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Physicochemical and Organoleptic Characteristics of Jelly Drink Produced from Lamtoro Gung (*Leucaena leucocephala*) Seed Juice, Pineapple Juice, and Kappa Carrageenan

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A B S T R A C T

In this study, a jelly drink was produced using lamtoro gung seed juice as a plant-based protein source, combined with pineapple juice to enhance aroma and flavour, and kappa carrageenan as a hydrocolloid to impart the jelly drink's gel texture. This study was an experimental research aimed at determining the effects of the proportions of lamtoro gung juice and pineapple juice, as well as the addition of kappa carrageenan, on the physicochemical and organoleptic characteristics of the jelly drink. The study employed a factorial Completely Randomized Design (CRD) with two factors and two replications. Factor I was the proportion of lamtoro gung juice to pineapple juice (60:40, 50:50, and 40:60), while Factor II was the concentration of kappa carrageenan (0.2%, 0.3%, and 0.4%). Data were analyzed using Analysis of Variance (ANOVA) followed by Duncan's Multiple Range Test (DMRT) at a 5% significance level. The best treatment was obtained from the proportion of lamtoro gung juice to pineapple juice of 40:60 with the addition of 0.4% carrageenan. This treatment exhibited favorable physicochemical and organoleptic characteristics, including moisture content (77.575%), total solids (22.675%), pH (4.69), total soluble solids (21 °Brix), protein content (0.935%), antioxidant activity (63.12%), vitamin C content (17.89%), syneresis (39.345%), viscosity (630), and hedonic scores for color 3.84 (neutral to slightly liked), aroma 3.36 (neutral to slightly liked), taste 3.84 (neutral to slightly liked), and texture 3.84 (neutral to slightly liked).

Contribution to Sustainable Development Goals (SDGs):
SDG 2: Zero Hunger
SDG 3 – Good Health and Well-Being
SDG 9 – Industry, Innovation, and Infrastructure
SDG 12 – Responsible Consumption and Production

1. INTRODUCTION

1.1. Research Background

Jelly drink is a gel-based beverage consumed by suction and is generally produced from fruit juice, sugar, and hydrocolloid compounds [1]. According to SNI 8897:2020, there are currently no quality standards specifying protein content in jelly drink products. The use of fruit juice as the main ingredient results in jelly drinks that primarily contain vitamins, while protein content has not been a major consideration in commercial jelly drink products. However, protein plays an essential role in children's growth and development [2] and serves as an important energy reserve for pregnant and breastfeeding women [3]. Therefore, the incorporation of protein sources into jelly drink formulations has the potential to generate innovative functional food products with enhanced nutritional value.

1.2. Literature Review

Mature lamtoro gung seeds, characterized by a brown color and dry condition, contain approximately 20% protein, indicating their potential as a plant-based protein source [4]. Lamtoro production in Indonesia has continued to increase, reaching approximately 50,000 tons per year in 2022; however, its utilization remains limited, with most of the production used as animal feed [6]. This limited utilization results in mature lamtoro gung seeds often being left to dry and discarded, despite their high nutritional value. Therefore, mature lamtoro gung seeds have strong potential to be developed as an alternative food ingredient and a raw material for plant-based protein functional foods.

The main drawback of lamtoro gung seeds is the presence of an undesirable beany odor, necessitating processing innovations to improve their sensory characteristics. In this study, lamtoro gung seeds were processed into a jelly drink product with the addition of pineapple juice, carrageenan as a gelling agent, and cinnamon as an aroma enhancer. The use of mature and dried lamtoro gung seeds was selected because drying processes have been reported to reduce beany odor [4]. Pineapple juice was incorporated due to its vitamin C, beta-carotene, and pectin contents [6], as well as its strong aroma and flavor capable of masking beany odor [7]. Previous studies have demonstrated that pineapple addition effectively suppresses beany odor in plant-based processed products [8].

Carrageenan was employed as a hydrocolloid in jelly drink production due to its function as a thickening and gelling agent [9]. Kappa carrageenan was specifically selected because it forms a firm yet brittle gel, making it suitable for jelly drink products intended for consumption by suction [10]. The addition of carrageenan affects the physical and chemical properties of jelly drinks, including viscosity and syneresis [11]. The optimum carrageenan concentration has been reported to vary depending on the raw material, such as 0.4% in pineapple jelly drinks [12] and 0.2% in pedada mangrove jelly drinks [13]. In addition, cinnamon, which contains cinnamomum oil and oleoresin, was added to enhance the aroma of the product [14].

