G-Tech : Jurnal Teknologi Terapan
Vol. 9, No. 2, 2025, p. 667-674
E-ISSN: 2623-064X | P-ISSN: 2580-8737

Development of Low-Fat Sambal Pecel Powder with Combination of Red Kidney Bean, Cowpea and Mung Bean Substitutions

Lathifah Kusuma Wardani [1], Hevenia Arma [2], Zeni Kurnia [3], Reza Widyasaputra[4]✉

[1, 2, 3, 4] Teknologi Hasil Pertanian, Fakultas Teknologi Pertanian, Institut Pertanian STIPER Yogyakarta, Indonesia

✉ **Corresponding Author :** Reza Widyasaputra (e-mail: rezasaputra73@gmail.com)

Article Information

Article History

Received : January 30, 2025
Revised : February 27, 2025
Published : April 04, 2025

***Keywords*:**

Powder;
Peanut;
Sambal Pecel.

ABSTRACT

Sambal pecel powder is one of the food innovations of sambal pecel paste which is made into powder through drying process. The purpose of this study was to determine the type of substitute peanuts and its comparison with peanuts that can produce chili powder with the lowest fat content and the best organoleptic characteristics. The factors of the research were substitution of cowpea, red kidney bean, and mung bean and their ratios were 30:70, 40:60, and 50:50. From 9 samples with 3 different types of peanut and different comparisons, it was found that sambal pecel powder with a combination of mung bean substitution and the ratio (40:60) produced sambal pecel with the lowest fat content. Sambal pecel powder with a combination of mung bean substitution gave good results in terms of all the analysis performed, but for organoleptic results, sambal pecel powder with a combination of kidney bean substitution was most liked by panelists. Mung bean powder has another potential to be used as a substitute ingredient because it contains higher protein than kidney bean and cowpea.

INTRODUCTION

Bean also known as legumes, belong to the leguminous family and are widely grown throughout Indonesia. Legumes contain significant amounts of dietary fiber, protein, folate, complex carbohydrates, and iron. Various types of legumes have been widely recognized such as red kidney bean (*Phaseoulus vulgaris*), mung bean (*Phaseoulus radiatus*), peanuts (*Arachis hypogaea*) and others. Various types of bean can be distinguished by their variety or name, color, shape, and physical characteristics (Al Rivan et al., 2020). Bean such as kidney bean, cowpea and mung bean are easily found in the market but are still rarely utilized. Some types of bean have good quality if utilized in the right way, one of which is by substituting them into processed pecel sauce.

In the food industry, red kidney bean can be utilized as tempeh, which is a fermented product native to Indonesia. Red kidney bean has a protein content of 23.75% wet weight and protein digestibility of 87.1% (Kusnandar et al., 2021). Mung bean are widely processed into various food products such as cakes, porridge, and drinks because they have high protein and fiber content (Ratnasari et al., 2021). Cowpea flour can be an alternative to ready-to-eat cereal-like foods that are high in calcium and protein (Iswahyudi et al., 2022).

Indonesia has various types of food from various regions throughout Indonesia, one of which is pecel. Pecel is a typical Javanese food that contains boiled vegetables and in serving it is added with sambal pecel made from peanuts (Azizah et al., 2019). Sambal pecel is also made with other additional ingredients such as chili, brown sugar, garlic, lime leaves, tamarind and salt.

This is an open access article under the CC BY license

Sambal pecel has a spicy, savory and sweet taste. Sambal pecel has a distinctive taste from a combination of savory, sweet, and spicy flavors, making it popular among the public (Hasanah et al., 2023).

However, sambal pecel on the market to date is usually produced in paste form and takes a long time if dissolved using cold water or iasa so hot water is usually used. In addition, the high oil content in sambal pecel paste so that it can dirty the place or hand when carried (Zhorif et al., 2023). In addition, sambal pecel has a long shelf life if packaged properly. Based on research Haeral et al., (2023) tested the resistance of pecel seasoning to mold growth by comparing packaged and unpackaged pecel seasoning for two weeks. The results obtained were that unpackaged pecel seasoning experienced more changes in color, scent, and taste as well as mold growth compared to packaged pecel seasoning.

