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Development Of Jelly Drink Bay Leaf Water Extract With Guava Juice Combination

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Abstract

One of the innovations of processed bay leaf water extract is a jelly drink combined with guava fruit juice. This research is the first study that directly discusses the development of bay leaf water extract jelly drink products containing a glucomannan combination of guava fruit juice in terms of sensory, macro, and micronutrient content in selected jelly drink products. The research was designed as a completely randomized design (CRD) using one-way ANOVA analysis, followed by Duncan's multiple range test (DMRT). The treatment consists of 3 groups and two repetitions with a ratio of (bay leaf water extract: guava juice) of 25:75 (P1), 50:50 (P2), and 75:25 (P3), respectively. Sensory tests of jelly drinks varied significantly (P 0.05) between treatments. The ash content of jelly drinks varied significantly (P 0.05) between treatments. In contrast, water, fat, protein, and carbohydrates by difference did not differ significantly. Jelly drink bay leaf water extract with guava juice combination is categorized as a fat-free food product. The carbohydrate difference in jelly drinks is very low, which means that this product is very good for people at risk and people with diabetes mellitus because it can help control blood glucose levels. Formula jelly drink P2 with a ratio of bay leaf water extract: guava juice = 50: 50 is the selected product in this study, where the content of vitamin C, dietary fiber, iron (Fe), and Calcium (Ca), each ranges from 9.20 mg/100 g; 2.01%; 0.41 mg / 100 g; 9.18 mg / 100 g.

Keywords: Bay leaf, fat-free product, glucomannan, guava juice, jelly drink

Full-length article **Corresponding Author*, e-mail: marliyati@apps.ipb.ac.id

1. Introduction

The Indonesian culinary arts have long employed bay leaf (*Syzygium polyanthum*) as a food ingredient and a means of treating diabetes with beneficial antioxidant effects using drying, crushing, and extraction methods through soaking in boiled water [1]. Empirically and scientifically, bay leaf decoction acts as an antimicrobial, antioxidant, antidiabetic, and anti-cholesterol. Bay leaf extract has high antioxidant activity (IC 2.46 g/ml) [2]. Boiling the leaves until the water is reduced by half is a typical method of making bay leaf decoction [3]. Bay leaf contains various active components that can modulate the function of insulin, glucose, and lipid metabolism [4]–[7]. Toxicity tests reported by Sumiwi et al. 2019 showed that when tested on Wistar rats, bay leaf extract proved non-toxic and harmless [8].

The jelly drink is one of the innovations of processed bay leaf water extract products. People have less time to find a healthy meal because they are busier at work. It is difficult to create a wholesome, ready-to-eat food product that will both satiate consumer demand and postpone hunger [9]. The problem of processing bay leaf extract into drinks is the taste of bay leaves, which is less preferred because it has a sharp and bitter taste [10]. This is because bay leaves contain high bioactive components. One of the efforts made is a combination of guava fruit juice. Guava fruit has great potential because of its excellent nutritional value, good taste, good palatability, and abundant availability at an affordable price [11]. Consumers often consider juice a healthy beverage because it has been marketed as a healthy and natural source of vitamins, minerals, and antioxidants without fat and cholesterol [12]. Guava fruit has no toxic effect on the liver and kidneys of Wistar rats [13]. Guava has been widely used in the culinary business to create popular healthy beverage items in China and Japan [14].

Jelly drink processing is one method that has been recommended as a way to add health value, the availability of good quality food, and ease of consumption [15]. The development of a jelly drink in this research resulted in the development of value-added and nutraceutical foods and produced a gel with a better texture. This research is the first study that directly discusses the development of bay leaf water extract jelly drink products containing a glucomannan combination of guava fruit juice in terms of sensory, macro, and micronutrient content in selected jelly drink products.

2. Materials and methods

2.1 Materials and chemicals

The raw materials are mature bay leaves picked starting from the fifth leaf from the shoots [3]. Fresh red guava fruits with optimal maturity [12] were purchased from a local Lampung market without signs of mold, pests, or diseases, glucomannan produced by Ikarie from Yogyakarta. Other ingredients include stevia [16] extract powder produced by Shandong Shengxiangyuan Biotechnology Co., Ltd. and citric acid produced by PT. Golden Sinar Sakti, Indonesian. The reagents utilized enzyme amyloglucosidase were procured from Sigma-Aldrich (St. Louis, MO, USA); H_2SO_4, H_3BO_3, Hexane, NaOH, HCl, ethanol, acetone, trichloroacetic acid, Folin–Ciocalteu, $CaCO_3$, Ca, Fe; were analytical grade and came from (Merck, U.S.A).

