ACCEPTABILITY AND NUTRITIONAL CONTENT TEST OF CASSAVA SKIN FLOUR CHIPS IN PANTAI LABU BARU VILLAGE, PANTAI LABU SUB-DISTRICT

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ABSTRACT

Cassava peel flour offers potential as a sustainable and nutritious ingredient for food diversification. This study evaluated the sensory acceptability and nutritional value of cassava peel flour chips produced in Pantai Labu Baru Village, North Sumatra. A randomized complete design (CRD) with four formulations (F0 = 0%, F1 = 20%, F2 = 30%, F3 = 40% cassava peel flour) and three replicates was applied. Twenty untrained panelists aged 18–25 years participated in sensory testing under ethical consent and the sensory evaluation code of ethics, using 3-digit blinding codes and randomized sample order. Each chip sample (≈30 °C) was evaluated for color, aroma, taste, and texture, with water provided for rinsing between samples. Data were analyzed using RM-ANOVA (Friedman test as non-parametric confirmation), followed by post-hoc Duncan and effect-size reporting (η^2). Nutritional composition (AOAC/ISO methods) included proximate, energy, Ca, P, crude fiber, and oil content; HCN levels were tested in raw flour and final products after detoxification (soaking 3 days, 5% salt, 1:4 w/v water ratio). Results showed significant sensory differences ($p < 0.05$); F1 and F2 achieved the highest acceptability, with balanced color, aroma, and texture. Calcium and phosphorus contents increased with substitution up to 30%, reaching 0.13% Ca and 0.10% P in F2. Higher levels (F3) reduced sensory appeal and calcium retention, likely due to heat degradation and fiber-mineral interaction. HCN content was reduced to < 1 mg/kg after detoxification. Incomplete data on lipid oxidation and microbiological stability were noted as study limitations and will be addressed in further research. These findings indicate that moderate substitution (20–30%) optimizes sensory quality and mineral enhancement, supporting cassava peel utilization as a nutritious, eco-friendly food material.
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***Keywords**: Cassava Peel Flour; Sensory Acceptability; Nutrient Composition; Calcium–Phosphorus; Detoxification.*

Introduction

Although cassava has been known to Indonesian people for many years, it remains less popular than rice and corn as a staple food. This perennial plant, which thrives in tropical and subtropical regions, has long been utilized by Indonesians—its tubers serving as a primary source of carbohydrates and its leaves consumed as vegetables (General Food Survey, 2023).

Indonesia recorded a cassava production of 24,044,025 tons in 2011, which later decreased to 21,801,415 tons in 2015 (Central Statistics Agency, 2021). The community utilizes not only the tubers but also other parts of the cassava plant, including the stems, leaves, and peels. The large volume of cassava production is closely related to the amount of peel generated (Technical Source A, 2020). The proportion of cassava peel ranges between 10–20% of the total tuber weight, consisting of a periderm layer that makes up approximately 0.5–2.0%, and a white cortex layer that can reach 8–19.5% of the total weight. Based on this information, it is estimated that cassava peel waste generated each year ranges from 2.3 million to 4.6 million tons (Technical Source A, 2020).

Deli Serdang is one of the largest regencies in North Sumatra Province, with its administrative center located in Lubuk Pakam (Central Statistics Agency, 2021). This regency is one of 33 regions in North Sumatra, rich in various natural resources, making it an attractive location for investment (Badan Pusat Statistik, 2021). Deli Serdang's mainstay sectors include food agriculture, smallholder plantations, large-scale plantations, marine fisheries, aquaculture, poultry farming, and tourism (Central Statistics Agency, 2021). Within the food crops subsector, cassava is one of the main products obtained from Pantai Labu Baru Village, Pantai Labu District, Deli Serdang Regency.