In general, sambal pecel can be stored for about 1 month at room temperature. The main problem of this panga material is rancidity, because the main ingredient for making this sauce is peanuts. The fat content in peanuts reaches 42.7gr. Therefore, to increase the shelf life of chili sauce pecel, it is necessary to substitute with other types of nuts that have equivalent nutrition but lower fat content (Syafira & Wibisono, 2023). Sambal pecel has a lot of interest in various regions in Indonesia so that it can create more innovations related to the processing of sambal pecel in terms of taste and packaging (Vinsensius Widdy Tri Prasetyo, 2023).

Based on the background that has been mentioned, research has been conducted on the development of low-fat sambal pecel powder using substitutions of red kidney bean, cowpea, and mung bean with the aim of knowing the type of substitute bean and their comparison with peanuts that can produce sambal pecel powder with the lowest fat content and the best organoleptic characteristics. The method used is to produce sambal pecel that has been substituted between peanuts with kidney bean, cowpea, and mung bean. The results of sambal pecel production will be analyzed physically and chemically.

RESEARCH METHODS

The ingredients used in the making of this chili pecel powder are peanuts substituted with mung bean, red kidney bean and cowpea, brown sugar, tamarind, cayenne pepper, curly chili, orange leaves, kencur, salt, and maltodextrin. Materials used for analysis include distilled water, n-hexane, filter paper. This study used a factorial Complete Block Design (CBD), with two factors. Factor I was peanut type and peanut ratio (A) with three levels (A1=peanut and cowpea, A2=peanut and kidney bean, A3=peanut and mung bean). Factor II is the ratio of and peanut substitute (B) with three levels (B1=30:70, B2=40:60, B3=50:50). The treatment was repeated 2 times.

The process of making sambal pecel powder begins with grinding all the bean that have been roasted. Grind all the ingredients of sambal pecel until smooth then add ground peanuts and substitute peanuts that have been ground according to the type of nut ratio. The finished sambal pecel paste is added with maltodextrin as much as 10% of the total ingredients to help during the drying process (Zhorif et al., 2023). Then sambal pecel was spread thinly onto a baking sheet and baked for 7 hours at 70^0C. The parameters tested for the finished product include moisture content, ash content muffle method, fat content soxhlet method, solubility analysis, rehydration power, yield analysis, and hedonic method organoleptic test using 20 untrained panelists with a rating scale of 1 to 5.

