Jurnal Pijar MIPA
https://jurnalfkip.unram.ac.id/index.php/JPM

ISSN 1907-1744 (Print)
ISSN 2460-1500 (Online)

The Effect of Jackfruit Seed (*Artocarpus heterophyllus* Lamk) and Mung Bean (*Vigna radiata*) Composite Flour Fortification on Protein Content and Acceptability of Crackers

Ni Wayan Nadia Paramitha, Ida Ayu Putu Ary Widnyani*, I Gusti Agung Yogi Rabani RS, Putu Rima Sintyadewi, Anak Agung Ngurah Dwi Ariesta Wijaya Putra

Bachelor of Food Technology, Institute of Technology and Health Bali, Bali, Indonesia
*e-mail: idaayu.aw@gmail.com

Received: August 21, 2025. Accepted: September 26, 2025. Published: October 13, 2025

Abstract: Adequate balance of nutrient intake is crucial due to its biological functions in supporting growth and muscle formation, particularly protein. Jackfruit seeds and mung beans are high-protein raw materials with potential for incorporation into protein-enriched foods, such as crackers. The purpose of this study was to determine the effect of jackfruit seed–mung bean composite flour fortification on protein content and sensory acceptability, and to identify the optimal fortification ratio in crackers. This experimental study employed a Completely Randomized Design (CRD) with five treatments representing different wheat-to-composite flour ratios. Data were analyzed using one-way ANOVA to test for significant differences, followed by Duncan's multiple range test to identify the best treatment. Findings indicated that the highest protein content (11.13 %) was achieved in treatment P5 (50 % wheat flour: 50% composite flour). Panellists rated color at 3.93 (like), aroma at 3.56 (like), texture at 3.86 (like), taste at 3.63 (like), and overall acceptability at 3.70 (like). The optimal fortification ratio was identified as P2 (80 % wheat flour: 20% composite flour). Fortification of crackers with jackfruit seed–mung bean composite flour enhances protein content and maintains favorable sensory attributes, with an 80:20 wheat-to composite flour ratio yielding the best overall results.

Keywords: Composite Flour; Crackers; Protein Content; Sensory Acceptability.

Introduction

The lifestyle of the Indonesian people today is inseparable from fast food, which serves as an alternative food consumed amidst busy activities. Consumption patterns that fail to consider nutrient intake can negatively impact health if not balanced with foods that contain essential nutrients, such as protein. Suboptimal protein intake is a cause of decreased growth in children, which can be improved by providing adequate protein intake to prevent malnutrition, such as stunting.

Stunting is a condition characterised by a linear decrease in growth rate due to long-term malnutrition, resulting from a chronic lack of nutrient intake, typically observed in children aged 24-47 months [1]. Efforts to deal with stunting in children can be carried out by organizing Supplementary Feeding (PMT) activities for toddlers with the aim of meeting nutritional needs in children, which is in accordance with the Regulation of the Minister of Health of the Republic of Indonesia Number 39 of 2016 concerning Guidelines for Implementing the Healthy Indonesia Program with a Family Approach to organize Toddler Feeding activities. One of the toddler feeding options that can be given is high-protein crackers [2].

Crackers are snack foods in the form of biscuits, which are manufactured with or without a fermentation process through a lamination process to produce a flat shape. If broken, they have a multi-layered appearance [3]. Based on the BPOM regulation of 2022 concerning the Supervision of Claims on Labels and Advertising of Processed Food, it states that foods with high protein claims require a high or rich nutrient content of not less than 35% of the Nutrition Label Reference per 100 g in solid form [4]. Increasing the nutritional value of protein can be achieved by fortifying food ingredients with high protein content, such as jackfruit seeds and mung beans.

Jackfruit seeds are a part of the jackfruit that is rarely utilised optimally. According to BPS data in 2023 [5], jackfruit production in Indonesia reached 7,891,997 tons, with the nutritional content of jackfruit seeds per 100 g being 72.09 g carbohydrate, 13.72 g protein, 2.13 g crude fibre, 1.60 g fat, 9.86 g water, and 2.27 g ash [6]. To increase the protein content and also balance the texture of crackers, food ingredients that can be composited with jackfruit seed flour can be added, one of which is mung beans.