1.3. Research Objective

This study aimed to determine the optimal proportion of lamtoro gung seed juice and pineapple juice as well as carrageenan concentration, based on the physical, chemical, and organoleptic characteristics of jelly drink.

2. MATERIALS AND METHODS

2.1. Research Materials

The materials used for the production of lamtoro-based jelly drink included mature, dried, brown-colored lamtoro gung seeds, kappa carrageenan, water, sugar, pineapple fruit, and cinnamon. The equipment used in jelly drink preparation consisted of a cooking pan, blender, strainer, weighing scale, and basin. The instruments used for protein analysis by the Kjeldahl method included Kjeldahl tubes, a distillation apparatus, 125 mL Erlenmeyer flasks, burettes, and Erlenmeyer flasks. Moisture content and total solids analyses using the oven method employed weighing bottles, an oven, an analytical balance, and a desiccator. pH measurement was performed using a pH meter. Syneresis analysis utilized filter paper and a weighing scale. Viscosity measurement was conducted using a viscometer. Total soluble solids were measured using a hand refractometer. Antioxidant activity analysis by the DPPH method used a spectrophotometer. Vitamin C analysis employed Erlenmeyer flasks, pipettes, and burettes.

2.2. Method

This study employed a Completely Randomized Design (CRD) with two factors. Factor I was the proportion of lamtoro gung juice to pineapple juice (60:40, 50:50, and 40:60), while Factor II was the concentration of carrageenan (0.2%, 0.3%, and 0.4%). The analyses conducted included chemical, physical, and organoleptic evaluations.

2.3. Process of Making Jelly Drink

The production process of jelly drink from lamtoro gung seed juice with the addition of pineapple juice was conducted with modifications based on the methods reported by Ressa [12], Putra [13], and Amelia [15]. Filtered lamtoro gung seed juice and pineapple juice were prepared according to the treatment proportions of 60:40, 50:50, and 40:60. Subsequently, sugar (18 g) and cinnamon (2 g) were added to the mixture. Carrageenan was then incorporated according to the treatment concentrations of 0.2%, 0.3%, and 0.4%. All ingredients were mixed and heated at 90 °C for 2 minutes with continuous stirring. The jelly drink solution was then poured into containers and allowed to cool.

2.4. Analysis of Chemical, Physical, and Organoleptic Characteristics of Jelly Drink

Chemical analyses of the jelly drink product included moisture content determination using the oven method (Sudarmadji et al., 1997), pH measurement (Apriyantono, 1989), protein content analysis using the Kjeldahl method (AOAC, 2005), vitamin C analysis using the titration method (AOAC, 2005), total solids determination (AOAC, 1980), total soluble solids measurement using a hand refractometer (AOAC, 1984), and antioxidant activity analysis using the DPPH method (Hatano et al., 1998). Physical analyses included syneresis testing (AOAC, 2005) and viscosity measurement (Putra, 2021). Organoleptic evaluation was conducted using a hedonic test assessing aroma, taste, color, and texture.

2.5. Data Analysis

The data obtained were analyzed using analysis of variance (ANOVA). When significant differences were observed, Duncan's Multiple Range Test (DMRT) at a 5% significance level was applied to determine interactions among treatment factors. The optimal treatment was subsequently determined using the De Garmo effectiveness test.

3. RESULT AND DISCUSSION

3.1. Chemical Analysis

The chemical analyses conducted included moisture content, total solids, pH, total soluble solids, protein content, antioxidant activity, and vitamin C content. The results are presented in **Table 1.**

3.1.1. Moisture Content

The statistical analysis of the data presented in **Table 1** showed that there was no significant interaction ($p > 0.05$) between the proportion of lamtoro gung juice to pineapple juice and carrageenan addition on the moisture content of the jelly drink. However, the proportion of lamtoro gung juice to pineapple juice affected the moisture content, which was presumably related to the pectin content in pineapple juice and the galactomannan content in lamtoro gung seeds.

