The Effect Used *Nangka* (*Musa X Paradisiaca* L.) Plantain Flour With A Different Process to The Macro-Micronutrient and Sensory of A Snack Bar

R Ekafitri[11], *D* Desnilasari[2], *N K I* Mayasti[1], *D* Kristanti[3], and *A* Indriati[1]

[1]Research Center for Appropriate Technology, National Research and Innovation Agency, Subang, West Java, Indonesia
[2]Research Center for Applied Microbiology, National Research and Innovation Agency, Cibinong, West Java, Indonesia
[3]Research Center for Food Technology and Processing, National Research and Innovation Agency, Yogyakarta, Indonesia

Abstract. Snack bars can be made from plantain flour, processed with and without peeling combined with fermentation and nonfermentation process as one of sustainable food innovation. This studied aimed to utilize peeled and unpeeled Nangka plantain processed with fermentation and non-fermentation on snack bar products and examined the effect on macro and micronutrient content and sensory acceptability. The snack bar was made from peeled and unfermented plantain flour (SB_TK), peeled and fermented plantain flour (SB_TKF), unpeeled and unfermented plantain flour (SB_K), and peeled and fermented plantain flour (SB_KF)The results showed that based on effectiveness index, the best snack bar was made from peeled and unfermented banana flour. This snack bar has 4.66% moisture content, 2.42% ash content, 6.37% protein content, 23.91% fat content, 62.67% carbohydrate content, 5.48% dietary fiber, and 28.39% total sugar, with micronutrients of K, Ca, Na, P, Vit A, Vit D, and Se respectively 304.10 (mg/100g); 111.92 (mg/100g); 425.18 (mg/100g); 270.14 (mg/100g); 97.36 (µg/100 g); 26.22 (µg/100 g); 13.86(µg/100 g). All snack bar has sensory acceptability that was not significantly different.
Keywords : Plantain Flour, Snack Bars, Fermentation, Nutrient Content, Sensory Acceptability

1 Introduction

In recent years, innovations in the food technology sector and the development of new food products have increased rapidly [1]. The development of healthy food products is an area of product innovation that is experiencing significant growth due to consumer demand for foods that can improve health and prevent disease [2]. One of food innovation is the

[1] Corresponding author: riyanti.ekafitri21@gmail.com

utilization of local raw materials such as bananas into healthy snack bars. Bananas are a consumption fruit which is the fifth most important commodity in the world [3]. Bananas is a climacteric fruit that can grow in tropical and subtropical areas with easy treatment [4]. Nearly 50% of banana production in Asia is produced from Indonesian bananas because they are supported by a suitable climate [5].

Banana is a fruit that is easily damaged due to high water content and metabolic activity after harvest, especially when bananas are perfectly ripe which requires a process to become a more stable intermediate form, one of which is to become flour. The banana's type that is mostly used as flour is unripe plantain [6–9]. In Indonesia, many varieties of plantain bananas are found such as Kapas, Rajabulu, Kepok Kuning, Tanduk, Siam, Nangka, and others [6,10], so that the development of plantain banana flour has great potential. Plantain banana flour was reported to have starch of 73.99%, amylose 22.47% - 23.48%, dietary fiber 16.32%, antioxidants 34.82%, protein 3.94%, fat 4.62% [6,11]. According to Juarez et al., plantain flour contains resistant starch and high dietary fiber so it is good for human health [12].

The development of plantain banana flour has been widely carried out, including the process of plantain banana flour at various maturity levels, with and without peel and with fermentation [6,11,13–17]. Campuzano et al., stated that the unripe banana flour has a higher total starch, resistant starch, amylose content than ripe banana flour [18]. In another study, those who made whole banana flour with stated that plantain banana flour without peeling produced plantain banana flour which had a higher content of starch, amylose, dietary fiber, and antioxidant activity compared to peeling plantain banana flour [6]. According to Acevedo et al., banana peel flour is a source of dietary fiber and antioxidant components, namely 376.4 g/kg dietary fiber, polyphenols 7.71-30.98 mg GAEs/g), and antioxidant capacity 49.65- 84.73 μmol Trolox eq/g [19]. Utilization of whole bananas (with fruit peels) into banana flour can increase the nutritional value of food products and reduce production waste, increase product yield and reduce labor costs because the banana peeling step is not required. This shows that the use of fruit peels in the manufacture of banana flour improves the quality of banana flour. Another effort was made by Desnilasari et al., to improve banana flour's quality by fermentation process [11]. The fermentation process carried out on unpeeling plantain bananas resulted in changes in the functional properties of banana flour such as decreasing solubility, increasing several parameters in the gelatinization profile. In addition, it also increases the amylose content, relatively does not cause changes in protein, fat and carbohydrate content, but causes some decrease in mineral content (potassium, magnesium, zinc, calcium and iron).