2.2 Study of the ratio of bay leaf water extract to guava juice optimization

The bay leaf water extract combination of guava juice in proportions of (75:25, 50:50, and 25:75) the same glucomannan (1 gram /L water (0.1%) and 0.75 gram /L water (0.075%) added stevia and citric acid was added until the pH reached 4.6 (0.05%), and then heated at 90 °C for 10 min [17]. The jelly drink was immediately cooled and bottled. The jelly drinks were stored at 7 °C [18]. The formula development of jelly drinks is shown in Table 1.

Table 1: Formula development of jelly drink bay leaf water extract with a combination of guava juice

Material	Formula		
	P1 (75: 25)	P2 (50: 50)	P3 (25: 75)
Bay leaf water extract (mL)	750	500	250
Guava juice (mL)	250	500	750
Glucomannan(g)	1	1	1
Stevia (g)	0.75	0.75	0.75
Citric acid (g)	0.5	0.5	0.5
Total (g)	1002.25	1002.25	1002.25

2.3 Measurement of the sensory

Test the sensory of jelly drink products using the hedonic method [19], which aims to assess the level of preference of panelists for the product. Organoleptic test at the Sensoric Laboratory of the Tanjungkarang Polytechnic of Health, Nutrition Department. The product to be tested is a jelly drink consisting of three formulas, namely F1 (jelly drink bay leaf water extract combination of guava juice (25: 75), F2 (50: 50), and F3 (75: 25). All three products are served cold. Panelists received as much as 50 ml [18] @ product to 40 semi-trained panelists who met criteria such as liking fruit juice drinks, not being allergic to spices plants, and not being in a state of pain or symptoms of increased stomach acid. Hedonic tests were conducted on the color, flavor, taste, viscosity, and aftertaste of jelly drink bay leaf water extract combination of guava juice. The value given is a line scale with a range of 1 to 9, namely 1 = dislike extremely, 2 = dislike very much, 3 = dislike moderately, 4= dislike slighly, 5= neither like nor dislike, 6= like slightly, 7= like moderately, 8= like very much, and 9 = like extremely [19]. Panelists were also asked to comment on the products being tested.

2.4 Macronutrition

Macronutrition assay at the chemistry and food analysis laboratory, Departement of Human Nutrition IPB. Proximate analysis of jelly drink bay leaf water extract combination of guava juice was determined using the standard method (SNI 01-2891-1992) with parameters analyzed including water, total ash, crude protein, fat, and carbohydrate by difference [20].

2.5 Micronutrition

Micronutrition assay at the PT Saraswanti Indo Genetech, Bogor, Indonesia. Enzymatic method of dietary fiber analysis [21]. Vitamin C in the sample was determined following the protocol proposed by [22]. Minerals will be investigated at varying quantities for macrominerals (calcium) variations, and microminerals will be used to calibrate products evaluated with AAS (iron). An atomic absorption spectrometer (AAS) fitted with a D2 lamp background correction system was used to measure the mineral content using an air acetylene flame in accordance with the official analysis technique (AOAC, 2005).

2.6 Statistical analysis

The research was designed as a completely randomized design (CRD). One-way analysis of variance was used to statistically examine the experimental data using the Statistical Software Package for Social Sciences from IBM Co. and SPSS Inc. (ANOVA). To ascertain whether there were any significant changes between treatment means at a 95 % confidence interval ($p<0.05$), Duncan's new multiple range tests (DMRT) were employed.

3. Results and Discussions

3.1 Product sensory test

The acceptability test with the hedonic test method aims to determine the level of preference of panelists for jelly drink products. Hedonic tests are performed without comparing between samples. The scale uses a 9-point scale where a scale of 1 means dislike extremely and a scale of 9 means like extremely. Acceptability tests between treatments differ significantly. The one-way ANOVA analysis showed a significant difference ($P<0.05$) in the color, flavor, taste, viscosity, and aftertaste jelly drink acceptability score between treatments. Jelly drink P3 has the most preferred acceptance, followed by jelly drink P2 and P1.

Color

Color is one sensory index of beverages that significantly impacts customers' acceptability [23]. The hedonic value of color ranges from 4.690 to 7.011. The combination of bay leaf water extract with guava juice affects the color of the jelly drink. The higher the comparison of guava juice combinations, the more attractive and preferred the jelly drink color preferred by panelists. Based on DMRT further tests, the highest value was obtained in bay leaf water extract combination jelly drink: guava juice = 75: 25 (7.011), where panelists liked the color of the P3 jelly drink. Further tests of DMRT showed a tendency to increase the color acceptability of panelists based on a comparison of the combination of bay leaf water extract with guava juice. Formula P3 produces lighter colors compared to other formulas.