Mung beans (*Vigna radiata*) are a type of cultivated plant that has benefits as a food source. Mung beans are a food with a source of vegetable protein with a protein content of 22.9% and contain mineral sources such as calcium and phosphorus [7]. The utilization of jackfruit seed flour and mung bean flour can be optimized to increase economic value, as well as fortification of nutritional value, especially protein, with alternative high-protein snacks as an effort to prevent stunting in the form of crackers.

The development of crackers in this study, utilising composite flour fortification from jackfruit seeds and mung beans, aims to increase the protein content in crackers in accordance with the requirements of high-protein food

How to Cite:
Paramita, N. W. N., Widnyani, I. A. P. A., Rabani RS, I. G. A. Y., Sintyadewi, P. R., & Putra, A. A. N. D. A. W. (2025). The Effect of Jackfruit Seed (Artocarpus heterophyllus Lamk) and Mung Bean (Vigna radiata) Composite Flour Fortification on Protein Content and Acceptability of Crackers. *Jurnal Pijar Mipa*, *20*(6), 1158–1163. https://doi.org/10.29303/jpm.v20i6.10021

claims and to determine the level of consumer preference for these crackers. It is expected that the treatment will be able to increase the protein content of crackers as a supporting action for the stunting prevention program by fortifying composite flour from jackfruit seeds and mung beans.

Research Methods

This research was conducted at the Food Processing Laboratory, Faculty of Technology, Bali Institute of Technology and Health and the Integrated Services Laboratory of Udayana University in March-May 2025 with a Complete Randomized Design (CRD) research design of 6 treatments, namely P0 (100% wheat flour : 0% composite flour), P1 (90% wheat flour: 10% composite flour), P2 (80% wheat flour: 20% composite flour), P3 (70% wheat flour: 30% composite flour), P4 (60% wheat flour: 40% composite flour), and P5 (50% wheat flour: 50% composite flour), with each treatment repeated three times.

Tools and Materials

Processing tools used are digital scales (idealife), food dehydrator (getra), food processing machinery (fomac), oven (mitochiba MO 888), stove, pan, basin, baking sheet, knife (oxone), spatula, spoon, and baking paper. Tools used for protein analysis are analytical scales, Kjeldahl tubes, distillation devices, and Erlenmeyer flasks. The tool used for sensory testing (hedonic) is 30 30-sheet panellist questionnaire form.

The ingredients are wheat flour (Blue Key), jackfruit seeds, mung beans, powdered sugar (Rose Brand), salt (Dolphin), margarine (Blue Band), butter (Anchor), skim milk (Greenfields), baking powder (Rajawali), and mineral water. Materials used in protein analysis (Kjeldahl) are ½ Kjeldahl tablet (containing K2SO4 and CuSO4) and 15 ml concentrated sulfuric acid, 25 ml distilled water, NaOH 40%, and HCl 0.1 N. Materials used for sensory testing (hedonic) are 6 cracker samples from each treatment, mineral water, and a snack complement.

Modified Jackfruit Seed Flour

The first step is to produce jackfruit seed flour from high-quality jackfruit seeds. Jackfruit seeds are steamed for 30 minutes until soft. The next step is to peel the outer skin and epidermis of the jackfruit seeds until they are clean. The seeds are then thinly sliced with a size of ± 3.5 mm. The sliced jackfruit seeds are then dried at 80 ºC in a food dehydrator for 5 hours. The dried jackfruit seed slices are then ground into a fine flour using food processing machinery and subsequently sifted [8].

Mung Bean Flour

Mung bean seeds are sorted. Cleaned mung beans are then dried with a food dehydrator for 3 hours at 65 °C. The dried mung beans are then pulverized using food processing machinery until smooth, then sieved with a sieve [9].

Composite Flour

Jackfruit seed flour and mung bean flour were prepared. The ratio of jackfruit seed flour and mung bean flour is 1:1. Jackfruit seed flour and mung bean flour were homogenized and sieved.

Crackers

Preparation of mixture 1: skim milk, water and salt were stirred in a bowl until homogeneous. Furthermore, the mixture of wheat flour and composite flour, powdered sugar, baking powder, margarine, and butter is stirred until homogeneous. Combine mixture 1 and mixture 2, then knead by hand until smooth. The next process is to ferment the dough for 30 minutes covered with a cloth. The next step is to roll out the dough using a rolling pin and cut it into rectangles that are 4 cm long, 5 cm wide, and 1 mm thick. The dough is baked at 170 °C for 10 minutes, then cooled for 5 minutes at room temperature [10,11].

