

PHYSICOCHEMICAL AND SENSORY CHARACTERISTICS OF CRISPY ALMOND PRODUCTS WITH PUMPKIN FLOUR SUBSTITUTION

Pamela Felita Tjendra^{1*}, Yuyun Yuniati², Fadjar Kurnia Hartati³

Faculty of Food and Fisheries Technology / Dr. Soetomo University, Surabaya ^{1,2,3}

E-mail: Pamelafelita29@gmail.com¹, yuyun.yuniati@unitomo.ac.id², fadjar.kurnia@unitomo.ac.id³

Received : 01 January 2026

Accepted : 17 February 2026

Revised : 15 January 2026

Published : 28 February 2026

Abstract

Pumpkin flour has the potential to be used as a substitute for wheat flour due to its high fiber and micronutrient content. This study aims to analyze the effect of pumpkin flour substitution on the physicochemical and sensory characteristics of *almond crispy* and to determine the best formulation. The study used a single-factor Completely Randomized Design with five substitution levels (0%, 30%, 40%, 50%, and 70%) and three replications. The parameters observed included moisture content, ash content, fiber content, and organoleptic tests (color, taste, aroma, and texture). Data were analyzed using ANOVA and the *Kruskal–Wallis test*. The results showed that pumpkin flour substitution significantly affected fiber content and sensory attributes, but did not significantly affect moisture and ash content. Increasing the proportion of pumpkin flour increased fiber content but tended to decrease panelists' preference level. Based on the effectiveness test, the formulation with 70% pumpkin flour substitution produced the best combination of chemical and sensory qualities, so it has the potential to be developed as a high-fiber functional food product.

Keywords: *crispy almonds, pumpkin flour, organoleptic.*

INTRODUCTION

Almond Crispy is a popular snack and has become a popular souvenir from Surabaya (Kusuma et al., 2017). This product is generally made from wheat flour, egg whites, sugar, vanilla extract, almonds, and cheese. *Almond Crispy* is characterized by its thin shape with a soft and crunchy texture (Sartika, 2018). The addition of cheese and almond toppings provides a savory flavor while enhancing its visual appeal, making this product acceptable to various age groups. The development of the food industry is driving product innovation that focuses not only on taste but also on nutritional value, food safety, and the long-term health impacts on consumers. Increasing public awareness of healthy lifestyles, including among those with *gluten intolerance* and those on diets, demands the development of functional food products that are healthier and safer to consume (Santoso, 2021). This situation opens up opportunities to modify *Almond Crispy products* by using alternative raw materials with high nutritional value. Indonesia has abundant local food resources, including pumpkin, with a total production reaching 523,063 tons (Fauzi et al., 2017). Pumpkin is known to contain beta-carotene, vitamin B1, vitamin C, and essential minerals such as calcium, phosphorus, and potassium (Oloyede, 2016). Its relatively high carbohydrate content, at 81.45% (Quintana et al., 2018), makes pumpkin potentially suitable for processing into flour as an alternative to wheat flour. However, the use of pumpkin is still limited to traditional processed products, so diversification of its processing into flour needs to be continuously improved. The development of plant-based food products is also in line with the increasing trend of *plant-based food consumption*, which is considered healthier and has functional potential, as reported by Wibawa et al. (2025) in an effort to utilize local soybeans and tubers into mayonnaise products, especially for vegetarians. Indonesia's dependence on wheat flour as a primary raw material for the food industry contributes to the high volume of wheat imports, reaching 9.45 million tons by September 2024 (BPS, 2024). Substituting wheat flour with pumpkin flour has the potential to increase the dietary fiber and vitamin content of processed products. However, pumpkin flour's protein content is relatively low, at 7.63%, so it needs to be combined with other ingredients to produce products with a balanced nutritional composition (Toan et al., 2018). Several studies have shown that the use of pumpkin flour can improve the nutritional quality of food products while maintaining consumer acceptance. Yani et al. (2021) reported that the use of pumpkin flour in steamed *brownies* can increase the product's