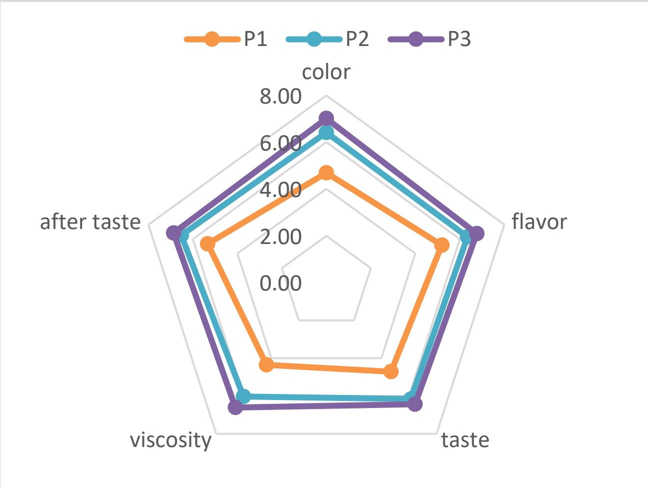

Figure 1: Sensory test evaluation of three formulation jelly drink bay leaf water extract with guava juice combination

Flavor

The analysis showed that the flavor's hedonic value ranged from 5,190 to 6,761. The combination of bay leaf water extract with guava juice affects the flavor of the jelly drink. Based on DMRT further tests, P2 and P3 values were not significantly different, with P2 and P3 flavor values of 6.345 and 6.761. The higher the ratio of guava juice combinations, the more preferred the flavor of the jelly drink. The flavor of the jelly drink is affected by volatile compounds found in bay leaf water extract and guava fruit juice, which have an important role in increasing the flavor of the jelly drink. Guava (*Psidium guajava*) is a tropical fruit with relevance, pleasant flavor, and taste [24]. The flavor of guava fruit is sweet, musky, and highly flavored, attributed to volatile and non-volatile constituents determined by the type and amount of sugars, acids, phenolics, and volatile compounds present in guava fruit and bay leaf water extract. The essential oils that bay leaves contain also contribute to the variation in scent [25]**.** The spicy flavor of bay leaves is affected by many compounds, including eugenol (11–12%), methyl-eugenol (9%–12%), and elemicin (1%–12%). These compounds are significant indicators of the quality of bay leaves [10].

Taste

The analysis showed that the hedonic value of taste ranged from 4,714 to 6,440. The combination of bay leaf water extract with guava juice affects the taste of the jelly drink. The higher the ratio of guava juice combinations, the more preferred the taste of jelly drinks. Based on DMRT further tests, P2 and P3 values were not significantly different, with P2 and P3 taste values of 6,154 and 6,440. The majority of panelists enjoyed practically every jelly drink product. Guava juice added in combination can enhance the flavor of jelly drinks. Taste determines panelists' acceptance or rejection of a food product [17].

Table 2: Sensory test jelly drink bay leaf water extract with guava juice combination

Variable	P1	P2	P3
Color	4.690±1.49[c]	6.416±1.25[b]	7.011±7.01[a]
Flavor	5.190±1.66[b]	6.345±1.35[a]	6.761±1.18[a]
Taste	4.714±1.54[b]	6.154±1.57[a]	6.440±1.45[a]
Viscosity	4.345±1.37[c]	6.023±1.49[b]	6.607±1.18[a]
AfterTaste	5.333±2.47[b]	6.523±2.08[a]	6.869±1.88[a]

Note: The value is presented as the mean ± SD. Values with different p-values in the same column differ significantly ($p < 0.05$). Ns means no significant difference.

Viscosity

The analysis showed that the hedonic viscosity value ranged from 4.345 to 6.607. Combining bay leaf water extract with guava juice affects the acceptability of jelly drink viscosity. The higher the ratio of guava juice combinations, the more preferable the viscosity of jelly drinks. Based on DMRT further tests, the highest value was obtained in the bay leaf water extract combination jelly drink: guava juice = 75: 25 (6.607), where panelists liked the thickness of the P3 jelly drink. Additional jelly drink ingredients include glucomannan, which has a high water absorption ability. Glucomannan will increase the amount of water trapped in the gel, resulting in a softer gel [26]. The pectin content of guava juice also affects the thickness of jelly drinks [27]. Guava is rich in pectin, which breaks down pectin molecules into polygalacturonase, which causes high viscosity [28].

