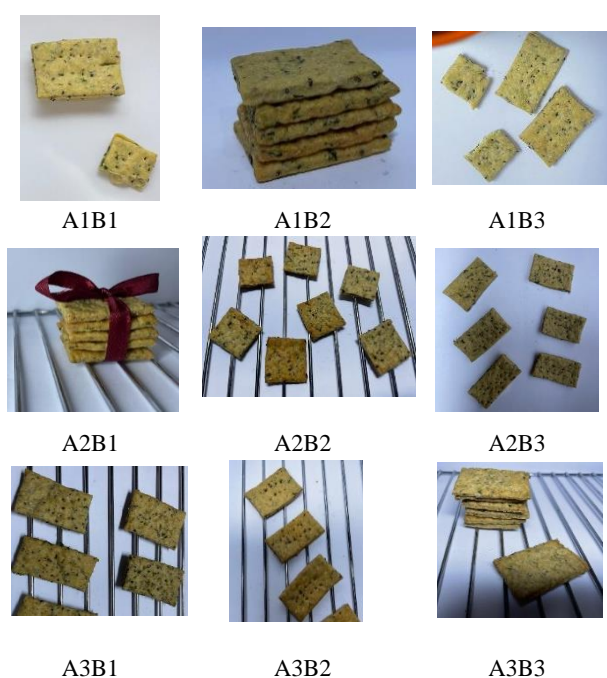A2B1   A2B2   A2B3

A3B1   A3B2   A3B3

Figure 1. Crackers from all treatments

3.1. Color

Color is a very important quality attribute; even though the product has high nutritional value, good taste, and good texture if the color is not attractive, it will cause the product to be less attractive to consumers. Therefore, color is one thing that influences people to consume a product. People can usually assess whether they like the product or not from its color [28].

The results of the color attribute testing research showed that crackers with a proportion of wheat flour, mocaf flour, red bean flour, and rice bran of 70: 21: 4.5: 4.5 with a fermentation time of 20 minutes were most liked by the panelists with a score of 3.52 (yellow). The results of research testing color attributes show that the proportion of mocaf flour and the shorter the fermentation time, the more panelists prefer it because it has a color that is not too brown.

This is due to the increasing use of red bean flour and rice bran, which causes the color to become browner. Red bean flour

is reddish brown [19]. Rice bran flour is light brown or yellowish brown [29]. This is different from mocaf flour, which is bright white [30]. If the proportion of mocaf flour is greater than red bean flour and rice bran, the color of the crackers will be yellower. The protein content of 19.48% and carbohydrates of 58% in red bean flour influence the product's color to become increasingly brown. Red bean flour contains high levels of protein and carbohydrates; mixed with other ingredients will cause a Maillard reaction, which results in a dark color that increases in the processed product as the proportion of ingredients used increases [31].

The color change is due to the Maillard reaction that occurs during the fermentation process [32]. The Maillard reaction can produce brown material due to the formation of melanoidin compounds, which affect the brightness of a material [33]. The longer the fermentation time, the darker the color produced [34].

3.2. Aroma

Aroma is more related to the five senses of smell. The aroma can only be recognized in the form of steam. The aroma received by the nose and brain is a mixture of four main odors: fragrant, sour, rancid, and burnt. Aroma is a very important factor in determining the level of consumer acceptance of a product because before eating it, consumers usually first smell the aroma of the product to assess whether the product is worth eating. The product will be accepted by the public if the aroma of the product is not strong or bland [35].

The results of the aroma attribute testing research showed that crackers with a proportion of wheat flour, mocaf flour, red bean flour, and rice bran of 70: 21: 4.5: 4.5 with a fermentation time of 20 minutes were most liked by the panelists with a score of 3.44 (normal). The results of research testing aroma attributes show that the proportion of mocaf flour and the shorter the fermentation time, the more panelists prefer it because it has a normal aroma.

The less red bean flour and rice bran were used, the more the panelists preferred them. This is because if the proportion of red bean flour and rice bran is higher, the aroma of the crackers will be more pleasant. The unpleasant aroma of rice bran is caused by the lipase enzyme in the rice bran, which can quickly catalyze the oxidation reaction so that the fat becomes pleasant and affects the resulting aroma [31]. The aroma of rice bran is formed by the presence of volatile components of tocophenol oil and the influence of the Maillard reaction [36]. The pleasant aroma of red beans is caused by the activity of the lipoxygenase enzyme, which is usually found in beans [37].