carbohydrate content. Meanwhile, Rosiana (2019) stated that substituting pumpkin flour in white bread can increase vitamin A content. Other research also shows that the use of pumpkin flour can enhance the natural color and antioxidant content of food products (Putri et al., 2020). However, most previous research has focused on bread and cookie products, while studies on thin-textured bakery products such as almond crisps are relatively limited. Furthermore, research integrating physicochemical and sensory analysis to comprehensively evaluate product quality has not been widely reported. This situation indicates an opportunity to develop pumpkin flour-based products with measurable quality characteristics. Based on this description, pumpkin flour has great potential as a substitute for wheat flour in making almond crisps. Therefore, this research is important to produce *Almond Crispy products* that not only have good sensory quality but also have higher chemical quality and functional value. This study aims to evaluate the effect of pumpkin flour substitution on the physicochemical characteristics (fiber content, water content, and ash content) and organoleptic properties of crispy almonds, as well as to identify substitution formulations that can produce products with increased nutritional quality and good sensory acceptance levels.

LITERATURE REVIEW

Crispy Almonds

Almond crispy is a thin, crunchy cookie product that has a high consumer acceptance rate in Indonesia. This product falls into the *tuille category*, a cookie made from a dough based on flour, sugar, fat, and egg whites, baked to a light, crispy texture. Sensory characteristics such as taste, color, aroma, and texture are important factors in determining product quality and consumer acceptance (Aini et al., 2022; Soechan 2016; Tanod 2019). *Almond Crispy* is classified as a cookie or biscuit product. The quality of these cookies is determined by the Indonesian National Standard (SNI) 2973:2022, which establishes quality requirements based on chemical, microbiological, and sensory parameters. These parameters include moisture content, protein content, ash content, acid value, metal contamination, and sensory characteristics such as taste, aroma, color, and total plate count (BSN, 2022). The implementation of this quality standard aims to ensure food safety, quality stability, and consumer acceptance of almond crispy products.

Summer squash

Pumpkin (*Cucurbita moschata*) is a local food commodity rich in dietary fiber, β -carotene, vitamins, and minerals, making it a potential raw material for functional foods. Processing pumpkin into flour can increase shelf life and expand its use in food product diversification. Several studies have reported that substituting pumpkin flour in bakery products can increase nutritional value, particularly fiber and antioxidant content, and provide natural color to the product. However, the high fiber and low protein content can affect dough structure formation and potentially reduce sensory characteristics when used in high concentrations.

Ingredients for Making Crispy Almonds

Pumpkin flour (*Cucurbita moschata*) is a local food commodity with high nutritional content, especially carbohydrates, dietary fiber, and β -carotene, which acts as an antioxidant (Manurung et al., 2021; Hanna et al., 2020). Processing it into flour aims to increase shelf life, ease of use, and support food diversification based on local ingredients. The fiber content of pumpkin flour, which reaches around 21.39–21.41% wet weight, makes it a potential source of functional fiber, while also providing natural color and increasing product crispness and stability by reducing water activity (Kristiani, 2016; Foschia et al., 2014; Coritama et al., 2021; Pereira et al., 2020). In the manufacture of bakery products such as almond crispy, the final product characteristics are influenced by the interaction of various ingredients in the dough. Butter acts as a source of fat that contributes to the formation of texture, flavor, and color and helps inhibit the formation of excess gluten, resulting in a more fragile and crispy texture (Syarbini, 2014; Jaya, 2022). Egg whites function as a binding agent because the proteins in them coagulate during baking and help form the product's structure (Grobis et al., 2001). Sugar not only acts as a sweetener but also supports the formation of a golden color and crispy texture through a caramelization reaction (Darwin, 2013), while salt is used in small amounts to enhance flavor, balance sweetness, and help extend shelf life by reducing water activity (Habsari, 2010; Manurung, 2023). Almonds also increase nutritional value because they contain vegetable fat, fiber, vitamin E, and phenolic compounds that provide a savory taste (Nareswara et al., 2016; Damayanti & Murtini, 2018), while vanilla essence acts as an aroma enhancer and masks the fishy smell of eggs, thereby improving sensory quality and consumer acceptance (Towaha, 2012; Eka, 2022). In general, the process of making almond crispy includes mixing ingredients, forming the dough into thin sheets, baking, and cooling to produce a product with a crispy texture, golden color, and optimal sensory characteristics (Wibowo, 2018).