Aftertaste

Aftertaste is all the taste left behind after consuming a jelly drink. The analysis showed that the hedonic value after taste ranged from 5.333 to 6.869. Combining bay leaf water extract with guava juice affects the aftertaste jelly drink. The higher the ratio of guava juice combinations, the more preferred aftertaste jelly drink. Based on DMRT's follow-up test, P2 and P3 values were not significantly different, with P2 and P3 taste values of 6.523 and 6.869, stating that panelists liked the aftertaste jelly drink. The acceptability of aftertaste in jelly drink shows an increasing score with the greater combination of guava. This is because the aftertaste left behind in jelly drinks is very weak. Bay leaves have a strong, bitter flavor that the combination of guava juice can cover up. The presence of essential oils in bay leaves allows for variation in flavor and scent [25]**.**

3.2 Nutritional content of jelly drink

The nutritional value of jelly drink bay leaf water extract with a combination of guava juice includes water, ash, total fat, protein, and carbohydrates by difference. The one-way ANOVA analysis showed a significant difference in jelly drink ash content (P<0.05), which was influenced by the ratio of bay leaf water extract : guava juice. However; water, fat, protein, and carbohydrate by difference showed no difference in jelly drink water content between treatments. The proximate jelly drink analysis results can be seen in Table 3.

Water

Jelly drink has a high water content ranging from 96.825% to 98.080% because the product is targeted to have a soft and thin gel extractor. A jelly sample showed a high water content of P1 (98.08%), followed by jelly drink P2, then P3. The higher the combination of guava juice, the increase in solids, causing a decrease in water content. This result aligns with the porang flour jelly drink of 94.44% [29], higher than herbal jelly drinks ranging from 75.01% - 86.58% [30]. Water content is also related to viscosity. The higher viscosity of jelly drinks shows a decrease in water content [29]. The water content of jelly drinks is influenced by the raw materials, namely fresh greetings, which have a water content of around 50% [25], [31].

Table 3: Nutritional content of the jelly drink

Variable	P1	P2	P3
Water^{s}	98.080±0.74	96.890±1.00	96.825±0.02
Ash	0.020±0.00^{b}	0.070±0.014^{a}	0.085±0.021^{a}
Fat^{ns}	0.080±0.042	0.090±0.000	0.070±0.014
Protein^{ns}	0.125±0.007	0.140±0.000	0.150±0.028
Carbohidrate-by-difference^{ns}	1.660±1.749	2.835±1.039	2.860±0.014

Note: The value is presented as the mean ± SD. Values with different p-values in the same column differ significantly ($p < 0.05$). ^{Ns} means that there is no significant difference.

Ash

Jelly drink has an ash content ranging from 0.020% to 0.085%. Further, DMRT tests showed the highest ash content in P3 jelly drink samples (0.085%), followed by P2 and P1. This result aligns with the porang flour jelly drink by 0.1% [29], lower than the herbal jelly drink by 0.65% - 0.74% [30].

Fat

Jelly drink has a fat content ranging from 0.070% to 0.090%. These results are in harmony with jelly gummies from amla (*Phyllanthus emblica L.),* i.e., they range from 0.07% - 0.11% [32]. This result is lower than the herbal jelly drink and porang flour jelly drink, respectively, by 0.02% - 1.03% and 5.38%. The difference in results is due to differences in the additives used, namely milk and glucomannan flour [29], [30]. A food product is fat-free if it contains less than 0.5 grams of fat/100 grams (0.50%) [33], [34]. Jelly drink bay leaf water extract with a combination of guava juice is categorized as a fat-free food product. This can happen because the ingredients used in making jelly drinks are bay leaf water extract, guava juice, and glucomannan, which contain low fat [35].

Protein

Jelly drinks have protein levels ranging from 0.125% to 0.150%. This result is lower than herbal jelly drinks and jelly gummies from amla (*Phyllanthus emblica L.),* respectively, by 1.46 - 2.45% and 1.33-1.6% [30], [32] but higher than porang flour jelly drink by 0.015% [29].

Carbohydrates difference

Based on the difference, the total carbohydrate content of the jelly drink is computed by deducting 100% of the sample's nutritional content from the water, ash, protein, and fat contents. The carbohydrate difference in jelly drinks ranges from 1.660% to 2.860%. The results of this study were lower than the guava jelly and red beet jelly combination of roselle and guava juice, respectively, by 30.21%, 26.83%, and 4.96% [36]–[38]. Low levels of carbohydrates difference in jelly drinks are very good for people at risk and people with DM because they can help control blood glucose levels. Consumption of jelly drinks in people at risk of Diabetes Mellitus makes their blood glucose levels more controlled.