So far, the utilization of banana/plantain flour by processing in general that has been carried out includes processing it into flakes, noodles, snack bars, bread, and cookies [20–25]. Utilization of banana flour processed by peeling and unpeeling accompanied by a fermentation process has not been found, especially for snack bar products. According to Sarifudin et al., banana-based snack bars can supply nutritional needs and provide health benefits due to the content of inulin, FOS, and dietary fiber so that they can be categorized as functional foods [22]. Therefore this research was conducted to utilize fermented banana flour processed by peeling and unpeeling in snack bar products and observe its effect on macro and micronutrient content, texture, and sensory acceptability.

2 Method

2.1 Material and methods

The material used in this reserach was plantain banana of *Nangka* cultivar obtained from the Subang traditional market at maturity level 1 based on peel color referred to Inyang et al. [9]. The starter used in plantain fermentation was powdered starter containing a mixture of lactic acid bacteria as a result of research by the Research Center for Appropriate Technology. The equipment used in the manufacture of banana flour includes knives, slicers, drying ovens, disk mills and sieves.

2.2 Preparation of plantain banana flour [11]

Plantain banana flour is prepared by four methods called peeled and non fermented plantain banana flour (TK), peeled and fermented plantain banana flour (TKF), unpleeled and nonfermented plantain banana flour (K), and unpeeled and fermented plantain banana flour (KF). TKF was prepared with the following steps: whole plaintain bananas were washed, peeled, and sliced using a slicer followed by immersion in 5% starter solution, and fermented for 24 hours, then the samples were washed,drained, and dried using a cabinet dryer at 50^{o}C for 18 hours. The dried banana chips obtained were then floured using a disk mill and sieved using a vibrator screen with a 40 mesh sieve size and the flour is ready to be used for making snack bars. TK was prepared in the same way but without the fermentation process. While KF was prepared without the peeling process, and K was prepared without peeling and fermenting process.

2.3 Preparation of snack bars [22]

Snack bars were made with the following steps: egg, emulsifier and granulated sugar were mixed using a high speed mixer for 30 minutes. After the cream was formed, banana puree and powdered milk wereadded, followed by added *Nangka* plantain flour, starch, salt, and baking powder and stirred at low speed. After that, melted margarine was added to homogen mixture and stirred at low speed to form dough. Then put 300 grams of the dough into a 10x22x4 cm tin and baked at 140^{o}C for 40 minutes then cake was cutted to size of 10 x 2 x 3 cm and baked at 90^{o}C for 40 minutes, The resulting snack bars then cooled and stored for analysis.

2.4 Analysis

The moisture, ash, and fat content of the snack bar were determined according to the AOAC [26]. The protein content was analyzed using a DuMaster protein analyzer (DuMaster D-480, Buchi, Switzerland). Carbohydrate was determined by differences. Total sugar of sample was analyzed using Luff Schoorl method [27]. Total dietary fiber (TDF) of sample was determined referred to AOAC 985.29. Mineral analysis of biscuit including potassium (K), calcium (Ca), sodium (Na), phosphor (P) and Se (Selenium) were analyzed using ICP-MS with slight modification [28]. HPLC analysis of vitamin A and D was referred to AOAC [26].

Sensory analysis was carried out by the scoring method to determine the most preferred snack bar formulations from the 4 snack formulations presented. The preference test used

30 untrained panelists with parameters of pref-erence for taste, color, aroma, texture, and overall acceptability. Five scales of preference score were used (1-5/ dislike-like).