RESULTS AND DISCUSSION

Yield

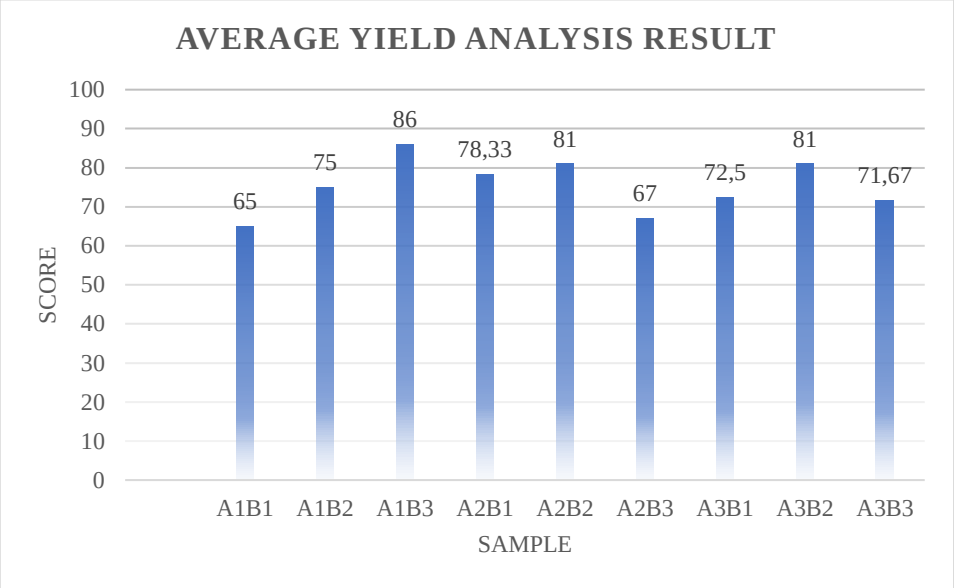

Figure 1. Graph of Yield Analysis Results

One of the important values in product manufacturing is the yield value. The yield here is the ratio of the weight of the raw material to the dry weight of the product produced (Dewatisari et al., 2018). In the analysis of the diversity of yields produced, there were significant differences based on the type of peanut and the ratio of peanuts to substitute peanuts used. The highest yield was produced in sample A1B3 with an average value of 86%. The analysis showed that the type of peanut used influenced the amount of yield produced.

Water Content

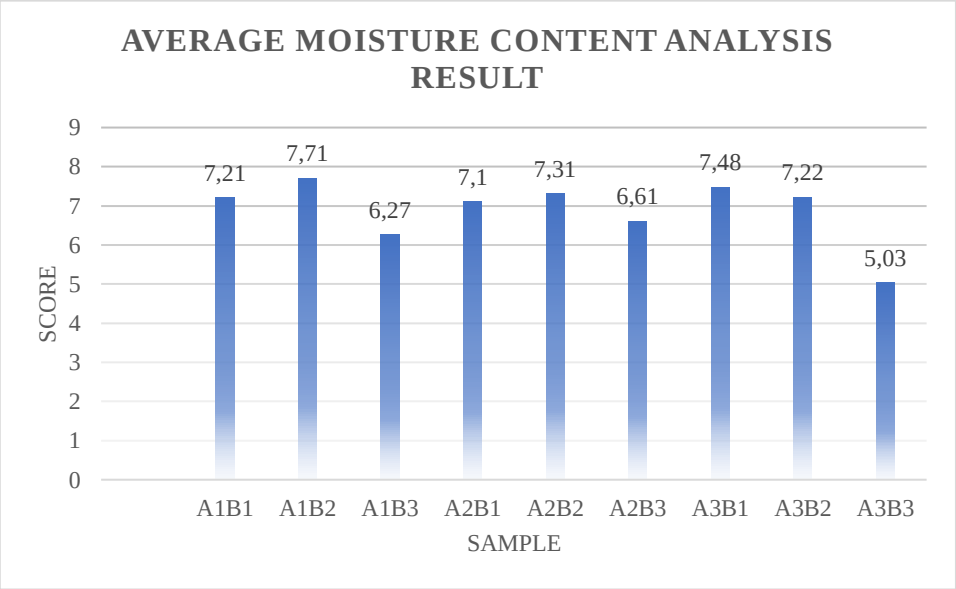

Figure 2. Graph of Moisture Content Analysis Results

In the food industry, moisture content is one of the most important tests to determine the quality and durability of a food ingredient. High moisture content will make damage more likely to occur, such as damage due to biological activity or damage due to destructive microbes (Daud et al., 2019). In the analysis of the diversity of water content produced, there is a significant difference based on the ratio of peanuts to substitute peanuts used. The graph above shows that

sample A3B3 is the sample with the lowest water content, which is an average value of 5.03% because mung bean contain less water content compared to kidney bean and cowpea, the ratio of mung bean will also affect the final result of the product's water content.