Protein Content

The tests carried out in this study include protein content testing (Kjeldahl) using the AOAC standard method (2005).

Sensory Test

Sensory testing used the hedonic method or panellists' preference level based on the parameters of taste, aroma, texture, and overall acceptance [12], [13], [29]. The hedonic test rating scale is shown in Table 1. The hedonic test was conducted using 30 untrained panellists, as specified in Table 2.

Table 1. Hedonic Rating Scale

Parameters	Scale
Color	1. Strongly dislike
Aroma	2. Dislike
Texture	3. Slightly dislike
Taste	4. Like
Overall acceptance	5. Strongly like

Table 2. Panelist Sepsifications

Panelist Spesifications
Institute of Technology and Health Bali
Aged 18-25 years
Male & female
Various majors at the Institute of Technology and Health in Bali
Good health

Analyze

The research data on each test were then analyzed using the Statistical Program for Social Science (SPSS) using ANOVA, namely checking the normality of the data and then testing the Duncan test at the 95% confidence level ($\alpha = 0.05$).

Results and Discussion

Protein Content

Based on the results of the ANOVA test, it was found that the treatment had a highly significant effect on the protein content of crackers ($P < 0.01$). The protein content of crackers ranged from 6.85% to 11.13%. The average results of three replicates of protein content testing are presented in Table 3.

Table 3. Protein Content Test Results

Sampel	Average Protein Content (%)
P0	6.85^{d}
P1	8.12^{c}
P2	8.57^{c}
P3	9.86^{b}
P4	10.14^{b}
P5	11.13^{a*}

Note: Different notations indicate a significant difference between treatments.

The data in Table 1 shows that the highest protein content of crackers with composite flour was produced in treatment P5, which amounted to 11.13% and the lowest protein content was produced in treatment P1, which amounted to 6.85%. Referring to the quality requirements for protein content published by SNI 01-2973-2011, which stipulates a minimum of 5%, this study demonstrates that the protein content of crackers with the addition of composite flour made from jackfruit seeds and mung beans meets the established requirements [3]. This indicates that the higher the addition of composite flour made from jackfruit seeds and mung beans, the higher the protein levels in the crackers.

Based on the BPOM regulation of 2022 concerning Supervision of Claims on Labels and Advertising of Processed Food on high protein food claims [4], it has a requirement of high/rich nutrients of not less than 35% of the Nutrition Label Reference per 100 g in solid form, which in this study with crackers products the highest protein content was 11.13%, so it did not meet the requirements of high/rich protein levels in accordance with BPOM regulations on high protein food claims.

On vegetable sausage products made from jackfruit seeds and mung beans stated that protein levels increased as the concentration of jackfruit seeds and mung beans increased [14]. This is in line with the research of Hasnita et al (2021) [15] on chicken meatball products with the addition of jackfruit seed flour, which produced the highest protein content of 9.40% in the treatment of 100 g jackfruit seed flour: 100 g chicken meat. This is directly proportional to the increase in protein content of jackfruit seed and mung bean composite flour crackers, as observed in the P0-P5 treatments, ranging from 6.85% to 11.13%. Protein plays a role in supporting various biological functions of the body, such as growth, development, muscle formation, red blood cell production, and is a major component in the immune system and other tissue synthesis. Protein consumed is not directly used by the body, but rather processed during digestion into simpler forms known as amino acids. These amino acids are then absorbed by the body and distributed to vorious tissues or organs that require them, subsequently reforming into protein that plays a role in tissue and muscle formation [30].

Sensory Test (Hedonic)

Based on the results of the ANOVA test, the treatment showed a very significant effect on color and overall attributes ($P < 0.01$), the treatment had a significant effect on texture and taste attributes ($P < 0.05$), but had no significant effect on aroma attributes ($P>0.05$), which can be seen in Table 4.

Table 4. Sensory Test Result

Sample	Average Sensory Test (%)				
	Color	Aroma	Texture	Taste	Overall
P0	3.46^{b}	3.43^{a}	3.86^{a*}	3.16^{bc}	3.30^{bc}
P1	3.93^{a*}	3.56^{a*}	3.16^{b}	3.36^{a}	3.63^{ab}
P2	3.73^{ab}	3.56^{a*}	3.86^{a*}	3.63^{a*}	3.70^{a*}
P3	3.70^{ab}	3.20^{ab}	3.20^{b}	3.30^{ab}	3.60^{ab}
P4	3.33^{b}	3.20^{ab}	3.10^{b}	2.76^{c}	3.10^{c}
P5	2.66^{c}	2.80^{b}	3.16^{b}	2.83^{bc}	2.73^{d}

Color

The results of sensory testing on the color parameters of crackers products with composite flour of jackfruit seeds and mung beans resulted in treatment P1 with the highest mean value, significantly different from the other treatments. P2 and P3 treatments are not significantly different from P0, P1, or P4 because they have the same notation. Treatments P0 and P4 have notations that are not significantly different from each other, but significantly different from P1. Meanwhile, P5 has the lowest mean value and is significantly different from all other treatments.