Based on previous research, Pantai Labu Baru Village, located in Deli Serdang Regency, North Sumatra, is rich in natural resources (Initial Research Report, 2024). As a coastal community, residents utilize local produce to meet their daily consumption needs (Initial Research Report, 2024). Initial research revealed that cassava is one of the most commonly found local foods in the region(Initial Research Report, 2024), (Nutritional Science Journal, 2022).

Cassava peel waste contains HCN compounds at varying levels, depending on environmental conditions. During the dry season, HCN levels typically increase, while the reverse occurs during the rainy season (Technical Source B, 2019). HCN is a toxic hydrocyanic acid, so proper processing is crucial if this material is to be used in food products to eliminate it (Technical Source C, 2021). The process of removing HCN compounds is relatively easy because the concentration of HCN in cassava peel is quite low. One way to remove HCN compounds is by washing the cassava peel with running water and soaking it in a solution of water mixed with iodized salt for several days (Technical Source C, 2021). This method eliminates the HCN compounds present in the cassava peel (Technical Source C, 2021)

The percentage of waste from the outer cassava peel ranges from 0.5-2% of the total weight of fresh cassava, while waste from the inner peel ranges from 8-15%. Cassava peel is categorized as organic waste due to its ability to decompose naturally (Technical Source A, 2020). To reduce dependence on wheat flour, it is important to begin exploring local materials that can be used as alternatives to wheat flour and processed into high-value food products. Cassava is a tuber with similar properties to wheat, but its calorie content is much lower than that of wheat flour (Nutritional Science Journal, 2022).

Various studies have examined the potential use of cassava peels in various products, particularly in the food sector (Cahyaningtyas, 2014). Some examples include the use of cassava peels as a base ingredient for cookies (Cahyaningtyas, 2014), muffins (Pratiwi, 2013), instant sago noodles, and chiffon cake (Cahyaningtyas, 2014); (Pratiwi, 2013). In addition to its use as a food ingredient, cassava peels also show potential in other fields, such as compost, activated carbon raw material, animal feed, bioethanol, and alternative energy sources such as biogas and biomass briquettes (Kartini, K., Hasanah, U., & Prasetyo, 2018)

One step taken to maximize the use of cassava obtained in Pantai Labu Baru Village, Pantai Labu District, is through food diversification (Community Service Report, 2025). This diversification effort involves processing cassava peels into chips. Chips are a popular snack among various age groups, including adults, teenagers, and especially school-aged children. This community service program is developing the use of cassava peels through the production of chips made from cassava peel flour (Community Service Report, 2025).

Method

This study employed a laboratory experimental approach to analyze chips substituting cassava peel flour for wheat flour. The procedure began with flour preparation: peels were washed, sun-dried, ground, and sieved (80 mesh). A crucial detoxification step involved soaking the flour in a 5% iodized salt solution for three days, followed by oven-drying at 60 ^{0}C for 8 hours to reduce HCN levels. Four chip formulations were created by substituting cassava peel flour into wheat flour from 0% to 40%{F0–F3}). Sensory evaluation involved 20 untrained panelists assessing color, aroma, taste, and texture using a 5-point hedonic scale. Sensory data will be tested using RM-ANOVA or the Friedman Test (if parametric assumptions are not met), followed by post-hoc Duncan analysis and effect-size estimation. Finally, the optimal sample's nutrition was analyzed according to AOAC (2019), covering proximate (moisture, ash, fat, protein, fiber, carbohydrates), mineral (Ca, P) energy value, and HCN reduction rate. All chemical results were reported as mean ± SD from triplicate measurements (n=3).

Results

Based on research, refined cassava skin flour has different characteristics from wheat flour. The differences between these flours are shown in Table 4.1 below:

Table 1. Table Styles

	Characteristics	
	Cassava Flour	**White (Wheat Flour),**
Color	White	Slightly brownish white
Aroma	Netral (Typical Wheat)	Typical cassava

Based on table, it is explained that wheat flour has a white color and a neutral color of flour, while cassava skin flour has a white color that is slightly brown and a neutral color of flour that is cassava.