Product Quality Analysis

1. **Fiber Content Analysis**
Fiber content analysis was carried out to determine the crude fiber content that is insoluble in acids and bases, which is used as an indicator of the functional value of fiber-based food products (Abdul et al., 2018).
2. **Water Content Analysis**
Moisture content analysis aims to determine the crispiness and shelf life of crispy almonds. Testing was conducted using an oven-drying method until a constant weight was achieved, as low moisture content affects product stability and quality during storage (Setyawan et al., 2025).
3. **Ash Content Analysis**
Ash content analysis was conducted to determine the total mineral content of the product. The test results were then statistically analyzed using ANOVA to determine the effect of treatment on the mineral content of *Almond Crispy* (Setyawan et al., 2025).
4. **Organoleptic Test**
Organoleptic testing was conducted to evaluate panelists' preference for the product's color, aroma, taste, and texture. Assessments were conducted using a hedonic scale to determine consumer acceptance of *Almond Crispy* (Gusnadi et al., 2021).
5. **Effectiveness Test**
The effectiveness test was carried out using the De Garmo effectiveness index method to determine the best treatment based on a combination of chemical and organoleptic parameters, so that the most optimal *Almond Crispy* formulation could be obtained (De Garmo, 1984).

RESEARCH METHODS

This research was conducted from October 2025 to January 2026. Product manufacturing and chemical analysis were conducted at the Food Processing Laboratory, Faculty of Food Technology and Fisheries, Dr. Soetomo University, Surabaya, while organoleptic testing was conducted at the Tristar Institute, Surabaya. The research method used was a laboratory experiment with a completely randomized design (CRD) with one factor, namely the concentration of pumpkin flour. The treatment consisted of five levels with three replications, resulting in a total of 15 experimental units. This design was chosen because it is able to optimally control research variables under homogeneous and relatively simple conditions (Hinkelmann, 2012; Sarmanu, 2017). *The Almond Crispy* production process uses a pumpkin flour substitution method, which includes weighing the ingredients, mixing the dough until homogeneous, forming the dough into thin sheets, baking at 120°C for 25 minutes, and cooling. The product manufacturing procedure follows the method proposed by Wikan and Ira (2023). The variables observed in this study included crude fiber content, water content, ash content, organoleptic testing, and effectiveness testing. Crude fiber content analysis was conducted using the acid and base reflux method (Pratiwi et al. , 2021), while moisture content analysis was conducted using the oven drying method (Abulais et al. , 2022). Ash content analysis was conducted through a high-temperature combustion process to determine the total mineral content of the product (Rizal et al. , 2023). Organoleptic testing was conducted using the hedonic method to assess color, aroma, taste, and texture attributes, involving 25 trained panelists (Napitupulu, 2018). Furthermore, an effectiveness test was used to determine the best treatment based on a combination of chemical and sensory parameters (Mayandri, 2017; Sari et al. , 2022). The research data were statistically analyzed using analysis of variance (ANOVA). If significant differences were found, further testing was performed based on the coefficient of variation obtained . For data that did not meet parametric assumptions, analysis was performed using the Kruskal–Wallis test (Akbar et al. , 2022).

RESULTS AND DISCUSSION

1. Chemical Test

Water content

Based on the results of the ANOVA analysis, the substitution of pumpkin flour for wheat flour did not have a significant effect on water content. *Crispy Almonds* ($p > 0.05$), so that all treatments (A0–A4) showed relatively the same water content.

Table 1. Average results of water content analysis

Treatment	Water Content (%) ± SD
A0	3.27a ± 0.632
A1	3.05a ± 0.017
A2	2.85a ± 0.161
A3	2.61a ± 0.566
A4	2.30a ± 0.601

Based on Table 1, the water content of *Almond Crispy* with pumpkin flour substitution variations ranged from 2.30–3.27%, with the highest value in the treatment without substitution and the lowest at 70% substitution. ANOVA results showed that pumpkin flour substitution had no significant effect on the product's water content ($p > 0.05$). However, descriptively there was a tendency for water content to decrease as the proportion of pumpkin flour increased, which is thought to be related to the dietary fiber content that is able to bind and release water during baking (Winarno in Yuliana et al., 2014). All treatments met the water content limit of SNI 2973:2022 (<5%), so the product has the potential to have a crispy texture and good shelf life. These results are in line with the research of Goswami et al. (2015) which stated that the use of high-fiber ingredients can reduce the water content of the product.