3.3 Correlation between sensory and physicochemical characteristics of jelly drink bay leaf water extract guava juice combination

The average score of all receptivity attributes was positively correlated with the physicochemical properties of the jelly drink. The average score of jelly drink color acceptability is positively correlated, where the higher the percentage of guava juice combination, the brighter the jelly has a brighter red color with high yellowish color intensity. The highest value of viscosity acceptability is obtained in a jelly drink combination of bay leaf water extract: guava juice = 75: 25 (P3). The higher the ratio of guava juice combinations, the higher the viscosity of the jelly drink produced. Water content also affects the viscosity of a product, where the lower the water content, the higher the viscosity of the jelly drink.

3.4 Selected Nutritional Value Information

Formula jelly drink P2 with a ratio of bay leaf water extract: guava juice = 50: 50 was the selected product in this study. The results showed the content of vitamin C, dietary fiber, iron (Fe), and Calcium (Ca), each ranging from 9.20 Mg / 100 g; 2.01%; 0.41 Mg / 100 g; 9.18 Mg / 100 g can be seen in Table 4. This result is almost equivalent to the vitamin C content of tomato jelly drink of 9.51 mg / 100 g [17] but lower than the combination of tamarillos and papaya jelly drink and pineapple-based tomato drink, respectively, by 31.8 mg / 100 grams and 27.3 ± 2.2 mg / 100 g [39], [40]. The food fiber from the study was comparable to amla drinks and ginger juice jelly sticks, respectively, by 2.41%, 2.38%, or 2.38g/100g [41], [42].

The content of minerals in food is very diverse. The iron content of a jelly drink is lower than that of a drink made from potatoes, a combination of fresh beet juice with guava juice, by 4.02 mg / 100 g [43]. The low iron content of a jelly drink is due to the raw materials used, where the iron content of fresh guava fruit varies by 1.1 mg / 100 g and 0.4 mg / 100 g [44], [45] while the iron content of bay leaves ranges from 1 -1.5 mg / 100 g [35].

Table 4: Micronutrient value jelly drink bay leaf water extract with combined guava juice

No	Parameters	Unit	Jelly drink (P2)
1	Vitamin C (Asam Askorbat)	Mg/100 g	9.20 ± 0.056
2	Dietary fiber	%	2.01 ± 0.056
3	Iron (Fe)	Mg/ 100 g	0.41 ± 0.00
4	Calcium (Ca)	Mg/ 100 g	9.18 ± 0.25

Note: P2 = jelly drink bay leaf water extract: guava juice (50: 50)

Teeth and bones are composed primarily of calcium, a mineral. Calcium is attributed to the normal functioning of the heart, hormone secretion, blood clotting, and the transmission of impulses from the neurological and muscular systems. Jelly drink has a calcium content of 9.18 mg / 100 g. This result is higher than the jelly drink green okra of 5.43 mg / 100g [46]. The calcium content of fresh guava fruit varies, respectively 14 mg / 100 g and 2 mg / 100 g [44], [45], While the calcium content of bay leaves ranges from 51 -53 mg / 100 g [35]. Adding water to the extraction process can reduce the concentration of minerals in beverages [46] so that each extract has decreased iron and calcium content. The heating process can also cause loss of nutrient content in food due to water-soluble and heating functions [47].

4. Conclusions

The product acceptability test of jelly drinks varied significantly (P 0.05) between treatments, according to the findings of the one-way ANOVA study. DMRT follow-up test results were not significantly different, including flavor, taste, and aftertaste of jelly drinks P2 and P3. The ash content of jelly drinks varied significantly (P 0.05) between treatments, according to the findings of the one-way ANOVA study. In contrast, water, fat, protein, and carbohydrates by difference did not differ significantly. Jelly drink bay leaf water extract with guava juice combination is categorized as a fat-free food product. The carbohydrate difference in jelly drinks is very low, which means that this product is very good for people at risk and people with diabetes mellitus because it can help control blood glucose levels. Formula jelly drink P2 with a ratio of bay leaf water extract: guava juice = 50: 50 is the selected product in this study, where the content of vitamin C, dietary fiber, iron (Fe), and Calcium (Ca), each ranges from 9.20 mg/100 g; 2.01%; 0.41 mg /100 g; 9.18 mg /100 g.

References

[1] I. D. Dewijanti *et al.*, "Bioactivities of Syzygium polyanthum (Wight) Walp leaf extract for decreasing diabetic risk," *AIP Conf. Proc.*, vol. 2024, no. November 2018, 2018, doi: 10.1063/1.5064297.

[2] M. A. Syabana, N. D. Yuliana, I. Batubara, and D. Fardiaz, "Antidiabetic activity screening and nmr profile of vegetable and spices commonly consumed in Indonesia," *Food Sci. Technol.*, vol. 41, no. June, pp. 254–264, 2021, doi: 10.1590/fst.14120.