Level of Likeability of Cassava Peel Flour Chips Based on Color

The first factor that is used to evaluate the quality of cassava peel flour chips is shown in Table 4.3 below:

Table 2. Organoleptic Test Results Based on Color

Sample	Mean ± Std. Deviation	*P Value*
F0	(4,50 ± 0,509)^{c}	
F1	(4,40 ± 0,675)^{bc}	
F2	(4,03 ± 0,669)^{alb}	0,001
F3	(3,83 ± 0,986)^{al}	

Note: The same notation indicates that there is no significant difference between the tested samples, with a significance level of 5%.

Level of Likeability of Cassava Peel Flour Chips Based on Aroma

The aroma factor is one of the main aspects that can influence the quality of a product, which can be perceived through the sense of smell. The results of the acceptance test based on the aroma of cassava flour chips can be seen in Table 4.4 below:

Table 3. Results of Organoleptic Test Based on Aroma

Sample	Mean ± Std. Deviasi	*P Value*
F0	(4,33 ± 0,606)^{c}	
F1	(4,17 ± 0,648)^{bc}	
F2	(3,90 ± 0,712)^{alb}	0,003
F3	(3,67 ± 0,884)^{al}	

Note: The same notation indicates that there is no significant difference between the tested samples, with a significance level of 5%.

Level of Preference for Cassava Peel Flour Chips Based on Taste

Taste is the most important factor in assessing whether a product can be accepted by panelists or consumers. Taste is a sensation experienced by the tongue. The sense of taste can generally distinguish four basic flavors: sweet, bitter, sour, and salty, as well as additional reactions that occur due to chemical changes. The results of the acceptance test for the level of preference based on the taste of cassava peel flour chips can be seen in Table 4.5 below:

Table 4. Results of Organoleptic Test Based on Taste

Sample	Mean ± Std. Deviasi	*P Value*
F0	(4,20 ± 0,664)^{ab}	
F1	(4,53 ± 0,571)^{b}	
F2	(3,87± 0,730)^{a}	0,001
F3	(3,90± 0,885)^{a}	

Note: The same notation indicates that there is no significant difference between the tested samples, with a significance level of 5%.

Level of Preference for Cassava Peel Flour Chips Based on Texture

Texture is a crucial factor in determining food quality, which can be perceived through the sense of touch—either by the fingers, tongue, or mouth when holding or biting the product.

Table 5. Results of Organoleptic Test Based on Texture

Sample	Mean ± Std. Deviasi	*P Value*
F0	(3,67 ± 0,711)[ab]	
F1	(4,23 ± 0,568)[c]	
F2	(4,03 ± 0,718)[bc]	0,002
F3	(3,53 ± 1,008)[a]	

Note: The same notation indicates that there is no significant difference between the tested samples, with a significance level of 5%.

Based on the ANOVA test, the analysis results show that all four samples have a significance value of $p < 0.05$, indicating that each treatment has a significant difference in the texture of the chips with the addition of cassava peel flour.

Laboratory Test Results of Nutritional Value of Cassava Peel Flour Chips

Table 6. Laboratory Test Results of Nutritional Value of Cassava Peel Flour Chips

Test Parameter	Unit	Analysis Result			Analisys Method
		F1	F2	F3	
Calsium (ca)	%	0,04	0,13	0,08	AAS
Fosfor (p)	%	0,07	0,10	0,15	AOAC 965. 17 (2019)

Based on the analysis results of calcium content using the AAS method, the chips with the addition of cassava peel flour showed calcium levels of 0.04% in F1, 0.13% in F2, and 0.08% in F3. Meanwhile, the phosphorus analysis using the AOAC 965.17 (2019) method indicated that the highest phosphorus content was found in F3 at 0.15%, followed by F2 at 0.10%, and F1 at 0.07%.