The results of research testing aroma attributes show that the longer the fermentation, the less the panelists like it; this is because the aroma becomes more intense from the fermentation process. Fat oxidation can cause rancidity, but if the fat oxidation process has not continued, it will produce an aroma that the panelists like [38]. Fermentation time also influences product quality; fermented products are acceptable in appearance, aroma, and nutrition [6].

3.3. Taste

Taste is different from smell and involves more of the five senses of the tongue. Taste sensing can be divided into four main tastes: salty, sour, sweet, and bitter. Taste is formed due to a response to chemical stimulation by the taste buds (tongue). Taste is one of the most important indicators in determining whether a product is

accepted. The reception response is greatly influenced by each person's sense of taste (tongue) [39].

The results of the research testing taste attributes showed that crackers with a proportion of wheat flour, mocaf flour, red bean flour, and rice bran of 70: 21: 4.5: 4.5 with a fermentation time of 60 minutes were most liked by the panelists with a score of 3.64 (quite savory). The results of research testing taste attributes show that the greater the proportion of mocaf flour and the longer the fermentation, the more panelists like it because it has quite a savory taste.

Panelists preferred crackers with a smaller proportion of red bean flour and rice bran because they did not taste bitter. Previous research explains that too much red bean flour can cause the product's bitterness [40]. Adding rice bran reduces the taste level of the product because the more rice bran flour is added, the more bitter the product tastes because it contains saponins [41]. The bitter taste of red bean flour is covered by mocaf flour, and the savory taste of other supporting ingredients such as fat and sunflower seeds.

The fermentation time affects the product's taste because the longer the fermentation takes, the more complex the taste becomes. The soft aroma will turn sharp if the fermentation process takes longer [42]. Fermentation in crackers aims to process part of the dough, forming the texture and taste of the crackers so that the dough is easy to handle and can produce good quality products [5].

3.4. Texture

Texture is a sensation of pressure observed by the mouth (when bitten, chewed, and swallowed) or touched with the fingers. The various types of texture sensing include wetness, dryness, smoothness, roughness, and oiliness [28]. The texture of biscuits (including crackers) includes hardness, crunchiness, ease of breaking, and consistency in the first bite [43].

The results of the research testing taste attributes showed that crackers with the proportion of wheat flour: mocaf flour, red bean flour, and rice bran 70: 21: 4.5: 4.5 with a fermentation time of 60 minutes were most liked by the panelists with a score of 3.56 (quite crispy). The results of research testing texture attributes show that the proportion of mocaf flour and the longer the fermentation, the more panelists prefer it because it has a quite crispy texture.

The crackers texture that the panelists liked was crackers with a crunchy texture. The factor influencing crispness is the amount of water evaporating during the roasting process [44]. If more water cannot evaporate, the crispness will decrease. The high amylopectin content can also cause the crispness value. The higher the amylopectin, the resulting product will be fluffy and crispier. The more the proportion of mocaf, the more the panelists prefer the texture [45]. This is because mocaf contains 19% amylose and 81% amylopectin [46]. The amylopectin content of mocaf flour is higher than red bean flour, which has an amylopectin content of 61% [47], and rice bran has 21.80% amylopectin [48].

The longer fermentation can affect the water content so that the water content in the crackers decreases. The low water content affects the texture of the crackers; the lower the water content, the crispier the texture of the crackers. As long as the water content in the product increases, the hardness will increase, and the friability and crispness of the product will also decrease [5]. Gluten in crackers can hold CO_2 gas produced by yeast during fermentation, so the more CO_2 gas that can be trapped, the more air cavities are produced, and the structure becomes looser and easier to break [45].

4. CONCLUSION

Based on the panelists' preference for crackers products, the best treatment was crackers with the proportion of wheat flour, mocaf flour: red bean flour, bran 70: 21: 4.5: 4.5 with a fermentation time of 40 minutes. It has a color score of 3.38 (brownish yellow), an aroma score of 3.36 (normal), a taste score of 3.40 (normal), and a texture score of 3.36 (normal).

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REFERENCE

[1]   Badan Ketahanan Pangan, "Direktori Perkembangan Konsumsi Pangan," Kementerian Pertanian RI, Vol. 3, 2020.