Ash Content

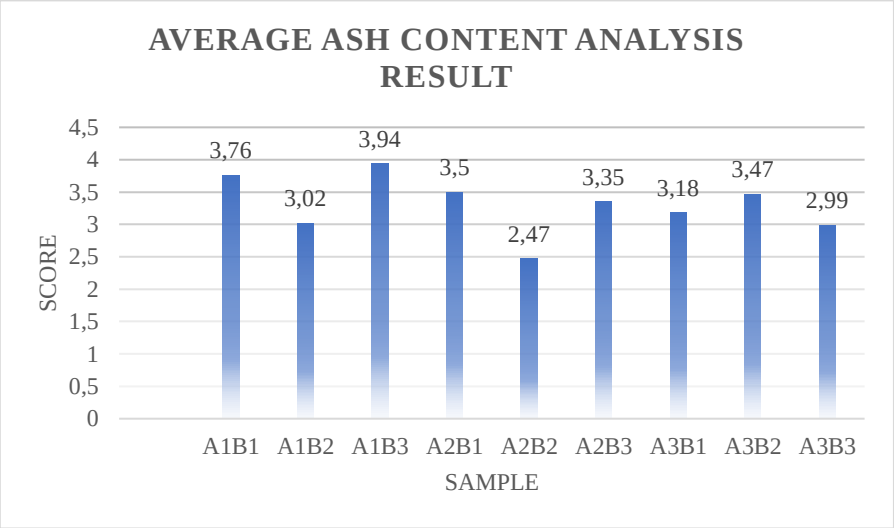

Figure 3. Graph of Ash Content Analysis Results

The combination of inorganic components, namely minerals present in foodstuffs, is called ash content. Food itself is composed of 96% organic matter and water and the rest is mineral elements. At a certain temperature, the organic components will burn while the inorganic components do not burn, which is known as ash (Ciptawati et al., 2021). In the analysis of the diversity of ash content, there was no significant difference between the samples of chili powder pecel. The ash content of the 9 samples met the quality standard requirements according to SNI 01-4228-1996 for ash content, which is below 7%, but the lowest ash content was found in sample A2B2 with an average value of 2.47% because kidney bean have a lower mineral content compared to mung bean and cowpea (Ananta et al., 2023).

Fat Content

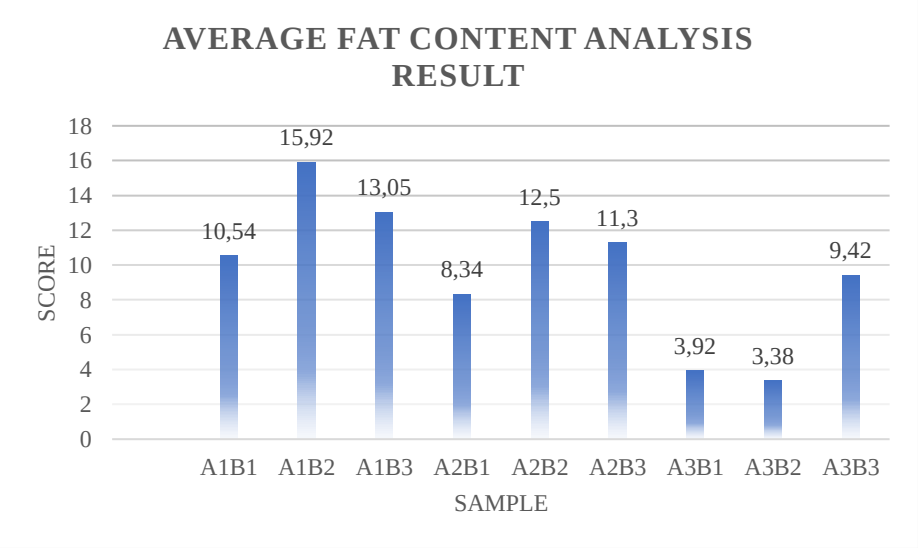

Figure 4. Graph of Fat Content Analysis Results

In the analysis of the diversity of fat content produced a very significant difference to the sample of chili powder pecel. Of the 9 samples, only 2 samples have fat content that meets the requirements of SNI 01-4228-1996, namely samples A3B1 and A3B2. Of the two samples, the

lowest fat content is owned by sample A2B2 with an average value of 3.38%. High and low fat content is influenced by the type of bean and the ratio of bean used. From the results obtained, sambal pecel using mung bean substitution has the lowest fat content because the fat content in mung bean is lower than that of kidney bean and cowpea, which is only about 1-1.2% (Sari et al., 2020). Fat content analysis aims to help calculate the total energy value in determining nutritional quality. Fat has a caloric value of 9 kcal per one gram (Pargiyanti, 2019).