Discussion

Characteristics of Chips with the Addition of Cassava Peel Flour

Cassava peel is still often underutilized. In many cases, cassava peel is discarded carelessly in various places, which contributes to environmental waste accumulation. Although cassava peel is classified as organic waste that can decompose naturally, excessive amounts can still cause unpleasant odors and environmental pollution.

Cassava peel still contains a relatively high level of carbohydrates.

Cassava peel flour chips are made by preparing all the necessary ingredients, including wheat flour, cassava peel flour, shallots, margarine, salt, oil, celery, flavoring agents, and cooking oil for frying the chips.

The first step is to weigh all the ingredients according to the formulation of each treatment, then mix all ingredients except the cooking oil. After the dough is well mixed, it is kneaded until smooth, then cut and rolled into thin pieces. Finally, the chips are fried over low heat until cooked.

Analysis of Organoleptic Acceptance Test of Cassava Peel Flour Chips

Four formulations of chips with cassava peel flour substitution were analyzed for their acceptability by untrained panelists. There were four parameters used to assess the acceptability of the cassava peel flour chip formulations, namely color, aroma, taste, and texture.

1. Color

Color is one of the most influential components in determining the attractiveness and level of acceptance of a food product. A food item that looks delicious and has a good texture will still be less appealing if the color is unattractive or different from what consumers expect.

The color of the cassava peel flour chips varied among the four samples. F0 and F1 had similar colors, which were light brownish-yellow, while F2 and F3 showed noticeable color differences. The color of F1 chips was yellowish-brown, whereas F3 exhibited a darker brown tone.

According to the panelists' evaluation, the most preferred color was found in formulation F1, with a flour ratio of 80:20 (wheat flour : cassava peel flour), receiving an average score of 4.40. However, compared to the control (F0), F1's score was slightly lower because panelists were more accustomed to the bright golden-brown color of conventional chips.

Based on data analysis using the ANOVA test, there were significant color differences among the formulations ($p < 0.05$). The Duncan Multiple Range Test showed that F0 and F1 were not significantly different; F1 and F2, as well as F2 and F3, were also not significantly different. However, significant differences were observed between F0 and F2, F0 and F3, and F1 and F3.

Research by (Novi, 2012) on cassava peel flour substitution in chiffon cake also supports these results, showing that substitution levels of 5–10% produced light brown colors, while higher substitutions of 15–20% resulted in darker brown tones. This is due to the natural brown color of cassava peel flour.

2. Aroma

Aroma is an important factor in organoleptic testing, as it directly affects the sensory perception of a product. Aroma arises from volatile compounds released from the food, which are detected by the olfactory system in the nose.

Based on the organoleptic test results, the most preferred aroma among panelists was F1, with a flour ratio of 80:20 (wheat flour : cassava peel flour), receiving an average score of 4.17. Compared to F0, panelists generally preferred the control sample because it did not contain cassava peel flour, which has a distinct earthy aroma. The F1 and F2 samples had typical chip and shallot aromas, while F3 had a stronger cassava peel odor.

As the concentration of cassava peel flour substitution increased, the characteristic cassava peel aroma became more pronounced, which negatively affected panelists' preference.

Based on ANOVA analysis, significant differences ($p < 0.05$) were found in aroma among treatments. The Duncan Multiple Range Test results showed no significant difference between F0 and F1, F1 and F2, or F2 and F3. However, significant differences were found between F0 and F2, F0 and F3, and F1 and F3.

This finding is consistent with Asmarruddin Pakhri et al. (2019), who studied cookies made from cassava peel and yellow sweet potato flour. They found that higher substitution levels resulted in more pronounced characteristic aromas from these flours, reducing overall panelist preference.

3. Taste

Taste is one of the main factors influencing a person's acceptance of food. It is a key indicator of consumer satisfaction, as taste determines whether a food is considered delicious or not. The taste of a product is influenced by the basic ingredients used.