[2]   Meliyana., Johan, V. S., and Zalfiatri, Y., "Pemanfaatan Tepung Talas dan Tepung Kacang Merah dalam Pembuatan Crackers," Jurnal Sagu. 18 (1): 1 – 8, 2019.

[3]   Handayani, D., Azizah, N., Hanifah., and Rahmawati., "Densitas Energi dan Sajian Karbohidrat Makanan Tradisional dan Modern di Kota Malang," Indonesian Journal of Human Nutrition, 2 (1): 11 – 18, 2016.

[4]   Kemenkes RI, "Hasil Riset Kesehatan Dasar Tahun 2018," Kementrian Kesehatan RI, 53(9), 1689–1699, 2018.

[5]   Kiranawati, T. M., Rohajatien, U., and Jayanti, R. S., "Pengaruh Lama Fermentasi Adonan Terhadap Sifat Fisik dan Kimia Krackers Substitusi Tepung Komposit," Jurnal Agroindustri. 11 (2): 133 – 142, 2021.

[6]   Darajat, D. P., Susanto, W. H., dan Purwantiningrum., I, "Pengaruh Umur Fermentasi Tempe dan Proporsi Dekstrin terhadap Kualitas Susu Tempe Bubuk," Jurnal Pangan dan Agroindustri, 2(1), 47– 53, 2014.

[7]   Batista, A. P., Alberto, N., Ivana, B., Isabel, S., Anabela, R., Liliana, R., Natascia, B., Mario, R. T., "Microalgae As Functional Ingredients in Savory Food Products: Application to Wheat Crackers," Foods, 8 (12): 1 – 22, 2019.

[8]   Manley, D., "Biscuit, Cracker and Cookie Recipes For The Food Industry," Stamford: Woodhead Publishing Limited, 2001.

[9]   Oktarini, I. T., "Pengaruh Proporsi Tepung Terigu: Tepung Jali (*Coix Lacrymajobi L.*) Terfermentasi Dan Penambahan $NaHCO_3$ terhadap Karakteristik Fisik, Kimia, dan Organoleptik Crackers," Univesitas Pembangunan Nasional "Veteran" Jawa Timur, Thesis, 2022.

[10]   Arwini, N. P. D., "Roti, Pemilihan Bahan dan Proses Pembuatan," Vastuwidya, 4 (1): 33 – 40. 2021.

[11]   Hernawan, E. and V. Melyani., "Analisis Karakteristik Fisikokimia Beras Putih, Beras Merah dan Beras Hitam (*Oryza Sativa L., Oryza Nivara* dan *Oryza Sativa L. Indica*)," Jurnal Kesehatan Bakti Tunas Husada, 15 (1): 79 – 91, 2016.

[12] Bodinham, C. L., Frost, G. S., And Robertson, M. D, "Acute Ingestion of 72 Resistant Starch Reduces Food Intake in Healthy Adults," British Journal Of Nutrition. 103: 917 – 922, 2010.

[13] Burhan, F. Z., Sirajuddin, S., Dan Indriasari., "Pola Konsumsi terhadap Kejadian Obesitas Sentral pada Pegawai Pemerintahan di Kantor Bupati Kabupaten Jeneponto," Universitas Hassanudin, Thesis, 2013.

[14] Syarbini, M., "Refrensi Komplet A – Z Bakery Bahan, Proses Pembuatan Roti, Panduan Menjadi Bakepreneur," Solo: PT. Tiga Serangkai Pustaka Mandiri, 2013.

[15] Aristawati, R., Atmaka, W., and Muhammad, D. R. A., "Subtitusi Tepung Tapioka (Manihot Esculenta) dalam Pembuatan Takoyaki," Jurnal Teknosains Pangan, 2(1): 56 – 65, 2013.

[16] Subagio, A., Windrati, W. S., Witono, Y., and Fahmi, F. "Produksi Operasi Standar (POS): Produksi Mocal Berbasis Klaster," Jember: Fakultas Teknologi Pertanian, Universitas Jember, 2008.

[17] Rahman, M. H. R., Ariani, R. P., and Masdarini, L., "Substitusi Penggunaan Tepung Mocaf (Modified Cassava Flour) pada Butter Cookies Kelapa," Jurnal Kuliner, 1(2): 89–97. 2021.

[18] Istiqomah, A., and Rustanti, N., "Indeks Glikemik, Beban Glikemik, Kadar Protein, Serat, dan Tingkat Kesukaan Kue Kering Tepung Garut dengan Substitusi Tepung Kacang Merah," Journal of Nutrition College, 4 (4): 620 – 627, 2015.