Solubility

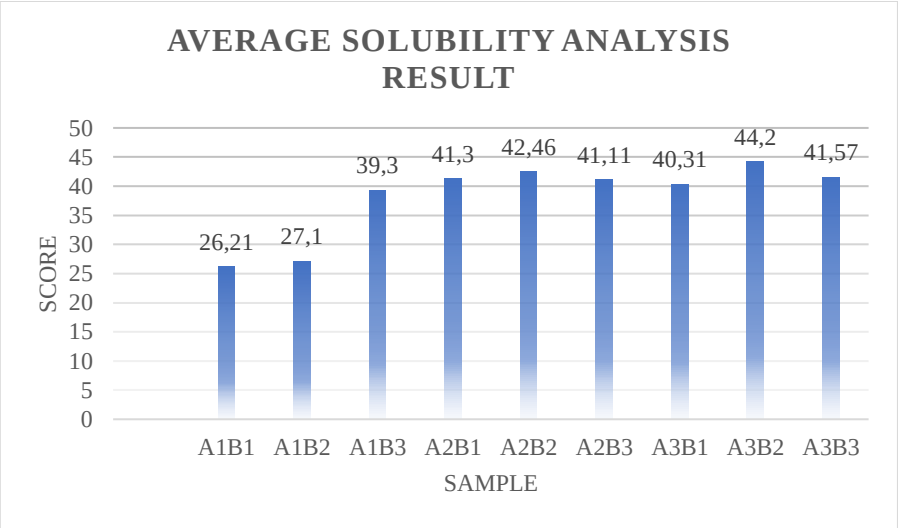

Figure 5. Graph of Solubility Analysis Results

In the analysis of the diversity of the resulting solubility provides a significant difference to the sample chili powder pecel. In the table, sambal pecel which gives the best solubility value results in sample A3B2, which is with an average value of 44.2% because mung bean contain more protein than kidney bean and cowpea, the amino acids in mung bean contribute to protein solubility (Trianto et al., 2013). Solubility analysis aims to determine how easily a material dissolves in water, so that if the solubility value is higher, the quality of the material is getting better (Hargo Saputro et al., 2015). One of the advantages of solubility analysis with the gravimetric method is that it does not require a comparison because the measurement is directly on the mass of the precipitate formed and has high accuracy if done correctly (Noviyanty, 2021).