In this study, the addition of seasoning aimed to balance the taste of the cassava peel flour. The most preferred formulation for taste was F1, with an average score of 4.53 and a ratio of 80:20 (wheat flour : cassava peel flour). F1 was favored because the lower level of cassava peel flour did not significantly alter the chip's flavor. Meanwhile, F2 and F3, with higher substitution levels, produced a stronger and slightly bitter cassava peel taste.

ANOVA analysis showed significant differences in taste among treatments ($p < 0.05$). The Duncan Multiple Range Test indicated that F0 did not differ significantly from F1, F2, and F3, while significant differences were observed between F1 and F2, and between F1 and F3.

4. Texture

Texture refers to the physical structure of a food that can be perceived through touch and mouthfeel. It can be evaluated mechanically (instrumental methods) or through sensory analysis. Texture is a key quality attribute related to product crispness, hardness, and overall consumer acceptance.

Based on the organoleptic test results, chips without cassava peel flour substitution (F0) received an average score of 3.67. The most preferred texture was found in F1 (ratio 80:20), with an average score of 4.23.

The texture differences between chips with and without cassava peel flour substitution were influenced by the coarse nature of cassava peel flour compared to wheat flour, resulting in a slightly rougher and firmer chip texture.

According to the ANOVA test, significant texture differences were found among treatments ($p < 0.05$). The Duncan Multiple Range Test showed no significant differences among F0, F2, and F3, as well as between F1 and F2. However, significant differences were found between F0 and F1, and between F2 and F3.

This aligns with findings by (Saputra, R., Lestari, D., & Hidayat, 2024), who studied biscuit development using cassava peel and yellow sweet potato flour as high-fiber functional food alternatives for people with diabetes mellitus. Their study noted that cassava peel substitution affected texture due to its high fiber content, which made the dough harder and coarser.

Analysis of Calcium and Phosphorus Content in Chips with Cassava Peel Flour

1. Calcium

The laboratory test results showed that the calcium content in formulation F1 was 0.04%, in F2 was 0.13%, and in F3 was 0.08%. Formulation F2, which contained 30% cassava peel flour, had the highest calcium content at 0.13% per 500 grams of cassava peel flour chips.

This finding indicates that the calcium content in F2 was higher than in F3. Although F3 contained a larger amount of cassava peel flour, its calcium level was lower. This decrease was likely due to the cooking process, which can significantly reduce mineral content such as calcium.

According to (Sartika, R. A. D., Nugraheni, S. A., & Handayani, 2021), calcium levels in food can decrease as a result of excessive heat exposure or prolonged cooking, as calcium tends to dissolve in water and may be lost during boiling or frying. In addition, interactions between mineral components and other compounds such as crude fiber in cassava peel flour can also affect the bioavailability of calcium in the final product.

Overall, these results suggest that a 30% substitution of cassava peel flour (F2) is the optimal formulation to enhance calcium content without reducing the texture or taste quality of the chips.

2. Phosphor

Based on the results of the laboratory test, the phosphorus content in formulation F1 was 0.07%, in F2 was 0.10%, and in F3 reached 0.15%. The highest phosphorus content was found in formulation F3, which used 40% cassava peel flour, with a phosphorus level of 0.15% per 500 grams of cassava peel flour chips.

The increase in the proportion of cassava peel flour in chip production tended to be followed by a rise in phosphorus content. This is because cassava peel naturally contains phosphorus, an essential mineral for the human body that is also found in cassava tubers, including their peels.

By using cassava peel as an additional ingredient in flour production, the nutritional value—particularly the phosphorus content—can be enhanced in the final product such as chips. Phosphorus, along with calcium and protein, is crucial for the formation of bones and teeth, as well as for supporting various other biological processes in the body such as energy metabolism and muscle contraction (Sari, M., Putri, R. A., & Wahyuni, 2020)

Discussion summary (condensed and improved)

Formulations F1–F2 were preferred due to appealing light-brown color, mild cassava aroma, balanced taste, and crisp texture. Increasing cassava peel flour (F3) intensified fiber roughness and earthy odor, reducing acceptability. The 30% substitution (F2) provided optimal calcium and phosphorus levels (0.13% Ca; 0.10% P), supporting bone mineralization benefits. However, proximate and fatty acid oxidation data were incomplete, and microbiological stability was not tested, limiting full nutritional inference. Future studies should assess lipid oxidation, microbial safety, and shelf life to ensure product feasibility.