[19] Pangastuti, H. A., Affandi, D. R., and Ishartani, D., "Karakterisasi Sifat Fisik dan Kimia Tepung Kacang Merah (Phaseolus Vulgaris L.) dengan Beberapa Perlakuan Pendahuluan," Jurnal Teknosains Pangan Januari, 2(2): 2302–2733, 2013.

[20] Astawan, M. and E. Febrinda, "Potensi Dedak dan Bekatul Beras sebagai Ingredient Pangan dan Produk Pangan Fungsional," Jurnal Pangan, 19(1): 14-21, 2010.

[21] Listyani, A., and Zubaidah, E, "Formulasi Opak Bekatul Padi (Kajian Penambahan Bekatul dan Proporsi Tepung Ketan Putih: Terigu)," Jurnal Pangan dan Agroindustri, 3(3): 950–956, 2015.

[22] Gopalan, C. J., Balasubramamian, C. S., and Sastri Rama, V. B., "Nutritive Value of India Foods IVth Edition, Printed By National Institute Of Nutrition (Nin)," Icar, 51, 2007.

[23] Safari, A., Kusnandar, F., and Syamsir, E., "Biji Chia : Karakteristik Gum dan Potensi Kesehatannya," Pangan, 25(2): 137 – 146, 2016.

[24] Angelina, C., Swasti, Y. R., and Pranata, F. S, "Peningkatan Nilai Gizi Produk Pangan Dengan Penambahan Bubuk Daun Kelor (Moringa Oleifera): Review," Jurnal Agroteknologi, 15(1): 79 – 93, 2021.

[25] Ketaren, S. "Pengantar Teknologi Minyak dan Lemak Pangan," Jakarta: UI Press, 2012.

[26] Sustriawan, B., Hania, R., Tresna, R., and Aini, R., "Karakteristik Cookies dari Tepung Sorgum dan Tepung Almond dengan Pemanis Stevia dan Gula Kelapa Kristal," Agrointek, 15(3): 893 – 902, 2021

[27] Arbie, F. Y., Hadi, N. S., Setiawan, D. I., Labatjo, R., and Anasiru, "Kualitas Cracker Cibi sebagai Alternatif Cemilan Sehat," Jurnal Action, 5(1): 35 – 44, 2020

[28] Sarlina., Wahyuni, S., and Sadimantara, M. S., "Penilaian Organoleptik Tepung Kulit Ubi Kayu Termodifikasi Ragi Tape," J. Sains dan Teknologi Pangan, 2(5): 863 – 872, 2017.

[29] Lavanya, M.N., Venkatachalapathy, N., And Manickavasagan, A., "Physicochemical Characteristics of Rice Bran," Brown Rice, 70-90, 2017.

[30] Rahman, M. H. R., Ariani, R. P., and Masdarini, L., "Substitusi Penggunaan Tepung Mocaf (Modified Cassava Flour) pada Butter Cookies Kelapa," Jurnal Kuliner, 1(2): 89–97, 2021.

[31] Damayanti, S., Bintoro, V. P., and Setiani, B. E., "Pengaruh Penambahan Tepung Komposit Terigu, Bekatul dan Kacang Merah terhadap Sifat Fisik Cookies," Journal of Nutrition College, 9(3): 180–186, 2020.

[32] Choi, I. S., Cha, H. S., and Lee, Y. S., "Physicochemical and Antioxidant Properties of Black Garlic," Molecules, 19(10):16811–16823, 2014.

[33] Anggraeni, M., "Sifat Fisikokimia Roti yang Dibuat dengan Bahan Dasar Tepung Terigu yang Ditambah Berbagai Jenis Gula," Jurnal Aplikasi Teknologi Pangan, 6(1): 52–56, 2017.

[34] Miladulhaq, M., "Perubahan Sifat Fisikokimia Selama Pengolahan Bawang Putih Tunggal Menjadi Bawang Hitam Menggunakan Rice Cooker," Insitut Pertanian Bogor, Thesis, 2018.

[35] Susanto, A., Radwitya, E., dan Muttaqin, K., "Lama Waktu Fermentasi dan Konsentrasi Ragi pada Pembuatan Tepung Tape Singkong (Manihot Utilissima) Mengandung Dekstrin, Serta Aplikasinya pada Pembuatan Produk Pangan," Jurnal Teknologi Pangan, 8(1): 82–92, 2017.