Selection of the best sample with effectiveness index method de Garmo [29]. The highest rating was determined from Nh (the highest score). Nh (result value) is obtained from the effectiveness value (Ne) multiplied by the normal weight (BN) of the parameter)

2.5 Statistical analysis

Completely randomized design was used in this research, with treatments 1) snack bars made from peeled and non fermented plantain banana flour (SB_TK), 2) snack bars made from peeled and fermented plantain banana flour (SB_TKF), 3) snack bars made from unpleeled and nonfermented plantain banana flour (SB_K), 4) snack bars made from unpeeled and fermented plantain banana flour (SB_KF), and. Each treatment was repeated 3 times with 3 repetitions of analysis. The resulting data were analyzed using One Way ANOVA at a confidence level of $p<0.05$ and if significantly different it was continued with Duncan's test using SPSS 13.00.

3 Result and discussion

3.1 Macronutrients, dietary fiber, and total sugar of snack bar

The moisture content of snack bar ranged from 4.53% to 5.74%, wherein the highest value moisture content was obtained at SB_KF, and the lowest was obtained at SB K (Table 1). Differences in moisture contents could be due to the differences in the processing method used in the preparation the banana plantain flour. Fermentation process on peeled banana plantain can increase water absorption capacity and entrapment of water in the material compared with banana with non-fermented [30]. The lower the moisture content indicated the better its storage stability [31]. The ash content of snack bar ranged from 2.05% to 2.64%. The fermented sample showed the lower ash content compared with non-fermented. Desnilasari et al., stated that the fermentation process reduced the ash content of the plantain banana flour [11]. The highest of protein content was resulted in SB_KF sample (7.21%). Fermentation process increased on protein content. It can be caused by biomass from peptidoglycan of lactic acid bacteria which increased protein content [30]. The use of peeled plantain flour increased the protein level of snack bar. It is caused banana peel is reach in protein [32]. The unpeeled snack bar (SB_TKF) had the highest fat content (25.35%). Bezerra et al., reported that fat content of unpeeled banana flour was higher than the peeled banana flour [33].

Table 1. Components of macronutrients, dietary fiber, and total sugar of snack bars

Samples	Moisture content (%)	Ash (%, db)	Protein (%, db)	Fat (%, db)	Carbohydrate (%, wb)	Total Dietary Fiber (%, db)	Total sugar (%, wb)
SB_TK	4.66±0.11^{b}	2.53±0.35^{b}	6.68±0.07^{a}	25.08±0.06^{c}	65.71±0.30^{a}	5.74±0.08^{b}	29.77±0.65^{a}
SB TKF	4.76±0.18^{b}	2.05±0.32^{a}	6.83±0.32^{ab}	25.35±0.15^{d}	65.77±0.17^{a}	6.06±0.07^{c}	30.86±0.18^{b}
SB K	4.53±0.02^{a}	2.64±0.12^{b}	7.06±0.12^{ab}	24.03±0.09^{b}	66.27±0.20^{b}	5.60±0.07^{a}	31.58±0.10^{b}
SB KF	5.74±0.04^{c}	2.27±0.11^{ab}	7.21±0.21^{b}	23.78±0.10^{a}	66.73±0.18^{c}	5.82±0.02^{b}	33.48±0.38^{c}

The carbohydrate content of snack bar ranged from 65.71% to 66.73%, wherein the carbohydrate content of SB K and SB_KF tended to be higher than SB_TK and SB_TKF ($p<0.05$). It was indicated that unpeeled banana flour increased the carbohydrate contents

of snack bar. For *Lactobacillus plantarum* banana peel can be used as a carbon source in the fermentation of lactic acid [34].

Table 1 shows that snack bars made from peeled and fermented banana (SB_TKF) produced the highest dietary fiber (6.06%) compared to other treatments. Snack bar made from fermented banana flour has a higher dietary fiber content compared to non-fermented. This is consistent with the fermentation of sorghum flour which also causes an increase in dietary fiber [35]. This could be due to the degradation of IDF into SDF during fermentation due to production of enzyme which in turn increases total dietary fiber [36]. The dietary fiber of snack bars in this study was lower than snack bars reported by Sarifudin et al., [22], namely 9.10-13.29% but higher than snack bars made from apple extract (2.47-5.42%) [37]. This difference can be caused by differences in the formulation and type of banana flour used.