[3] M. A. Syabana, N. D. Yuliana, I. Batubara, and D. Fardiaz, "α-glucosidase inhibitors from Syzygium polyanthum (Wight) Walp leaves as revealed by metabolomics and in silico approaches," *J. Ethnopharmacol.*, vol. 282, no. April 2021, p. 114618, 2022, doi: 10.1016/j.jep.2021.114618.

[4] L. Sulastri, P. Simanjuntak, W. Sumaryono, R. Djamil, D. Ardiaynto, and S. Abdillah, "Antidiabetic Formulation Development Based on Natural Materials As α-Glucosidase Enzyme Inhibitor," *J. Hunan Univ. Nat. Sci.*, vol. 49, no. 1, pp. 228–238, 2022, doi: 10.55463/issn.1674-2974.49.1.29.

[5] W. Kooti, M. Farokhipour, Z. Asadzadeh, D. Ashtary-Larky, and M. Asadi-Samani, "The role of medicinal plants in the treatment of diabetes: a systematic review," *Electron. physician*, vol. 8, no. 1, pp. 1832–1842, 2016, doi: 10.19082/1832.

[6] K. Hanhineva *et al.*, "Impact of dietary polyphenols on carbohydrate metabolism," *Int. J. Mol. Sci.*, vol. 11, no. 4, pp. 1365–1402, 2010, doi: 10.3390/ijms11041365.

[7] M. Ali Asgar, "Antidiabetic potential of phenolic compounds: A review," *Int. J. Food Prop.*, vol. 16, no. 1, pp. 91–103, 2013, doi: 10.1080/10942912.2011.595864.

[8] S. A. Sumiwi, A. Zuhrotun, R. Hendriani, M. Rizal, J. Levita, and S. Megantara, "Subchronic toxicity of ethanol extract of Syzygium polyanthum (Wight) Walp. leaves on wistar rat," *Indones. Biomed. J.*, vol. 11, no. 1, pp. 30–35, 2019, doi: 10.18585/inabj.v11i1.458.

[9] S. Rittisak, N. Lonuch, S. Buakeeree, and S. Yimtoe, "Development of jelly drink from cultivated banana pseudo stem juice (Musa sapientum L.) and pineapple juice supplemented with pineapple pulp," *Food Res.*, vol. 7, no. 2, pp. 52–59, 2023, doi: 10.26656/fr.2017.7(2).721.

[10] M. A. Hanif, H. Nawaz, M. M. Khan, and H. J. Byrne, *Medicinal Plants of South Asia*, vol. 11, no. 11. 2020. doi: 10.1016/c2017-0-02046-3.

[11] D. M. Kadam, P. Kaushik, and R. Kumar, "Evaluation of Guava Products Quality," *Int. J. Food Sci. Nutr. Eng.*, vol. 2, no. 1, pp. 7–11, 2012, doi: 10.5923/j.food.20120201.02.

[12] S. Fereidoon and A. Cesarettin, *Handbook of Functional Beverages and Human Health*. 2016. doi: 10.1201/b19490.

[13] B. Legba *et al.*, "Toxicological characterization of six plants of the beninese pharmacopoeia used in the treatment of salmonellosis," *J. Toxicol.*, vol. 2019, 2019, doi: 10.1155/2019/3530659.

[14] Y. Jiao, D. Hua, D. Huang, Q. Zhang, and C. Yan, "Characterization of a new heteropolysaccharide from green guava and its application as an α-glucosidase inhibitor for the treatment of type II diabetes," *Food Funct.*, vol. 9, no. 7, pp. 3997–4007, 2018, doi: 10.1039/c8fo00790j.

[15] E. Z. M. Zitha *et al.*, "Impact of processing, packages, and storage on quality of mangaba (Hancornia speciosa Gomes) jelly," *J. Food Process. Preserv.*, vol. 44, no. 10, pp. 1–13, 2020, doi: 10.1111/jfpp.14814.

[16] D. Villaño, H. Masoodi, J. Marhuenda, C. García-Viguera, and P. Zafrilla, "Stevia, sucralose and sucrose added to a maqui-Citrus beverage and their effects on glycemic response in overweight subjects: A randomized clinical trial," *Lwt*, vol. 144, no. February, 2021, doi: 10.1016/j.lwt.2021.111173.

[17] Novelina, N. Nazir, and M. R. Adrian, "The Improvement Lycopene Availability and Antioxidant Activities of Tomato (Lycopersicum Esculentum, Mill) Jelly Drink," *Agric. Agric. Sci. Procedia*, vol. 9, pp. 328–334, 2016, doi: 10.1016/j.aaspro.2016.02.144.