Ash Content

The results of the ANOVA analysis showed that the substitution of pumpkin flour for wheat flour did not have a significant effect on the ash content of the product. Ash content ($p > 0.05$) = no significant difference (All treatment variations produced relatively the same ash content statistically).

Table 2. Average results of ash content analysis

Treatment	Ash Content (%) ± Elementary School
A0	8.76 ^a ± 1,011
A1	8.92 ^a ± 0.595
A2	9.03 ^a ± 0265
A3	9.35 ^a ± 0.078
A4	9.83 ^a ± 0.205

Based on Table 2, the ash content of *Almond Crispy* ranged from 8.76–9.83%, with the highest value in treatment A4 and the lowest in A0. The statistical analysis showed that the substitution of pumpkin flour did not significantly affect the ash content of the product, as indicated by the similarity of the letter notation across all treatments. However, descriptively, there was a tendency for the ash content to increase with the increase in the proportion of pumpkin flour, which is thought to be related to the relatively high mineral content of pumpkin. This finding is in line with the research of Amelia (2005) which stated that the addition of pumpkin can increase the ash content of the product. Pumpkin is known to contain minerals such as calcium, phosphorus, and iron (Hendrasty, 2003), while the mineral contribution from other ingredients, such as egg white, was relatively similar in each treatment and therefore was not a major differentiating factor.

Fiber Content

The results of the ANOVA analysis showed that there was a significant difference in the substitution of pumpkin flour for wheat flour (treatments A0-A4 had a significant effect on fiber content).

Table 3. Average results of fiber content analysis

Treatment	Fiber Content (%) ± SD
A0	10.36 ^a ± 0.623
A1	11.72 ^a ± 0.164
A2	13.15 ^b ± 0.223
A3	13.18 ^b ± 0.183
A4	13.30 ^a ± 0.055

Based on Table 3, the highest fiber content of *Almond Crispy* was obtained in treatment A4 (70% pumpkin flour), while the lowest fiber content was found in treatment A0. Statistically, treatments A2 and A3 showed significant differences compared to A0 and A1, while treatment A4 was not significantly different from the other treatments. These results indicate that increasing the proportion of pumpkin flour tends to increase the fiber content of *Almond Crispy*. The increase in fiber content is related to the high content of pumpkin dietary fiber, which plays a role in binding water and affecting starch hydration and dough elasticity (Struck *et al.*, 2016). Based on BPOM regulations (2011), the resulting fiber content has met the criteria for high-fiber food because it exceeds the minimum limit of 6 g/100 g of food ingredients.

2. Organoleptic Test

Color

the Kruskal Wallis test, the substitution of pumpkin flour had a significantly different effect on the panelists' level of preference for the product color.

Table 4. Organoleptic Test Results for color parameters

Treatment	Median Color ± Elementary School
A0	6 ^a ± 1.12
A1	6 ^a ± 1.08
A2	5 ^a ± 1.41
A3	4 ^b ± 1.29
A4	3 ^b ± 1.60

Based on Table 4, treatments A0 and A1 obtained a median color score of 6, which is included in the like category, while treatment A2 obtained a score of 5 or slightly like and showed no significant difference. Meanwhile, treatments A3 and A4 showed a decrease in the level of color acceptance with scores of 4 (neutral) and 3 (slightly dislike) respectively and were significantly different. Color is one of the main factors that influence the quality and attractiveness of food products (Winarno, 1992). A low level of pumpkin flour substitution resulted in a brighter yellow color and was preferred by panelists, while increasing the proportion caused the product color to become darker due to the influence of natural pumpkin pigments and the browning reaction during baking. This indicates that the use of pumpkin flour in large amounts can reduce the color acceptance of *Almond Crispy*, so it needs to be limited to keep the product attractive to consumers.

Flavor

the Kruskal Wallis test, the substitution of pumpkin flour had a significantly different effect on the panelists' level of preference for the product color.