Total sugar snack bar made from whole and fermented plantain banana flour (SB_KF) had the highest total sugar (33.48%) while a snack bar made from peeled and unfermented plantain banana flour (SB_TK) had the lowest total sugar (29.77%). This is due to the fermentation process resulting in hydrolysis of the starch chain by active maltase and alpha amylase produced by fermenting into simple sugars and increasing total sugar [38]. Total sugar of snack bars in this study ranged from 29.77-33.48% lower than chocolate bars (33.7-63.0%) [39].

3.2 Micronutrient components of snack bars

Table 2. *Components of Micronutrient components of snack bars*

Samples	K (mg/100g db)	Ca (mg/100g db)	Na (mg/100g db)	P (mg/100g db)	Se (µg/100g db)	vit A (µg/100g db)	vit D (µg/100g db)
SB_TK	318.97±2.21^{b}	117.39±1.51^{b}	445.96±2.54^{c}	283.34±0.69^{c}	14.54±0.48^{a}	102.12±0.77^{a}	27.50±0.03^{d}
SB TKF	248.95±0.66^{a}	116.19±0.81^{b}	408.98±3.43^{a}	272.27±0.22^{a}	15.87±0.54^{b}	131.12±0.83^{c}	18.58±0.54^{b}
SB K	498.58±3.78^{d}	124.58±1.35^{c}	456.14±4.41^{d}	292.01±0.48^{d}	16.41±0.01^{b}	105.03±0.28^{b}	22.43±0.11^{c}
SB KF	350.84±5.93^{c}	79.96±1.18^{a}	426.77±0.75^{b}	281.91±0.20^{b}	16.27±0.45^{b}	177.77±0.19^{d}	16.58±0.24^{a}

The treatment with the greatest grade value was the addition of banana plantain flour from whole bananas without the fermentation process. This is owing to the fact that plantain peels can improve the mineral content of flour, and the non-fermentation procedure can reduce mineral loss due to leaching during the fermentation phase [11,32,40,41]. The snack bar contains potassium levels ranging from 248.95 - 498.58 mg/100g, calcium levels ranging from 79.96 – 124.58 mg/100g, sodium levels ranging from 426.77-456.14 mg/100g, phosphor levels ranging from 272.27-292.01 mg/100g, and selenium levels ranging from 14.54-16.41 µg/100 g. The mineral content, based on The dietary reference intakes for minerals issued by the Institute of Medicine, meets the daily requirement of 10% potassium, 11.8% calcium, 39.8% phosphorus and 22.4% selenium [42,43]. Potassium maintains fluids homeostasis in the body, steady heartbeat, muscle contaction, and transmission of nerve impulse. A potassium-rich diet appears to reduce blood pressure. Getting enough potassium in diet may help bones health [22,43] . Calcium helps to develop and protect bones and teeth. Phosphorus Aids in the formation and protection of bones and teeth. A component of DNA and RNA. Aids in the conversion of food into energy. Part of phospholipids, which transport lipids in the blood and aid in the transport of nutrients into and out of cells. selenium As an antioxidant, it neutralizes unstable chemicals that can harm cells. Aids in the regulation of thyroid hormone activity [42].

The vitamin A content of snack bar in this study were ranged from 102.12 – 177.77 µg/100g. Menawhile, the vitamin A and D content of bananas were ranged from 5.76-16.09 µg/100g and 0.40-0.51 µg/100g [44]. Fermentation on unpeeled and peeled banana