[18] R. S. Bueno *et al.*, "Quality and shelf life assessment of a new beverage produced from water kefir grains and red pitaya," *Lwt*, vol. 140, no. December 2020, 2021, doi: 10.1016/j.lwt.2020.110770.

[19] J. Lim, "Hedonic scaling: A review of methods and theory," *Food Qual. Prefer.*, vol. 22, no. 8, pp. 733–747, 2011, doi: 10.1016/j.foodqual.2011.05.008.

[20] AOAC, "Official Methods of Analysis of AOAC International," *Aoac*, no. February, 2005.

[21] B. V. McCleary *et al.*, "Determination of insoluble, soluble, and total dietary fiber (CODEX definition) by enzymatic-gravimetric method and liquid chromatography: Collaborative study," *J. AOAC Int.*, vol. 95, no. 3, pp. 824–844, 2012, doi: 10.5740/jaoacint.CS2011_25.

[22] L. E. Ordóñez-Santos and J. Martínez-Girón, "Thermal degradation kinetics of carotenoids, vitamin C and provitamin A in tree tomato juice," *Int. J. Food Sci. Technol.*, vol. 55, no. 1, pp. 201–210, 2020, doi: 10.1111/ijfs.14263.

[23] X. Chen, Y. Xu, J. Wu, Y. Yu, B. Zou, and L. Li, "Effects of Pectinase Pre-Treatment on the Physicochemical Properties, Bioactive Compounds, and Volatile Components of Juices from Different Cultivars of Guava," *Foods*, vol. 12, no. 2, 2023, doi: 10.3390/foods12020330.

[24] S. S. Campoli, M. L. Rojas, J. E. P. G. do Amaral, S. G. Canniatti-Brazaca, and P. E. D. Augusto, "Ultrasound processing of guava juice: Effect on structure, physical properties and lycopene in vitro accessibility," *Food Chem.*, vol. 268, no. June, pp. 594–601, 2018, doi: 10.1016/j.foodchem.2018.06.127.

[25] Y. Khaled Khodja, M. Bachir-Bey, M. Belmouhoub, R. Ladjouzi, F. Dahmoune, and B. Khettal, "The botanical study, phytochemical composition, and biological activities of Laurus nobilis L. leaves: A review," *Int. J. Second. Metab.*, vol. 10, no. 2, pp. 269–296, 2023, doi: 10.21448/ijsm.1171836.

[26] H. Herawati and E. Kamsiati, "The Characteristics of Low Sugar Jelly Made From Porang Flour and Agar," *IOP Conf. Ser. Earth Environ. Sci.*, vol. 1024, no. 1, 2022, doi: 10.1088/1755-1315/1024/1/012019.

[27] M. S. Hashim and F. A. Ismail, "Innovation And Influence Of Storage Temperature On Viscosity , Colour , Emulsion And Vitamin E Stability Of Pink," vol. 5, no. 13, pp. 65–79, 2023, doi: 10.35631/IJIREV.513007.

[28] K. A. Ninga, Z. S. C. Desobgo, S. De, and E. J. Nso, "Pectinase hydrolysis of guava pulp: effect on the physicochemical characteristics of its juice," *Heliyon*, vol. 7, no. 10, p. e08141, 2021, doi: 10.1016/j.heliyon.2021.e08141.

[29] E. A. Suryana, E. Kamsiati, S. Usmiati, and H. Herawati, "Effect of Porang Flour and Low-Calorie Sugar Concentration on the Physico-Chemical Characteristics of Jelly Drinks," *IOP Conf. Ser. Earth Environ. Sci.*, vol. 985, no. 1, 2022, doi: 10.1088/1755-1315/985/1/012042.

[30] A. Bahar, M. Monica Sianita Basukiwardojo, N. Kusumawati, S. Muslim, and A. Sella Auliya, "Effect of Milk on Physico-Chemical and Functional of Herbal Jelly Drink," *Atlantis-Press.Com*, vol. 209, no. Ijcse, pp. 34–39, 2021, [Online]. Available: https://www.atlantis-press.com/article/125966530.pdf

[31] Tabel Komposisi Pangan Indonesia, *Tabel komposisi pangan indonesia*. Indonesia: Kementerian Kesehatan Republik Indonesia, 2018. [Online]. Available: https://panganku.org/id-ID/beranda

[32] K. Ts, V. Hena, I. Wilson, and S. Kn, "Development of nutraceutical jelly gummies from amla (Phyllanthus emblica L.) using natural sugar sources," *Pharma Innov. J.*, vol. 12, no. 6, pp. 2344–2348, 2023, [Online]. Available: www.thepharmajournal.com

[33] BPOM, “Peraturan Badan Pengawas Obat dan Makanan Nomor 1 Tahun 2022,” *Menteri Kesehat. Republik Indones. Peratur. Menteri Kesehat. Republik Indones.*, vol. 69, no. 555, pp. 1–53, 2022.