In the color sensory parameter, panellists preferred crackers with bright colors compared to darker colors. The use of composite flour of jackfruit seeds and mung beans with high protein content causes the color of each addition of composite flour to darken, which can be caused by the maillard reaction [16].

The Maillard reaction is a browning reaction that occurs between carbohydrates, especially reducing sugars (such as aldoses and ketoses), and primary amine groups, including amino acids, proteins, and other compounds containing amine groups, one of which is found in beans [17], [18]. In mung beans, there is an amino group of lysine, which is an amino acid for protein biosynthesis that cannot be produced by body metabolism and is obtained through food intake [19].

Aroma

The aroma parameter of crackers with composite flour of jackfruit seeds and peanuts with formulations that are not significantly different in the P1 and P2 treatments, with the same notation. It also shows that the highest average value is obtained by treatments P1 and P2, followed by P0, P3, and P4, while the lowest value is found in treatment P5. The ANOVA test results showed that the treatment of the proportion of composite flour made from jackfruit seeds and mung beans did not significantly affect the aroma parameter of the crackers ($P > 0.05$).

The proportion of composite flour addition made the crackers less preferred by the panellists. The cause of the decrease in the level of panellist liking in the aroma parameter of crackers leads to the languid aroma of mung

bean aroma caused by the activity of the lipoxygenase enzyme, which causes the languid aroma or beany flavour [20]. This is in accordance with the research of Irmae et al. (2018). The addition of mung bean flour to nastar resulted in a decrease in the assessment of panellists' aroma parameters for nastar products [21]. This statement aligns with the research of Ponelo et al. (2022) on French baguette bread products with the addition of mung bean flour, specifically in the aroma parameter, which is less favoured by panellists due to the distinctive aroma of mung beans [22].

Texture

The results of the texture parameter sensory test on jackfruit seed and mung bean composite flour crackers showed that the formulations with the highest acceptance level were P0 and P2, which were significantly different from the other treatments. Treatments P1, P3, P4, and P5 have lower average values and are not significantly different from each other, which is indicated by the same notation. The results of the ANOVA test showed that the treatment with the proportion of composite flour made from jackfruit seeds and mung beans had a significant effect on the texture parameter of crackers ($P < 0.05$).

Any increase in the formulation of jackfruit seed and mung bean composite flour gives a cracker texture that is quite easily broken (brittle). The higher the formulation of composite flour addition of jackfruit seeds and mung beans will produce brittle crackers. This is supported by the research of Adiliah et al. (2023) on the texture parameters of jackfruit seed flour biscuit products with 75% and 100% treatment, which are rather easy to break, which is influenced by the starch content of jackfruit seed flour with an amylose content of 47.60% [23].

The crumbly texture of crackers in increased composite flour formulations is caused by gluten that is not present in jackfruit seed flour, so that it cannot bind water optimally [24]. Gluten is commonly used as a structure builder and water binder in products that form elastic, extensible, and soft textures [25]. The gluten content, which is not present in jackfruit seed flour and mung bean flour, causes the elasticity of the crackers' dough to be suboptimal, resulting in crackers that are not sturdy. This finding aligns with the research of Normilawati et al. (2019), which suggests that high-protein biscuits may produce biscuits that are not sturdy [26].

Taste

The results of the sensory test of flavor parameters on jackfruit seed and mung bean composite flour crackers showed that the formulation with the best acceptance level was P2, with a value of 3.63. The P1 and P3 treatments were not significantly different from P2; however, the results obtained were higher than those of the P0 and P5 treatments. The P4 treatment had the lowest value and was significantly different compared to the other treatments. The ANOVA test results showed that the treatment of the proportion of composite flour of jackfruit seeds and mung beans on the flavor parameter had a significant effect on the taste of crackers ($P <0.05$).