significantly increased the vitamin A content in snack bar ($p<0.05$). It is inversely proportional to vitamin D content. Fermentation was significantly reduced the content of vitamin D ($p<0.5$). In this study, vitamin D content of snack bar were ranged from 16.58-22.43 µg /100 g. Meanwhile, the vitamin A content of snack bar made from unpeeled banana flour was higher than snack bar made from peeled banana flour. This is due to the possibility that the banana peel also contains vitamin A. Banana peels are a rich source of bioactive compounds, like carotenoids (β-carotene), antioxydative enzymes and carbohydrates [45]. This is in accordance with reported by Thomas and Isong that the vitamin A content of unpeeled red banana flour (0.19 µg/g) is higher than that of peeled red banana flour (0.07 µg/g) [32]. Increasing of vitamin A content after fermentation treatment in this study in line with study of Kiczorowski et al. that fermentation in carrot was increased vitamin A content from 736.1 to 987.5 µg/g [46]. Fermentation can optimize the cell wall degradation process, thereby increasing the diffusion of biologically active substances from the inside of the cell, and then starting a better extraction [47].

3.3 Sensory of snack bar

Sensory evaluation with parameters including texture, color, aroma, taste, and overalls did not significantly different in all treatment samples (Table 3). Samples assessment of taste in the range of 2.29 – 2.64, texture in the range of 1.94 – 2.20, color in the range of 1.91 – 2.14, and overalls in the range of 2.40 – 2.57. All assessments on sensory evaluation parameters represent dislike to slightly dislike. This result indicates that the presence of banana peels and fermentation process in banana flour did not affect the panelists' acceptance. However, the results of this sensory evaluation showed that the product was less acceptable to the panelists. The result was similar to Singh et al. study, adding the unripe banana peel powder gradually reducing the sensory acceptability in aroma, taste, texture, color and appearance of functional snack bar [48].

Table 3. Sensory of snack bar

Samples	Sensory parameter				
	Taste	Texture	Aroma	Color	Overall
SB_TK	2.43[a]	2.03[a]	2.20[a]	1.91[a]	2.40[a]
SB TKF	2.63[a]	1.94[a]	2.20[a]	2.14[a]	2.57[a]
SB K	2.29[a]	2.14[a]	1.89[a]	2.11[a]	2.46[a]
SB KF	2.29[a]	2.20[a]	1.94[a]	2.11[a]	2.51[a]

Therefore, the formulation improvements were needed to increase the sensory acceptability of banana snack bar product. The combination of banana flour with pumpkin seed flour was shown to increase panelists' sensory acceptance of nutrition bar [49]. Safrida el al also reported that the sensory acceptance of bread and kastengel products increased due to the use of a combination of banana and sweet potato flour [50].

3.4 Selection of the best product

Selection of the best product is taken according to macro and micronutrient parameters. Macronutrient parameters include moisture content, ash, protein, fat, carbohydrates, total dietary, total sugar, while micronutrient parameters include potassium, calcium, sodium, phosphorus, vitamin A, vitamin D, and selenium. Assessment of smaller better (the smaller value indicates the better quality) for the parameters of water content, fat, total sugar, while the assessment of higher better (the higher value indicates the better

quality) for other parameters. Based on the calculation of the total Nh for each sample of all parameters, it was found that the SB_K sample had the highest total Nh value, namely 3.588 followed by the SB_KF, SB_TKF samples and finally SB_TK.

Table 4. Selection of the best product with effectiveness index method

Samples	Total Nh	Rank
SB_TK	2.792	4
SB TKF	2.822	3
SB K	3.588	1
SB KF	2.961	2

4 Conclusion

The results showed that snack bars made of unpeeled and fermented plantain flour produced better macronutrients than other. Meanwhile peeled and unfermented plantain flour produced better micronutrient tendencies compared to other treatments. Based on the effectivity index using the De Garmo method, the best snack bar is made from peeled and unfermented banana flour (SB-K). However, this snack bar has sensory acceptability which is not significantly different from other treatments.

This research was funded by Insentif Riset Sistem Inovasi Nasional (INSINAS) 2020. The authors acknowledge the facilities, scientific and technical support from Laboratory of Research Center for Appropriate Technology, National Research and Innovation Agency.