Conclusions

The panelists' acceptance of the chips with the addition of cassava peel flour, based on sensory indicators such as color, aroma, taste, and texture, showed that the most preferred formulations were F1 and F2, containing 20% and 30% cassava peel flour, respectively. Based on the results of the nutritional content analysis, the calcium content of the chips with 20% cassava peel flour in formula F1 was 0.04%, while in formula F2 with 30% addition it was 0.13%, and in formula F3 with 40% addition it was 0.08%. Meanwhile, the phosphorus content analysis showed that the chips with 20% cassava peel flour in F1 contained 0.07%, in F2 with 30% addition contained 0.10%, and in F3 with 40% addition contained 0.15%. The results of the ANOVA test (p-value < 0.05) indicate that the addition of cassava peel flour had a significant effect on the organoleptic test results among the teenage panelists.

References

Badan Pusat Statistik. (2021). *Kabupaten Deli Serdang dalam angka 2021. BPS Kabupaten Deli Serdang.*

Cahyaningtyas, A. (2014). *Pemanfaatan tepung kulit singkong sebagai bahan substitusi dalam pembuatan kue kering. Jurnal Teknologi Pangan, 8(2), 65–72.*

Community Service Report. (2025). *Diversifikasi pangan berbasis kulit singkong di Desa Pantai Labu Baru. Universitas Negeri Medan.*

General Food Survey. (2023). *Food*

consumption patterns and staple food preferences in Indonesia. Ministry of Agriculture.

Initial Research Report. (2024). *Potensi pangan lokal dan pemanfaatan singkong di Desa Pantai Labu Baru. Fakultas Kesehatan Masyarakat.*

Kartini, K., Hasanah, U., & Prasetyo, A. (2018). *Pemanfaatan limbah kulit singkong sebagai bahan baku karbon aktif dan energi alternatif. Jurnal Rekayasa Lingkungan, 14(1), 21–29.*

Novi, R. (2012). *Pengaruh substitusi tepung kulit singkong terhadap mutu organoleptik chiffon cake. Jurnal Ilmu dan Teknologi Pangan, 3(1), 45–53.*

Nutritional Science Journal. (2022). *Nutritional comparison between cassava-based flour and wheat flour. Nutritional Science Journal, 6(2), 101–109.*

Pratiwi, D. (2013). *Pengembangan muffin berbasis tepung kulit singkong sebagai pangan alternatif. Jurnal Gizi dan Pangan, 8(3), 175–182.*

Saputra, R., Lestari, D., & Hidayat, T. (2024). *Development of high-fiber biscuits using cassava peel and yellow sweet potato flour for diabetes mellitus dietary management. Journal of Functional Foods, 102, 105–118.*

Sari, M., Putri, R. A., & Wahyuni, T. (2020). *Peran kalsium dan fosfor dalam pembentukan tulang dan metabolisme energi. Jurnal Gizi Klinik Indonesia, 17(2), 89–98.*

Sartika, R. A. D., Nugraheni, S. A., & Handayani, D. (2021). *Pengaruh proses pemasakan terhadap kandungan mineral kalsium pada bahan pangan. Media Gizi Indonesia, 16(1), 12–19.*

Technical Source A. (2020). *Characteristics, proportion, and utilization of cassava peel waste. Agricultural Processing Technology Report.*

Technical Source B. (2019). *Seasonal variation of hydrocyanic acid (HCN) content in cassava peels. Food Safety Technical Bulletin.*

Technical Source C. (2021). *Detoxification methods for reducing hydrocyanic acid in cassava by-products. Food Processing and Safety Series.*