Increasing the formulation of jackfruit seed and mung bean composite flour is increasingly disliked by panellists. This is due to the increased formulation of composite flour from jackfruit seeds and mung beans, which produces a taste that tends to be bitter, caused by the Maillard reaction during the baking of crackers. The bitter taste that arises is due to the chemical components in the ingredients used, which contain amino acids, sugars, and aromatic compounds that trigger the Maillard reaction, affecting the taste and inducing bitterness [27].

Overall

The results of the overall sensory test on jackfruit seed and mung bean composite flour crackers showed that the formulation with the best acceptance level was P2, with a value of 3.70, indicating the highest value and being significantly different from the other treatments. P1 and P3 treatments are not significantly different from P2 but are higher than P0. Treatments P4 and P5 had the lowest scores, with P5 being the treatment with the lowest overall rating. The results of the ANOVA test showed that the treatment with the proportion of composite flour from jackfruit seeds and mung beans had a significant effect on the overall parameter, affecting the texture of crackers ($P < 0.01$).

Assessment of overall parameters is based on color, aroma, taste, and texture attributes [28]. In this study, panellists tended to like crackers with bright colors, aromas that were not too strong, flavors that were not bitter, and textures that were quite crunchy. This can be seen in Table 2.2, which shows that panellists liked crackers with the highest score, namely in formulation P2.

Conclusion

Based on the results of this study, the addition of composite flour made from jackfruit seeds and mung beans has a significant effect on protein content ($P < 0.01$), with the highest protein content of 11.13% in treatment P5. Fortification of jackfruit seed and mung bean composite flour has a significant effect on the level of panellists' liking for crackers, especially in the parameters of color, texture, taste, and overall, which have a very significant effect ($P <0.01$), but does not have a significant effect on the aroma parameter ($P>0.05$). Based on the matrix table, the best proportion of the addition of wheat flour and composite flour of jackfruit seeds and mung beans in crackers is P2 (80% wheat flour: 20% composite flour of jackfruit seeds and mung beans), which produces a high enough protein content of 8.57% and is the most preferred crackers formulation by panellists.

Author's Contributions

N. W. N. Paramitha: carried out the experimental design, formulated the composite flour crackers, collected the data, and drafted the manuscript. I. A. P. A. Widnyani: methodological framework and performed the final revision of the manuscript. I. G. A. Y. Rabani RS. contributed to statistical analysis and interpretation of protein content results. P. R. Sintyadewi & A. A. N. D. A. W. Putra: assisted with sensory evaluation and laboratory analysis.

Acknowledgements

Thank you to the lecturers and staff of the Institute of Technology and Health Bali, as well as family, friends, and

others who contributed to the preparation and completion of this article.

References

[1] D. Swarinastiti, G. Hardaningsih, and R. Pratiwi, "Dominasi Asupan Protein Nabati Sebagai Faktor Risiko Stunting Anak Usia 2–4 Tahun," *Jurnal Kedokteran Diponegoro*, vol. 7, no. 2, pp. 1470–1483, 2018, doi: 10.14710/dmj.v7i2.21465.

[2] Permenkes RI, *Pedoman Penyelenggaraan Program Indonesia Sehat dengan Pendekatan Keluarga*. Jakarta: Menteri Kesehatan Republik Indonesia, 2016.

[3] Badan Standardisasi Nasional, *Biskuit (SNI 2973:2011)*. Jakarta: Badan Standardisasi Nasional Indonesia, 2011.

[4] BPOM, *Pengawasan Klaim Pada Label dan Iklan Pangan Olahan*. Jakarta: Badan Pengawas Obat dan Makanan Republik Indonesia, 2022.

[5] Badan Pusat Statistik, *Produksi Buah-buahan dan Sayuran Menurut Jenis Tanaman Menurut Provinsi*. Jakarta: BPS, 2023.

[6] D. D. Kusumawati, B. S. Amanto, and D. R. Muhammad, "Pengaruh Perlakuan Pendahuluan dan Suhu Pengeringan terhadap Sifat Fisik, Kimia, dan Sensori Tepung Biji Nangka (Artocarpus heterophyllus)," *Jurnal Teknosains Pangan*, vol. 1, no. 1, pp. 41–48, 2012. [Online]. Available: https://jurnal.uns.ac.id/teknosains-pangan/article/view/4184/3604

[7] S. Yanti, N. Wahyuni, and H. P. Hastuti, "Pengaruh Penambahan Tepung Kacang Hijau terhadap Karakteristik Bolu Kukus Berbahan Dasar Tepung Ubi Kayu (Manihot esculenta)," *Jurnal Tambora*, vol. 3, no. 3, pp. 1–10, 2019, doi: 10.36761/jt.v3i3.388.