Pectin is known to function as a gelling agent in food products. Panjaitan et al. [16] reported that pectin is capable of binding water, allowing its application as a gel-forming agent. Siregar [17] stated that pineapple fruit contains approximately 2.3% pectin. In addition, the moisture content of the jelly drink was also presumed to be influenced by the polysaccharide content of lamtoro gung seeds, particularly galactomannan, which possesses water-binding properties and forms viscous and mucilaginous solutions. This is consistent with the findings of Mittal [18], who reported that lamtoro gung contains 20–25% galactomannan. Bieniek [19] also explained that galactomannan has the ability to bind water and form viscous solutions.

The addition of carrageenan showed a significant effect on the moisture content of the jelly drink. This effect was attributed to the increased amount of water entrapped within the gel structure as the carrageenan concentration increased, resulting in reduced free water. Selviana [20] reported that the addition of carrageenan as a hydrocolloid forms a double-helix structure capable of binding water. According to Siregar et al. [17], water binding due to the addition of hydrocolloids in food products can significantly influence the moisture content of the final product.

Table 1. Chemical Analysis Results of Jelly Drink

Lamtoro gung juice : pineapple juice	Carrageenan	Moisture Content (%)	Total Solids (%)	pH	Total Soluble Solids (Brix)	Protein (%)	Antioxidant (%)	Vitamin C (mg/100g)
60 : 40	0.2%	77.70±0.21^{a}	22.29±0.21^{a}	4.95±0.01^{a}	20.25±0.35^{a}	1.28±0.01^{a}	79.40±0.21^{g}	15.10±0.01^{a}
	0.3%	77.37±0.08^{a}	22.63±0.17^{a}	4.99±0.02^{a}	20.5±0.70^{a}	1.26±0.01^{a}	79.50±0.20^{g}	15.32±0.04^{b}
	0.4%	76.51±0.12^{a}	23.48±0.12^{a}	4.99±0.09^{a}	20.75±0.35^{a}	1.23±0.02^{a}	81.12±0.48^{h}	15.67±0.04^{c}
50 : 50	0.2%	78.90±0.12^{a}	21.10±0.12^{a}	4.76±0.01^{a}	20.25±0.35^{a}	1.17±0.01^{a}	66.78±0.12^{d}	16.18±0.04^{d}
	0.3%	78.22±0.16^{a}	21.77±0.16^{a}	4.80±0.06^{a}	20.75±0.35^{a}	1.14±0.02^{a}	68.35±0.35^{e}	16.35±0.05^{e}
	0.4%	77.53±0.21^{a}	22.46±0.21^{a}	4.84±0.01^{a}	21±0^{a}	1.10±0.01^{a}	78.05±0.15^{f}	16.62±0.04^{f}
40 : 60	0.2%	79.29±0.37^{a}	20.70±0.37^{a}	4.59±0.03^{a}	20.25±0.35^{a}	0.96±0.02^{a}	52.06±0.61^{a}	17.14±0.08^{g}
	0.3%	78.29±0.28^{a}	21.71±0.28^{a}	4.65±0.02^{a}	20.75±0.35^{a}	0.95±0.02^{a}	58.32±0.65^{b}	17.46±0.08^{h}
	0.4%	77.57±0.20^{a}	22.67±0.14^{a}	4.69±0.02^{a}	21±0.70^{a}	0.93±0.02^{a}	63.12±0.18^{c}	17.89±0.07^{i}

3.1.2. Total Solids

The statistical analysis of the data presented in **Table 1** showed that there was no significant interaction ($p > 0.05$) between the proportion of lamtoro gung juice to pineapple juice and the addition of carrageenan on the total solids content of the jelly drink. An increase in the proportion of lamtoro gung juice tended to increase the total solids value, which was presumably attributed to the protein content of lamtoro gung juice. Protein compounds are known to contribute to total solids, as they are classified as solid components in food materials [21].

The addition of sugar in equal amounts, which was treated as a fixed variable, also contributed to the soluble solids that were measured as part of the total solids. Baskara [22] stated that total solids represent the sum of dissolved and suspended solids, both organic and inorganic, remaining after water removal. In addition, pineapple juice also contributed to total solids due to the presence of water-soluble components such as simple sugars, organic acids, vitamins, and polyphenols [23].