Rehydration Power

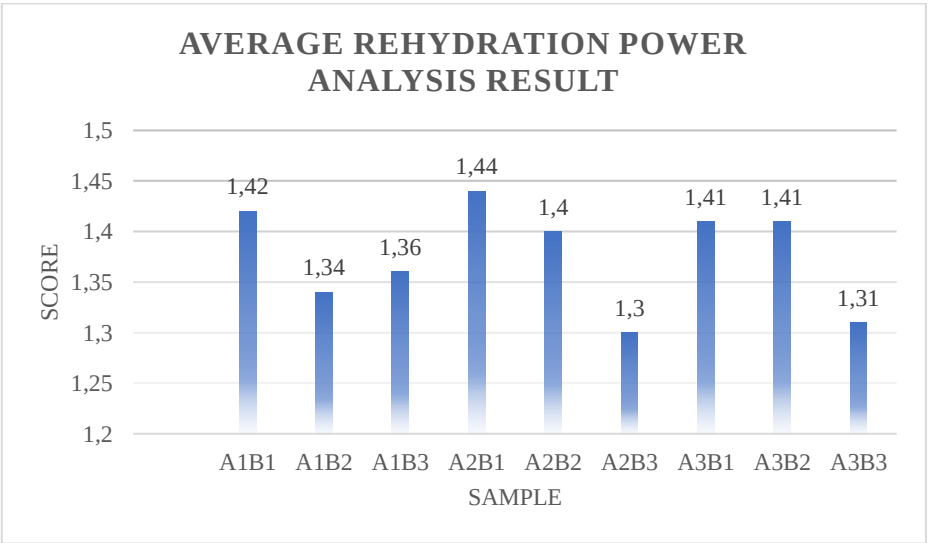

Figure 6. Graph of Rehydration Power Analysis Results

In the analysis of the diversity of rehydration power produced does not provide a significant difference to the sample chili powder pecel. The sample that has the best rehydration power is sample A2B1 with an average value of 1.44. High rehydration power indicates that the product has good quality because the easier the product absorbs water, the easier it is to serve (Zhorif et al., 2023). In the analysis results obtained sambal pecel which is substituted with red kidney bean is sambal pecel which has the highest rehydration power. This is because kidney bean have a relatively high protein content compared to other types of bean. The rehydration power of a product is influenced by its constituent components, one of which is protein because of the nature of proteins that absorb water (Tamrin & Pujilestari, 2016). In sample A2B1 has a higher rehydration power caused by a higher ratio of kidney bean and kidney bean contain high protein, this does not happen with mung bean despite having a high protein content as well, because the nature of the protein in mung bean is more hydrophobic so it is difficult to water or tends to be less able to absorb water than the protein in kidney bean which is hydrophilic (Hidayat et al., 2022).

Organoleptic Test

Table 1. Average Value of Sambal Pecel Powder

Sample	Nilai Rata-Rata Uji Hedonik			
	Scent	Color	Taste	Texture
A1B1	3,53	3,38	4,2	3,33
A1B2	3,45	3,25	4,63	3,35
A1B3	4,55	3,3	4,78	3,33
A2B1	3,43	4,38	4,23	4,33
A2B2	3,48	4,28	4,83	4,43
A2B3	4,73	4,4	4,93	4,7
A3B1	3,53	2,63	4,25	4,03
A3B2	3,6	2,65	4,65	4,15
A3B3	4,55	2,5	4,8	4,2

Scent

In the hedonic test diversity analysis of the scent produced, the type of peanut used does not provide a significant difference to the sample of chili pecel powder, but the ratio of peanuts to substitute peanuts provides a significant difference to chili pecel powder. The sample most favored by panelists was sample A2B3 with an average value of 4.73%.

Color

In the analysis of the diversity of the hedonic test of the resulting color, the type of peanut used gave a very significant difference to the sample of chili powder pecel, while the comparison of peanuts with peanut substitutes did not give a significant difference. The sample most favored by panelists was sample A2B3 with an average value of 4.40%.

Taste

In the hedonic test diversity analysis, the resulting flavor gives a significant difference to the sample of chili powder pecel. The sample most favored by panelists was sample A2B3 with an average value of 4.93%.

Texture

In the analysis of the diversity of the hedonic test, the resulting texture gives a very significant difference to the sample of chili powder pecel. The sample most favored by panelists was sample A2B3 with an average value of 4.70%. The texture of an ingredient is an important parameter that needs to be considered in food quality. One of the factors that affect texture liking is the moisture content contained in the food ingredient (Wibowo et al., 2018). The texture of a food can be influenced by its protein content (Ginting et al., 2018).

CONCLUSION

Based on this study, sambal pecel substituted with kidney bean, cowpea and mung bean gave a real influence on the parameters of yield, moisture content, fat content, solubility, rehydration power and hedonic organoleptic including scent, color, taste and texture of the resulting sambal pecel. Sambal pecel powder with a combination of mung bean substitution and the ratio (40:60) produces chili sauce with the lowest fat content. In addition, sambal pecel powder with a combination of mung bean substitution gave quite good results in terms of the entire analysis with results that meet the requirements of the quality standards that have been set compared to the combination of substitution with cowpea and kidney bean.

Sambal pecel powder has the potential as the latest innovation of chili processing because it has a shelf life that tends to be longer because there is a reduction in water content first compared to ordinary sambal pecel which has more water content. Recommendations for further research are to *pre-treat* the mung bean with bleaching to remove the epidermis which can affect the color appearance of the resulting chili sauce. Then at the time of drying, a constant drying temperature and drying time are needed to produce an optimal finished product. Furthermore, the analysis of protein content needs to be done to determine the number of calories contained in chili sauce powder and it is necessary to analyze the shelf life in order to know the length of time the chili sauce powder can be consumed.