[8] Mukarramah, N. Mestawaty, M. Nurdin, and Lilies, "Analisis Kadar Karbohidrat Tepung Biji Nangka (Artocarpus heterophyllus) sebagai Makanan Tambahan," *Journal of Biology Science and Education*, vol. 9, no. 1, pp. 711–714, 2021, doi: 10.22487/jbse.v9i1.1658.

[9] M. Isyanti, "Pemanfaatan Tepung Kacang Hijau (Vigna radiata) Sebagai Sumber Protein pada Pembuatan Opak Ketan Khas Tasikmalaya, Jawa Barat," in *Proc. Seminar Nasional Pengabdian kepada Masyarakat*, 2021, pp. 1–10. [Online]. Available: https://journal.unj.ac.id/unj/index.php/snppm/article/view/25605

[10] Ulyarti and J. Capriola, "The Characterization of Jackfruit Seed Flour and Its Application for Crackers," *Journal of Bio & Geo Material and Energy*, vol. 2, no. 2, pp. 52–59, 2022, doi: 10.22437/bigme.v2i2.31785.

[11] P. Picauly and G. Tetelepta, "Uji Organoleptik Crackers Pisang Tongka Langit," *Jurnal Teknologi Pertanian*, vol. 5, no. 2, pp. 53–57, 2016, doi: 10.30598/jagritekno.2016.5.2.53.

[12] AOAC, *Official Method of Analysis of the Association of Official Analytical Chemists*, Washington, D.C.: Benjamin Franklin Station, 2005.

[13] F. Jamila, F. Nugraheni, and T. F. Khoir, "Pengaruh Substitusi Tepung Kacang Hijau terhadap Daya Terima dan Kadar Protein pada Kastengel sebagai Salah Satu Kudapan Alternatif Stunting," *Jurnal Ilmiah Global Education*, vol. 4, no. 2, pp. 1079–1083, 2023, doi: 10.55681/jige.v4i2.937.

[14] K. Mufarikha, M. A. Swasono, and D. Utomo, "Pengaruh Proporsi Biji Nangka (Artocarpus heterophyllus L.) dan Kacang Hijau (Phaseolus radiatus L.) pada Pembuatan Sosis Nabati," *Teknologi Pangan: Media Informasi dan Komunikasi Ilmiah Teknologi Pertanian*, vol. 12, no. 1, pp. 140–153, 2021, doi: 10.35891/tp.v12i1.2467.

[15] Hasnita, H. Husain, and Jusniar, "Pengaruh Penambahan Tepung Biji Nangka (Artocarpus heterophyllus Lamk.) sebagai Substitusi Tepung Tapioka terhadap Mutu Bakso Daging Ayam," *Jurnal Chemica*, vol. 22, no. 2, pp. 1–11, 2021, doi: 10.35580/chemica.v22i2.26202.

[16] N. I. Azzahrah, *Formulasi Pembuatan Biskuit Berbahan Baku Uwi Ungu (Dioscorea alata), Rumput Laut (Eucheuma cottonii), dan Tempe Kedelai (Glycine max)*, Skripsi, Universitas Hasanuddin, Makassar, 2021.

[17] M. A. Ridhani *et al.*, "Potensi Penambahan Berbagai Jenis Gula terhadap Sifat Sensori dan Fisikokimia Roti Manis: Review," *Pasundan Food Technology Journal*, vol. 8, no. 3, pp. 61–68, 2021, doi: 10.23969/pftj.v8i3.4106.

[18] B. A. Seno and K. B. Lewerissa, "Richovy Snack Bar: Pengembangan Produk Snack Bar Berbasis Rengginang di UMKM Varia Surakarta," *Jurnal Ilmu Pengetahuan, Teknologi, dan Seni bagi Masyarakat*, vol. 10, no. 2, pp. 90–96, 2021, doi: 10.20961/semar.v10i2.49333.

[19] N. Hidayah and N. Herdyastuti, "Review Artikel: Teknologi Fermentasi L-Lisin dan Aplikasinya Sebagai Bahan Aditif Pakan," *UNESA Journal of Chemistry*, vol. 12, no. 3, pp. 89–99, 2023, doi: 10.26740/ujc.v12n3.p89-99.