An increase in carrageenan concentration resulted in higher total solids values in the jelly drink. This effect was attributed to the ability of carrageenan to bind water, thereby allowing suspended particles to be retained and uniformly distributed within the solution. Marpaung [21] explained that the increase in total solids occurs because free water is bound by carrageenan, leading to a higher concentration of dissolved total solids in the system. Furthermore, carrageenan functions to maintain suspended particles in a homogeneous dispersion and prevent sedimentation.

3.1.3. pH

The statistical analysis of the data presented in Table 1 indicated that there was no significant interaction ($p > 0.05$) between the proportion of lamtoro gung juice to pineapple juice and carrageenan addition on the pH of the jelly drink. A higher proportion of pineapple juice resulted in a lower pH value of the jelly drink, which was presumably due to the acidic nature of pineapple juice, with a raw material pH of 4.12. In addition, pineapple juice contains organic acids such as citric acid, malic acid, and ascorbic acid, which contribute to the reduction of product pH [24]. Citric acid is known to function as a pH regulator and helps maintain pH stability in food systems [25]. These organic acids may also act as buffering agents, thereby resisting pH changes caused by the addition of other ingredients. Carrageenan is known to exhibit alkaline properties due to the use of alkaline solutions during its extraction process [26]. However, the carrageenan concentrations applied in this study were relatively low (0.2–0.4%), resulting in a negligible contribution to pH elevation.

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3.1.4. Total Soluble Solids

The statistical analysis of the data presented in **Table 1** showed that there was no significant interaction ($p > 0.05$) between the proportion of lamtoro gung juice to pineapple juice and carrageenan addition on the total soluble solids of the jelly drink. This result was presumably due to the relatively small differences in the proportion of lamtoro gung juice to pineapple juice among treatments (10% intervals), resulting in similar ranges of soluble components that were not detected as significantly different by the hand refractometer.

The addition of sugar in equal amounts across all treatments made sugar the dominant component in total soluble solids measurements, thereby masking minor differences that might arise from variations in the proportion of lamtoro gung juice to pineapple juice. This finding is consistent with Irawan [27], who reported that sugar is the dominant contributor to total soluble solids measurements using a hand refractometer due to its high solubility. Carrageenan primarily functions as a gelling agent and does not contribute soluble compounds; therefore, it is not detected in total soluble solids measurements [28]. This result is in agreement with Maleki [29], who stated that carrageenan addition does not significantly increase total soluble solids values, although it may affect other physical parameters.

3.1.5. Protein

The statistical analysis of the data presented in **Table 1** indicated that there was no significant interaction ($p > 0.05$) between the proportion of lamtoro gung juice to pineapple juice and carrageenan addition on the protein content of the jelly drink. The results showed that an increase in the proportion of lamtoro gung juice led to a higher protein content in the jelly drink. This was attributed to the relatively higher protein content of lamtoro gung juice, which was reported to be 1.89%, thereby contributing more substantially to the protein content of the product. In contrast, an increased proportion of pineapple juice resulted in a decrease in protein content due to the relatively low protein content of pineapple, which is approximately 0.4% [30].

An increase in carrageenan concentration tended to reduce the measured protein content of the jelly drink. This effect occurred because carrageenan is a polysaccharide that does not contain protein and is capable of forming complexes with proteins, known as proteocarrageenates, which enhance the water-binding capacity of the system [31]. As a hydrocolloid, carrageenan also forms a more extensive gel network, increasing the amount of bound water within the gel matrix. Protein analysis using the Kjeldahl method is expressed on a wet weight basis; therefore, the increase in bound water and sample weight results in a lower measured protein percentage, even though the total nitrogen content of the sample does not decrease [32].

3.1.6. Antioxidant

The statistical analysis of the data presented in **Table 1** showed a significant interaction ($p \leq 0.05$) between the proportions of lamtoro gung juice and pineapple juice and the addition of carrageenan on the antioxidant activity of the jelly drink. Higher proportions of lamtoro gung juice combined with increased carrageenan concentrations tended to enhance the antioxidant activity of the jelly drink. This effect was primarily attributed to the substantially higher antioxidant activity of lamtoro gung juice (83.93%) compared to pineapple juice (42.80%). Lamtoro gung contains various phytochemical compounds, including saponins, tannins, terpenoids, alkaloids, and phenolic compounds, which contribute to its high antioxidant activity [4].