Table 5. Organoleptic Test Results of Taste Parameters

Treatment	Median Taste ± Elementary School
A0	6 ^a ± 1.41
A1	6 ^a ± 1.32
A2	6 ^a ± 1.38
A3	5 ^{ab} ± 1.93
A4	5 ^b ± 1.85

PHYSICOCHEMICAL AND SENSORY CHARACTERISTICS OF CRISPY ALMOND PRODUCTS WITH PUMPKIN FLOUR SUBSTITUTION

Pamela Felita Tjendra et al

Based on Table 5, treatments A0, A1, and A2 obtained a median taste score of 6, which is included in the liking category and does not show a significant difference. Treatment A4 has a score of 5 (somewhat liking) and is significantly different from the control treatment, while treatment A3 obtained the same score with an intermediate notation so it is not significantly different from the other treatments. Taste is a primary attribute that determines the level of consumer acceptance of food products (Soekarto, 1985; Winarno, 1997). *Almond Crispy* with a pumpkin flour substitution level of up to 40% is still acceptable to panelists because it produces a relatively neutral taste, while increasing the substitution to 70% tends to decrease preference due to the appearance of an unfamiliar unpleasant taste. These results indicate that the use of pumpkin flour in high concentrations has the potential to reduce taste acceptance compared to products without substitution.

Aroma

The results of further tests showed that the substitution of pumpkin flour had a significantly different effect on the level of panelists' preference for the aroma parameter.

Table 6. Organoleptic Test Results of Aroma Parameters

Treatment	Median Aroma \pm Elementary School
A0	6 ^a \pm 1.32
A1	6 ^a \pm 0.91
A2	5 ^{ab} \pm 0.76
A3	4 ^{ab} \pm 1.48
A4	4 ^b \pm 1.82

Based on Table 6, treatments A0 and A1 obtained a median aroma score of 6, which is categorized as liking and does not show a significant difference. In contrast, treatment A4 obtained a score of 4 (neutral) and was significantly different from the control treatment. Treatments A2 and A3 were in the intermediate notation, indicating that the product aroma was still close to the control, although it was starting to be influenced by the characteristic aroma of pumpkin flour. A low level of pumpkin flour substitution was preferred by panelists, while increasing the proportion tended to decrease aroma acceptance due to the increasingly dominant characteristic pumpkin aroma that disrupted the balance of the crispy almond aroma.

Texture

The results of further tests showed that the substitution of pumpkin flour had a significantly different effect on the level of panelists' preference for texture parameters.

Table 7. Organoleptic Test Results of Texture Parameters

Treatment	Median Texture \pm Elementary School
A0	6 ^a \pm 1.08
A1	6 ^a \pm 1.15
A2	6 ^a \pm 0.96
A3	5 ^b \pm 1.29
A4	5 ^b \pm 1.73

Based on Table 7, treatments A0, A1, and A2 obtained a median texture score of 6, which is categorized as "like" and shows no significant difference. Meanwhile, treatments A3 and A4 obtained a score of 5 (somewhat like) and were significantly different from the control treatment. Treatments with a low level of pumpkin flour substitution produced a texture preferred by panelists, while increasing the proportion of pumpkin flour tended to decrease the level of texture acceptance. This decrease is thought to be related to reduced gluten formation and increased fiber content, which affects the dough structure and reduces the crispiness of the almond crispy.

3. Determination of Best Treatment (effectiveness test)

Determining the best treatment was carried out using the effectiveness test method according to DeGarmo (1984). This method integrates all objective (chemical) and subjective (organoleptic) parameters to determine the treatment with the most optimal functional value.

Table 8. Effectiveness Test of *Almond Crispy Pumpkin Flour*

Parameter	Treatment Result Value				
	A0	A1	A2	A3	A4
Water content %	0.03	0.14	0.06	0.10	0.00
Ash Content %	0.06	0.11	0.12	0.00	0.14
Fiber Content %	0.01	0.00	0.14	0.08	0.01
Color	0.00	0.02	0.07	0.12	0.14
Aroma	0.00	0.01	0.08	0.12	0.14
Flavor	0.00	0.01	0.05	0.11	0.14
Texture	0.00	0.02	0.06	0.11	0.14
Total	0.04	0.13	0.25	0.27	0.30*