ACKNOWLEDGEMENTS

We want to acknowledge and thank Institut Pertanian STIPER for their generous funding, which has greatly facilitated the progress and success of our research project.

REFERENCES

Al Rivan, M. E., Rachmat, N., & Ayustin, M. R. (2020). Klasifikasi Jenis Kacang-Kacangan Berdasarkan Tekstur Menggunakan Jaringan Syaraf Tiruan. *Jurnal Komputer Terapan*, *6*(1), 89–98. https://doi.org/10.35143/jkt.v6i1.3546

Ananta, P. R., Singamurni, I. G. A. N., & Ridawati. (2023). Pengaruh Perbandingan Kacang Merah dan Tepung Tapioka dalam Pembuatan Keripik Tempe Kacang Merah (Phaseolus Vulgaris L.) terhadap Daya Terima Konsumen dan Sifat. *Jurnal Sains Boga*, *5*(2), 100–110. https://doi.org/10.21009//jsb.005.2.03

Azizah, A. N., Setiani, B. E., & Pramono, Y. B. (2019). Sifat Organoleptik Sambal Pecel UKM Hj Sartinah Semarang Selama Masa Penyimpanan Suhu Ruang. *Jurnal Teknologi Pangan*, *3*(1), 134–141. https://doi.org/10.14710/jtp.2019.19959

Ciptawati, E., Budi Rachman, I., Oktiyani Rusdi, H., & Alvionita, M. (2021). Analisis Perbandingan Proses Pengolahan Ikan Lele terhadap Kadar Nutrisinya. *IJCA (Indonesian Journal of Chemical Analysis)*, *4*(1), 40–46. https://doi.org/10.20885/ijca.vol4.iss1.art5

Daud, A., Suriati, & Nuzulyanti. (2019). Kajian Penerapan Faktor yang Mempengaruhi Akurasi Penentuan. *Lutjanus*, *24*(2), 11–16.

Dewatisari, W. F., Rumiyanti, L., & Rakhmawati, I. (2018). Rendemen and phytochemical screening using leaf extract of Sansevieria sp. *Jurnal Penelitian Pertanian Terapan*, *17*(3), 197–202.

Ginting, Y., Setiani, B., & Hintono, A. (2018). Karakteristik Hedonik Sambal Pecel dengan Subtitusi Kacang Merah. *Jurnal Teknologi Pangan*, *2*(2), 211–214.

Haeral, U., Ridwan, A., Makmur, A. S., & Arwie, A. . D. (2023). A-faskes-review-assignment-2401-Article+Text-9422+hal.+171-176. *Jurnal Farmasi*, *1*(Kesehatan dan Sains (FASKES)), 171–176.

Hargo Saputro, D., Martina Andriani, I. M., & Siswanti. (2015). Karakteristik Sifat Fisik Dan Kimia Formulasi Tepung Kecambah Kacang-Kacangan Sebagai Bahan Minuman Fungsional Characteristics of the Physical and Chemical Properties, Antioxidant Activity

of Flour As Well As Sprouts Bean As an Ingredient of Functional D. *Jurnal Teknosains Pangan Januari Jurnal Teknosains Pangan*, *4*(1), 2302–2733.

Hasanah, U. A., Tapu, W., & Hasta, N. (2023). Pengolahan Kacang Tanah Menjadi Sambal Pecel Instan Sebagai Makanan Tambahan Untuk Paud. *Community Development Journal*, *4*(2), 2741–2748.

Hidayat, J. P., Robiandi, F., Arisalwadi, M., & Hariyadi, A. (2022). Peluang Tepung Biji Durian Sebagai Alternatif Tepung Terigu Komersial. *Journal of Agritechnology and Food Processing*, *2*(2), 54–67.