References

[1] M. C. T. R. Vidigal, V. P. R. Minim, A. A. Simiqueli, P. H. P. Souza, D. F. Balbino, and L. A. Minim, "LWT - Food Sci. Technol.," vol. 60, pp. 832-840, 2015.
[2] M. Castillo-Vergara, I. Quispe-Fuentes, and J. Poblete, "Eng. Econ.," vol. 32, pp. 197-209, 2021.
[3] T. A. Anyasi, A. I. O. Jideani, and G. R. A. Mchau, "Food Res Int.," vol. 104, pp. 100-109, 2018.
[4] T. A. Anyasi, A. I. O. Jideani, and G. R. A. Mchau, "Compr Rev Food Sci Food Saf.," vol. 12, pp. 509-522, 2013.
[5] F. M. E. Dwivany, "Pisang Indonesia," ITB Press, Bandung, 2021.
[6] R. Ekafitri, R. Kumalasari, Y. Suryani, N. S. Acahyadi, D. Desnilasari, N. K. I. Mayasti, and D. N. Surahman, "Emirates J. Food Agric.," vol. 33, pp. 980-991, 2021.
[7] O. M. Elvis, "Adv. Food Sci. Technol.," vol. 2, pp. 276-280, 2014.
[8] K. O. Falade and S. A. Oyeyinka, "J. Food Process. Preserv.," vol. 39, pp. 816-828, 2014.
[9] U. Inyang, S. Nkop, and E. Umoh, "Curr. J. Appl. Sci. Technol.," vol. 24, pp. 1-9, 2017.
[10] R. Kumalasari, L. Vanadiani, R. Ekafitri, I. S. Nurminabari, D. Desnilasari, N. K. I. Mayasti, and D. N. Surahman, "Czech J. Food Sci.," vol. 39, pp. 35-41, 2021.
[11] D. Desnilasari, S. A. Kusuma, R. Ekafitri, and R. Kumalasari, "Biopropal Ind.," vol. 11, pp. 19-31, 2020.
[12] E. Juarez-Garcia, E. Agama-Acevedo, S. G. Sáyago-Ayerdi, S. L. Rodríguez-Ambriz, and L. A. Bello-Pérez, "Plant Foods Hum. Nutr.," vol. 61, pp. 131-137, 2006.