Based on the results of the effectiveness test with the criteria that smaller values indicate better results, all research parameters showed that treatment A4 (30% wheat flour and 70% pumpkin flour) was the best treatment with a yield value (NH) of 0.30. This treatment has chemical characteristics including water content of 3.27%, ash content of 8.76%, and fiber content of 13.15%, as well as an average organoleptic value including color 3.84, taste 2.72, aroma 3.00, and texture 2.80. The superiority of the A4 treatment is supported by the high proportion of pumpkin flour which contributes to the increase in the nutritional value of the product, especially the fiber and β -carotene content. In addition, the presence of aromatic compounds such as flavonoids, aliphatic alcohols, and carbonyl compounds in pumpkin plays a role in forming the product's distinctive aroma (Cahyaningtyas, 2014). The natural sugar content in pumpkin flour can also trigger the formation of caramel aroma during the baking process, thus adding value to *Almond Crispy products* (Hartati, 2016). Although the level of preference for texture is relatively lower, the low water content in the A4 treatment still supports the formation of a fairly crispy texture. Overall, the A4 treatment shows the most balanced combination of chemical quality and sensory acceptance, so it is recommended as the best formulation for making *Almond Crispy* based on pumpkin flour.

CONCLUSION

Based on the research results of pumpkin flour-based *Almond Crispy*, it can be concluded that pumpkin flour substitution does not have a significant effect on water content and ash content, but has a significant effect on fiber content, thus increasing the nutritional value of the product, especially dietary fiber. Treatment A4 with 70% pumpkin flour substitution produces the highest fiber content, while the lowest fiber content is obtained in the control treatment A0. Organoleptically, increasing the concentration of pumpkin flour has a significant effect on the level of panelists' preference for color, taste, aroma, and texture parameters, with a tendency to decrease in preference as the proportion of pumpkin flour increases due to the emergence of distinctive characteristics and changes in color and texture of the product. Based on the effectiveness test, treatment A4 (30% wheat flour and 70% pumpkin flour) is the best formulation with a yield value (NH) of 0.30, because it provides an optimal combination of chemical and organoleptic quality, supported by the content of aromatic compounds, natural sugars, and β -carotene which produce a distinctive aroma, natural yellow color, and a relatively crunchy texture.

REFERENCES

Abdul, R. H. K., Fatimah, F., & Wuntu, A. D. (2018). Kandungan serat kasar dari bakasang ikan tuna (*Thunnus sp.*) pada berbagai kadar garam, suhu, dan waktu fermentasi. *Jurnal Ilmiah Sains*, 18(1).

Akbar, M. H., Setyaningsih, S., & Virgantari, F. (2022). Pengujian pertumbuhan produksi maggot melalui kombinasi sampah rumah tangga dan daun kering menggunakan rancangan acak lengkap. *Jurnal Ilmiah Matematika*.

Badan Standardisasi Nasional. (2022). SNI 2973:2022 Cookies. BSN.

Creswell, J. W. (2021). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research*. Pearson.