Iswahyudi, I., Khoirunissa, Y. S., & Putri, I. E. (2022). PEMANFAATAN TEPUNG KACANG TUNGGAK (Vigna unguiculata) DAN TEPUNG BIJI SAGA POHON (Adenanthera pavonina Linn) DALAM PEMBUATAN FLAKES. *ARGIPA (Arsip Gizi Dan Pangan)*, *7*(1), 80–92. https://doi.org/10.22236/argipa.v7i1.7768

Kusnandar, F., Wicaksono, A. T., Firlieyanti, A. S., & Purnomo, E. H. (2021). Prospek Pengolahan Kacang Merah (Phaseolus vulgaris L.) Dalam Bentuk Tempe Bermutu. *MANAJEMEN IKM: Jurnal Manajemen Pengembangan Industri Kecil Menengah*, *15*(1), 1–9. https://doi.org/10.29244/mikm.15.1.1-9

Noviyanty, Y. (2021). IDENTIFIKASI DAN PENETAPAN KADAR SENYAWA SAPONIN DARI EKSTRAK ETANOL BUNGA BIDURI (Calotropis Gigantea L) DENGAN METODE GRAVIMETRI. *Jurnal Ilmiah Pharmacy*, *8*(1), 136–146. https://doi.org/10.52161/jiphar.v8i1.318

Pargiyanti, P. (2019). Optimasi Waktu Ekstraksi Lemak dengan Metode Soxhlet Menggunakan Perangkat Alat Mikro Soxhlet. *Indonesian Journal of Laboratory*, *1*(2), 29. https://doi.org/10.22146/ijl.v1i2.44745

Ratnasari, D., Dewi Rahmawati, Y., Fajarini, H., & Nafisyah, D. (2021). Potensi Kacang Hijau Sebagai Makanan Alternatif Penyakit Degenaratif. *JAMU : Jurnal Abdi Masyarakat UMUS*, *1*(02), 90–96. https://doi.org/10.46772/jamu.v1i02.365

Sari, A. M., Melani, V., Novianti, A., Dewanti, L. P., & Sa'pang, M. (2020). Formulasi Dodol Tinggi Energi untuk Ibu Menyusui dari Puree Kacang Hijau (Vigna radiata l), Puree Kacang Kedelai (Glycine max), dan Buah Naga Merah (Hylocereus polyrhizus). *Jurnal Pangan Dan Gizi*, *10*(2), 49–60.

Syafira, O. D., & Wibisono, Y. (2023). Kajian Penggunaan Biji Saga Merah (Adenanthera pavonina L.) Terhadap Sifat Kimia dan Organoleptik Sambal Pecel. *JOFE : Journal of Food Engineering*, *2*(3), 134–139. https://doi.org/10.25047/jofe.v2i3.4081

Tamrin, R., & Pujilestari, S. (2016). Karakteristik Bubur Bayi Instan Berbahan Dasar Tepung Garut Dan Tepung Kacang Merah. *Jurnal Konversi*, *5*(2), 49. https://doi.org/10.24853/konversi.5.2.49-58

Trianto, Y., Sutedja, A. M., & Trisnawati, C. (2013). Karakteristik Sifat Fungsional Kacang Hijau Kukus dengan Variasi Waktu Pengukusan. *Jurnal Teknologi Pangan Dan Gizi*, *12*(2), 69–74.

Vinsensius Widdy Tri Prasetyo. (2023). Analisis Strategi Usaha Sambal Pecel Lumpang Mas Kota Madiun. *JUSTER : Jurnal Sains Dan Terapan*, *2*(1), 77–84. https://doi.org/10.57218/juster.v2i1.479

Wibowo, N., Setiani, B. E., Hintono, A., & Tanah, K. (2018). Karakteristik Hedonik Sambal Pecel Hasil Substitusi Kacang Tanah (Arachis hypogaea) dengan Kacang Hijau (Vigna Radiata L). *Jurnal Teknologi Pangan*, *2*(2), 191–197–197.

Zhorif, M. N., Rosida, R., & Sarofa, U. (2023). Pengaruh Maltodekstrin Dan Waktu Pengeringan Terhadap Sifat Sambal Pecel Bubuk Dan Pendugaan Umur Simpannya. *Jurnal Sains Dan Teknologi Pangan*, *8*(1), 5930–5944. https://doi.org/10.33772/jstp.v8i1.30916