[34] E. A. Wartella, A. H. Lichtenstein, and C. S. Boon, *Examination of Front-of-Package Nutrition Rating Systems and Symbols*. 2010. doi: 10.17226/12957.

[35] S. Batool, R. A. Khera, M. A. Hanif, and M. A. Ayub,

"Bay Leaf," *Med. Plants South Asia Nov. Sources Drug Discov.*, pp. 63–74, 2019, doi: 10.1016/B978-0-08-102659-5.00005-7.

[36] K. M. Cho and H. H. Lwin, "Comparative Study on Nutritional Values and Some Physicochemical Properties of Jelly Prepared from Psidium guajava (Guava) Comparative Study on Nutritional Values and Some Physicochemical Properties of Jelly Prepared from Psidium guajava (Guava) Intro," *Univ. Yangon Res. J.*, vol. 9, no. 1, pp. 469–476, 2019, [Online]. Available: https://www.researchgate.net/publication/342762934_Comparative_Study_on_Nutritional_Values_and_Some_Physicochemical_Properties_of_Jelly_Prepared_from_Psidium_guajava_Guava

[37] S. M. S. Awad and A. M. Shokry, "Usage of Red Beet (Beta vulgaris L.) and Roselle (Hibiscus sabdarriffa L.) in Jelly Production," *Int. J. Environtment*, vol. 08, no. 02, pp. 142–150, 2019.

[38] M. S. Hashim and F. A. Ismail, "Proximate And Physicochemical Analysis Of Pink Guava Juice Fortified With Vitamin E," vol. 9, no. 2, pp. 21–29, 2021.

[39] I. Nuraeni, A. Proverawati, and A. Ulfa, "Characteristics of tamarillo jelly drink using various sugar concentration and the proportion of papayas as a healthy drink for school children," *Ann. Trop. Med. Public Heal.*, vol. 22, no. 11, 2019, doi: 10.36295/ASRO.2019.221156.

[40] R. Kaur *et al.*, "Assessing the Protein-Ligand Interaction and Thermally Induced Quality Changes in Tomato-Based Pineapple Beverage," *Beverages*, vol. 9, no. 1, pp. 1–16, 2023, doi: 10.3390/beverages9010012.

[41] T. S. Mastuti and A. F. Setiawanto, "Characteristic of Red Ginger Jelly Stick with Variation Type of Gelling Agent," *Proc. 6th Int. Conf. Food, Agric. Nat. Resour. (IC-FANRES 2021)*, vol. 16, pp. 199–207, 2022, doi: 10.2991/absr.k.220101.026.

[42] N. Surya, S. J. Poornakala, S. Kanchana, and G. Hemalatha, "Development of Amla (Emblica officinalis) ready to serve beverage fortified with dietary fiber," *emergent Life Sci. Res.*, vol. 06, no. 01, pp. 06–15, 2020, doi: 10.31783/elsr.2020.610615.

[43] F. Elzamzamy and M. Mostafa, "Effect of Fruit/Vegetable Drink from Potato Skin Water Extract, Beetroots and Fruit Juice Combinations on Iron Bioavailability in Iron Deficient Rats," *J. Food Dairy Sci.*, vol. 2018, no. 0, pp. 197–204, 2018, doi: 10.21608/jfds.2018.77779.

[44] U. Upara, "Improvement of guava drink processing," *Acta Hortic.*, vol. 1213, pp. 339–343, 2018, doi: 10.17660/ActaHortic.2018.1213.49.

[45] D. Izwardy, M. Mahmud, Hermana, and Nazarina, *Tabel Komposisi Pangan Indoensia 2017*, vol. 2, no. 2. Kementerian Kesehatan Republik Indonesia: Kementerian Kesehatan Republik Indonesia, 2018. doi: 10.29103/averrous.v2i2.412.

[46] B. Sugara, K. Ambarwati, and E. Damayanthi, "Mineral bioavailability in jelly drink made of green okra (Abelmoschus esculentus) and strawberry (Fragaria ananassa) extract," *IOP Conf. Ser. Earth Environ. Sci.*, vol. 196, no. 1, 2018, doi: 10.1088/1755-1315/196/1/012007.

[47] H. W. Xiao *et al.*, "Recent developments and trends in thermal blanching – A comprehensive review," *Inf. Process. Agric.*, vol. 4, no. 2, pp. 101–127, 2017, doi: 10.1016/j.inpa.2017.02.001.