- Coritama, C., Pranata, F. S., & Swasti, Y. R. (2021). Manfaat bekatul beras putih dan angkak dalam pembuatan cookies dan roti. *Muhammadiyah Journal of Nutrition and Food Science*, 2(1), 43.
- De Garmo, E. P. (1984). *Engineering economy*. Macmillan.
- Eka Ayu Widyawati. (2022). “Substitusi Tepung Labu Kuning (*Cucurbita Moschata* Duschenes). Dalam Pembuatan Cookies Sebagai Pangan Fungsional dan Kaya Serat”. Skripsi. Universitas Lampung.
- Foschia, M., Peressini, D., Sensidoni, A., & Brennan, C. S. (2013). The effect of dietary fibre addition on the quality of common cereal products. *Journal of Cereal Science*, 58, 216–227.
- Fauzi, M., Kuliahsari, D. E., Diniyah, N., & Rusdianto, A. S. (2017). Penggunaan vitamin C dan suhu pengeringan pada pembuatan chip labu kuning LA3 (*Cucurbita moschata*). *Jurnal Penelitian Pascapanen Pertanian*, 14(2), 108–115.
- Grobas, S., Méndez, J., Lázaro, R., de Blas, C., & Mateos, G. G. (2001). Influence of source and percentage of fat added to diet on performance and fatty acid composition of egg yolks of two strains of laying hens. *Poultry Science*, 80, 1171–1179.
- Gusnadi, D., Taufiq, R., & Baharta, E. (2021). Uji organoleptik dan daya terima pada produk tapai singkong sebagai komoditi UMKM di Kabupaten Bandung. Universitas Telkom.
- Hanna, N., Budi, S., & Katrin, R. (2020). Potensi labu kuning (*Cucurbita moschata*) sebagai makanan tinggi serat dalam bentuk cair. *Indonesian Journal of Human Nutrition*, 7(1), 54–68.
- Hanafiah, K. A. (2000). *Rancangan percobaan: Teori dan aplikasi*. Raja Grafindo Persada.
- Kusuma, A., Nugroho, S. D., & Parsudi, S. (2017). Selera konsumen dalam pembelian “Almond Crispy” di Toko Wisata Rasa Jemursari Surabaya. *AGRIDEVINA*, 6(1), 13–26.
- Manurung, M. P., Seveline, & Taufik, M. (2021). Formulasi kukis berbahan tepung labu kuning (*Cucurbita moschata*) dan tepung terigu dengan penambahan pisang ambon (*Musa paradisiaca*). *Jurnal Agroindustri Halal*, 7(2), 156–164.
- Mayandri, F. (2017). Efektivitas fungsi terminal Gerbangsari Kecamatan Rengat Barat Kabupaten Indragiri Hulu. *JOM FISIP Universitas Riau*, 4(1), 1–10.
- Nareswara, A. R., & Anjani, G. (2016). Studi tentang susu almond dan kentang sebagai alternatif minuman fungsional untuk anak autisme. *Jurnal Nutrition College*, 5(4), 269–279.
- Napitupulu, K.D.Y. (2018). Deskripsi dan Uji Organoleptik Klon-Klon Daun Ubi Kayu Sayur (*Manihot esculenta* Crantz). Universitas Lampung Bandar Lampung.
- Oloyede, F. M. (2016). Pengaruh penambahan labu kuning (*Cucurbita moschata*) dan ubi jalar ungu (*Ipomoea batatas* L.) terhadap kecepatan leleh es krim. *Jurnal Pendidikan Teknologi Pertanian*, 2, S7–S13.
- Pereira, A., Krumreich, F., Ramos, A., Krolow, A., Santos, R., & Gularte, M. (2020). Physicochemical characterization, carotenoid content and protein digestibility of pumpkin access flours for food application. *Food Science and Technology*, 40(2), 691–698.
- Pratiwi, N. W., Handayani, R., & Siregar, M. A. (2021). Analisis kadar serat kasar pada produk olahan pangan menggunakan metode refluks asam-basa. *Jurnal Teknologi dan Industri Pangan Indonesia*, 13(2), 55–62.
- Rosiana, U., & Lailianisa, W. P. (2019). Karakteristik kimia roti tawar dengan substitusi tepung labu kuning. *Jurnal Teknologi Pangan dan Ilmu Pertanian*.
- Rizal, F., Hermanto, & Mariani. (2023). Analisis kualitas mutu gula aren yang diproduksi di Kecamatan Tiworo Selatan dan Tiworo Tengah Kabupaten Muna Barat. *Jurnal Riset Pangan*, 1(2), 85–95.
- Sari, N., Pratiwi, D., & Lestari, R. (2022). Uji efektivitas formulasi kue lumpur berbasis bahan lokal. *Jurnal Pengembangan Teknologi Pangan*, 9(1), 33–40.
- Santoso, A. S. (2021). Digital health literacy: Meningkatkan kesadaran pola hidup sehat di era digital. *Jurnal Pendidikan Kesehatan Nasional*, 15(2), 91–99.
- Soechan, L. (2016). *Crispy cookies*. Gramedia Pustaka Utama.
- Wibawa, N. N. H., Suciato, B. S., & Yuniati, Y. (2025). Karakterisasi kimia dan organoleptik mayones vegetarian berbasis kedelai (*Glycine max*) dan tepung ubi ungu (*Ipomoea batatas* L.). *Jurnal Sains dan Teknologi Pangan*, 10(1), 8139-8151.

PHYSICOCHEMICAL AND SENSORY CHARACTERISTICS OF CRISPY ALMOND PRODUCTS WITH PUMPKIN FLOUR SUBSTITUTION

Pamela Felita Tjendra *et al*

Yani, S., Wahyono, A., Yudiastuti, S. O. N., & Mahros, Q. A. (2021). Pengaruh substitusi tepung labu kuning (*Cucurbita moschata* L.) terhadap nilai gizi brownies kukus labu kuning. *Jurnal Ilmiah Inovasi*, 21(1).