[36] Winanti, D. D. T., Susilawati, S., and Zulferiyenni, Z. "Pengolahan Bekatul dan Spirulina Menjadi Cookies Kaya Protein," Jurnal Teknik Pertanian Lampung, 10(3): 309, 2021.

[37] Irmawati, F. M., Ishartani, D., and Affandi, D. R., "Pemanfaatan Tepung Umbi Garut (Maranta Arundinacea L) sebagai Pengganti Terigu dalam Pembuatan Biskut Tinggi Energi Protein dengan Penambahan Tepung Kacang Merah (Phaseolous Vulgaris L)," Jurnal Teknosains Pangan, 3(1), 3– 14, 2014.

[38] Adawyah, R., Syifa, M., and Habibie, R., "Pengaruh Lama Fermentasi terhadap Karakteristik Kimia, Organoleptik dan Total Plate Count (TPC) Cumi Kering (Loligo Sp.)," Jurnal Pengolahan Hasil Perikanan Indonesia, 24(2): 160–166, 2021

[39] Nasution, E., Setiawati, V. R., and Nairfana, I., "Pengaruh Lama Fermentasi terhadap Mutu Organoleptik, Tingkat Keasaman (Ph) dan Tingkat Kemanisan Tape Sorghum (Sorghum Bicolor L. Moench)," Food And Agroindustry Journal, 2(2): 53–61, 2021.

[40] Fatimah, P. S., E. Nasution, and E. Y. Aritohang., "Uji Daya Terima dan Nilai Gizi Biskuit yang Dimodifikasi Dengan Tepung Kacang Merah," Jurnal Kesehatan Masyarakat, 2 (6): 1-7, 2013.

[41] Rahmawati, L., Asmawati, A., and Saputrayadi, A., "Inovasi Pembuatan Cookies Kaya Gizi dengan Proporsi Tepung Bekatul dan Tepung Kedelai," Jurnal Agrotek Ummat, 7(1): 30, 2020.

[42] Rahmi, R., Mursyid, M., and Wulansari, D., "Spiced Tempe Formulation and Evaluation of Its Nutrition Values," Industria: Jurnal Teknologi Dan Manajemen Agroindustri, 7(1): 57–65, 2018.

[43] Hasnelly, Nurminabari, I, S., and Meiliawati, A., "Pengaruh Perbandingan Tepung Talas Bogor (Colocasia Esculenta L. Schott) dengan Tepung Ubi Jalar Oranye (Ipomea Batatas L) dan Waktu Fermentasi terhadap Karakteristik Crackers Sayuran," Pasundan Food Technology Journal, 7(2): 44 – 56. 2020.

[44] Rosiani, N., Basito, B., and Widowati, E., "Kajian Karakteristik Sensoris Fisik dan Kimia Kerupuk Fortifikasi Daging Lidah Buaya (Aloe Vera) dengan Metode Pemanggangan Menggunakan Microwave," Jurnal Teknologi Hasil Pertanian, 8(2): 84 – 98, 2015.

[45] Astuti, D., Kawiji, K., and Nurhartadi, E., "Kajian Sifat Fisik, Kimia dan Sensoris Crackers Substitusi Tepung Sukun (*Artocarpus Communis*) Termodifikasi Asam Asetat dengan Penambahan Sari Daun Pandan Wangi (*Pandanus Amaryllifolius*), Jurnal Teknologi Hasil Pertanian, 11(1): 1 – 10. 2018.

[46] Endang, Yeyen Prestyaning, and Wanita., "Pengaruh Cara Pembuatan Mocaf Terhadap Kandungan Amilosa Dan Derajat Putih Tepung," Prosiding Seminar Hasil Penelitian Tanaman Aneka Kacang Dan Umbi, 2013.

[47] Asfi, W. M., Harun, N., and Zalfiatri, Y., "Pemanfaatan Tepung Kacang Merah dan Pati Sagu pada Pembuatan Crackers," Jom Faperta UR, 4(1): 1 – 12, 2017.

[48] Hildayanti, T. M., and Pangesthi, L. T., "Pengaruh Substitusi Bekatul dan Jenis Shortening terhadap Sifat Organoleptik Sus Kering," E-Journal Boga, 5(1): 20 – 39, 2017.