[13] C. Y. Cheok, R. Sulaiman, N. A. Manan, A. J. Zakora, N. L. Chin, and N. Hussain, "Int. Food Res. J.," vol. 25, pp. 2585-2592, 2018.
[14] J. G. Mahore and S. V. Shirolkar, "J. Young Pharm.," vol. 10, pp. 293-297, 2018.
[15] F. S. R, R. Saifullah, F. M. A. Abbas, and M. E. Azhar, "Int. Food Res. J.," vol. 19, pp. 1041-1046, 2012.
[16] V. N. Castelo-Branco et al., "Brazilian J. Food Technol.," vol. 20, pp. 1-8, 2017.
[17] A. K. B, F. Persia, P. S. Aswathy, J. Chandran, M. S. Sajeev, P. Jayamurthy, and P. Nisha, "J. Food Sci. Technol.," vol. 52, pp. 6355-6364, 2015.
[18] A. Campuzano, C. M. Rosell, and F. Cornejo, "Food Chem.," vol. 256, pp. 11-17, 2018.
[19] E. Agama-Acevedo, J. A. Sañudo-Barajas, R. V. Rocha, G. A. González-Aguilar, and L. A. Bello-Peréz, "CYTA - J. Food.," vol. 14, pp. 117-123, 2016.
[20] L. Ratnawati and N. Afifah, "Proc. of the 3rd International Symposium on Applied Chemistry 2017," vol. 1904, pp. 1-8, American Institute of Physics, New York, 2017.
[21] R. Ekafitri et al., "Biopropal Ind.," vol. 10, pp. 15-28, 2019.
[22] A. Sarifudin et al., "Food Sci. Technol.," vol. 41, pp. 21-28, 2021.
[23] D. N. Surahman et al., "Biopropal Ind.," vol. 11, pp. 127-137, 2020.
[24] I. S. P. Genitha, "J. Food Process. Technol.," vol. 5, pp. 1-6, 2014.
[25] E. Agama-Acevedo, J. J. Islas-Hernández, G. Pacheco-Vargas, P. Osorio-Díaz, and L. A. Bello-Pérez, "LWT - Food Sci. Technol.," vol. 46, pp. 177-182, 2012.
[26] "AOAC Official Methods of Analysis," Association of Official Analytical Chemist, Virginia, 1990.
[27] J. P. Girard, "Technology of meat and meat products," Ellis Horwood, New York, 1992.
[28] S. R. Rocha, F. J. Sánchez-Muniz, M. Gómez-Juaristi, and M. T. L. Marín, "J. Food Compos. Anal.," vol. 22, pp. 330-336, 2009.
[29] N. K. I. Mayasti et al., "International Conference on Green Agro-industry and Bioeconomy," vol. 733, IOP Publishing, England, 2021.
[30] M. N. Buwono, B. S. Amanto, and E. Widowati, "Indones. Food Nutr. Prog.," vol. 15, pp. 30-42, 2018.
[31] G. I. Onwuka, A. D. Onyemachi, and N. P. David-Chukwu, "IOSR J. Environ. Sci. Toxicol. Food Technol.," vol. 9, pp. 1-4, 2015.
[32] I. A. Thomas and N. Isong, "Texas J. Agric. Biol. Sci.," vol. 15, pp. 37-42, 2023.
[33] C. V. Bezerra, A. M. C. Rodrigues, E. R. Amante, and L. H. M. Silva, "Rev. Bras. Frutic.," vol. 35, pp. 1140-1146, 2013.
[34] A. Abdullah and Y. Amalia, "Reaktor.," vol. 22, pp. 92-101, 2022.
[35] R. S. Adiandri and N. Hidayah, "2nd International Conference on Agriculture Postharvest Handling and Processing," vol. 309, IOP Publishing, England, 2019.
[36] Z. Ma, X. Zhai, N. Zhang, and B. Tan, "Foods.," vol. 12, pp. 1-17, 2023.
[37] D. Sun-Waterhouse, A. Teoh, C. Massarotto, R. Wibisono, and S. Wadhwa, "Food Chem.," vol. 119, pp. 1369-1379, 2010.
[38] S. G. Nkhata, E. Ayua, E. H. Kamau, and J. B. Shingiro, "Food Sci. Nutr.," vol. 6, pp. 2446-2458, 2018.
[39] M. Klerks, S. Román, R. Verkerk, and L. Sanchez-Siles, "J. Funct. Foods.," vol. 89, pp. 1-10, 2022.
[40] O. T. Adepoju, B. E. Sunday, and O. A. Folaranmi, "African J. Biotechnol.," vol. 11, pp. 13601-13605, 2012.
[41] W. H. Haslinda, L. H. Cheng, L. C. Chong, and A. A. N. Aziah, "Int. J. Food Sci. Nutr.," vol. 60, pp. 232-239, 2009.

[42] "Dietary Reference Intakes for Calcium, Phosphorus, Magnesium, Vitamin D, and Fluoride," The National Academies Press, Washington DC, 1997.
[43] "Dietary Reference Intakes for Sodium and Potassium," The National Academies Press, Washington DC, 2019.
[44] H. Nadeeshani, G. Samarasinghe, R. Silva, D. Hunter, and T. Madhujith, "J. Food Compos. Anal.," vol. 100, pp. 1-7, 2021.
[45] L. Castelo-Branco et al., "Brazilian J. Food Technol.," vol. 20, pp. 1-8, 2017.
[46] K. B. Arun et al., "J. Food Sci. Technol.," vol. 52, pp. 6355-6364, 2015.
[47] A. Campuzano, C. M. Rosell, and F. Cornejo, "Food Chem.," vol. 256, pp. 11-17, 2018.
[48] E. Agama-Acevedo, J. A. Sañudo-Barajas, R. V. Rocha, G. A. González-Aguilar, and L. A. Bello-Peréz, "CYTA - J. Food.," vol. 14, pp. 117-123, 2016.
[49] L. Ratnawati and N. Afifah, "Proc. of the 3rd International Symposium on Applied Chemistry 2017," vol. 1904, pp. 1-8, American Institute of Physics, New York, 2017.
[50] R. Ekafitri et al., "Biopropal Ind.," vol. 10, pp. 15-28, 2019.