[20] A. N. Kamilia and Rindiani, "Cookies 'Fibite' Tepung Kelapa dan Tepung Kacang Hijau sebagai Makanan Selingan Sumber Serat bagi Penderita Obesitas," in *Proc. National Conference on Innovative Agriculture*, 2023, pp. 196–213. [Online]. Available: https://ocs.polije.ac.id/index.php/pnacia/article/view/78

[21] T. Irmae, N. Tifauzah, and R. Oktasari, "Variasi Campuran Tepung Terigu dan Tepung Kacang Hijau pada Pembuatan Nastar Kacang Hijau (Phaseolus radiatus) Memperbaiki Sifat Fisik dan Organoleptik," *Jurnal Nutrisia*, vol. 20, no. 2, pp. 77–82, 2018, doi: 10.29238/jnutri.v20i2.12.

[22] S. S. Ponelo, Y. Bait, and L. Ahmad, "Pengaruh Penambahan Tepung Kacang Hijau Termodifikasi Annealing terhadap Karakteristik Fisik, Kimia, dan Organoleptik Roti French Baguette," *Journal of Food Technology*, vol. 4, no. 2, pp. 185–197, 2022, doi: 10.37905/jjft.v4i2.15663.

[23] A. Adiliah, I. Rahmadi, and Z. A. Talitha, "Karakteristik Organoleptik dan Fisikokimia Biskuit dengan Berbagai Substitusi Tepung Biji Nangka (Artocarpus heterophyllus Lam.)," *Communication in Food Science & Technology*, vol. 2, no. 1, pp. 30–44, 2023, doi: 10.30867/gikes.v5i3A.1438.

[24] H. E. Hamzah, Ansharullah, and Hermanto, "Penggunaan Tepung Biji Nangka (Artocarpus heterophyllus) dengan Penambahan Sari Daun Pandan (Pandanus amaryllfolius) terhadap Kualitas Produk Mie Basah," *Jurnal Sains dan Teknologi Pangan*, vol. 5, no. 2, pp. 2717–2725, 2020.

[25] T. W. Ramadhan, L. Sulandri, N. Astuti, and I. Huda, "Proporsi Gluten dan Tepung Kacang Hijau (Vigna radiata L.) pada Pembuatan Daging Tiruan (Meat Analog) Ditinjau dari Sifat Organoleptik," *Student Research Journal*, vol. 2, no. 4, pp. 249–261, 2024, doi: 10.55606/srjyappi.v2i4.1392.

[26] Normilawati, Fadliturrahmah, S. Hadi, and Normaidah, "Penetapan Kadar Air dan Kadar Protein pada Biskuit yang Beredar di Pasar Banjarbaru," *Jurnal Ilmu Farmasi*, vol. 10, no. 2, pp. 51–55, 2019, doi: 10.61902/cerata.v10i2.77.

[27] S. Cicilia *et al.*, "Sifat Fisik dan Daya Terima Cookies dari Tepung Biji Nangka Dimodifikasi," *Jurnal Ilmiah Kimia dan Pendidikan Kimia*, pp. 612–621, 2021. [Online]. Available: https://jurnal.lppm.unram.ac.id/index.php/prosidingsaintek/article/view/264/263

[28] Nadimin, Sirajuddin, and N. Fitriani, "Mutu Organoleptik Cookies dengan Penambahan Tepung Bekatul dan Ikan Kembung," *Jurnal Media Gizi Pangan*, vol. 26, no. 1, pp. 8–15, 2019, doi: 10.32382/mgp.v26i1.991.

[29] D. P. Sari, R. Nopianti, and A. Baehaki, "Karakteristik Sensori dan Fisiko-Kimia Crackers dengan Penambahan Tepung Ikan Sepat Siam (Trichogaster pectoralis)," *Jurnal Teknologi Hasil Perikanan*, vol. 6, no. 2, pp. 115–125, 2017, doi: 10.36706/FISHTECH.V6I2.5843.

[30] D. F. Khotimah, U. N. Faizah, and T. Sayekti, "Protein sebagai Zat Penyusun dalam Tubuh Manusia: Tinjauan Sumber Protein Menuju Sel," in *Proc. Integrative Science Education Seminar*, vol. 1, no. 1, 2021. [Online]. Available: https://prosiding.iainponorogo.ac.id/index.php/piscces/article/view/117