The addition of carrageenan also had a significant effect on increasing the antioxidant activity of the jelly drink. This increase was not due to carrageenan acting as a direct source of antioxidants, but rather to its role in protecting antioxidant compounds during the heating process. Carrageenan forms a double-helix gel structure capable of entrapping antioxidant compounds and increasing viscosity, thereby limiting oxygen diffusion and reducing oxidative reactions. This finding is consistent with Atmaka [33], who reported that carrageenan plays a protective role in preserving antioxidant compounds from degradation caused by heat and oxygen exposure. Nevertheless, the increase in antioxidant activity of the jelly drink was predominantly influenced by the high antioxidant activity of the lamtoro gung juice used as the primary raw material.

3.1.7. Vitamin C

The statistical analysis of the data presented in **Table 1** showed a significant interaction ($p \leq 0.05$) between the proportion of lamtoro gung juice to pineapple juice and carrageenan addition on the vitamin C content of the jelly drink. A higher proportion of pineapple juice relative to lamtoro gung juice, along with increased carrageenan concentration, tended to increase the vitamin C content of the jelly drink. This increase was attributed to the relatively high vitamin C content of pineapple juice, which is approximately 20.70 mg/100 g. The Ministry of Health of the Republic of Indonesia [34] reported that lamtoro gung seeds contain only about 9 mg of vitamin C; therefore, increasing the proportion of pineapple juice directly contributed to the higher vitamin C content of the product.

Carrageenan addition also influenced the vitamin C content of the jelly drink. Haryu [35] reported that higher carrageenan concentrations resulted in increased vitamin C levels in samples. In addition, Agustin [36] explained that higher carrageenan concentrations promote the formation of a more stable colloidal dispersion (double-helix structure). This double-helix structure enables carrageenan to protect vitamin C and inhibit its oxidation by forming a robust gel matrix.

3.2. Physical Analysis

The physical analyses conducted included syneresis and viscosity. The results are presented in Table 2.

3.2.1. Syneresis

The statistical analysis of the data presented in **Table 2** showed a significant interaction ($p \leq 0.05$) between the proportion of lamtoro gung juice to pineapple juice and carrageenan addition on the syneresis characteristics of the jelly drink. Increased syneresis at higher proportions of pineapple juice was associated with the pectin content of pineapple, which is approximately 2.3% and forms a soft gel with relatively low water-holding capacity [17]. Anggreini [37] reported that pectin forms a gel network with a soft texture.

Carrageenan forms a strong gel, however, its stability may decrease under acidic pH conditions when used without combination with other gelling agents. Hughes [38] explained that pectin can form an optimal gel under low or acidic pH conditions. The combination of pectin and carrageenan results in interactive effects, in which pectin contributes to gel formation under acidic conditions, while carrageenan reinforces the gel structure and enhances water-holding capacity. Sunyoto et al. [39] stated that the combined use of gelling agents can improve gel stability and reduce syneresis in jelly drink products. In addition, an increased proportion of lamtoro gung juice, which contains galactomannan, further reduced syneresis by increasing system viscosity and restricting water mobility within the gel matrix [18].

Table 2. Physical Analysis of Jelly Drink

Lamtoro gung juice : pineapple juice	Carrageenan	Syneresis (%)	Viscosity (mPa.s)
60 : 40	0.2%	50.07±0.22^{f}	341±4.24^{c}
	0.3%	37.78±0.13^{c}	522±5.66^{f}
	0.4%	27.33±0.18^{a}	873±4.24^{i}
50 : 50	0.2%	59.55±0.39^{h}	230±5.66^{b}
	0.3%	40.60±0.37^{e}	464±5.66^{e}
	0.4%	32.33±0.18^{b}	758±2.83^{h}
40 : 60	0.2%	70.11±0.18^{i}	188±2.83^{a}
	0.3%	53.10±0.1^{g}	417±1.41^{d}
	0.4%	39.34±0.04^{d}	630±4.66^{g}

3.2.2. Viscosity

The statistical analysis of the data presented in **Table 2** showed a significant interaction ($p \leq 0.05$) between the proportion of lamtoro gung juice to pineapple juice and carrageenan addition on the viscosity of the jelly drink. An increase in viscosity at higher proportions of lamtoro gung juice was associated with the presence of galactomannan, a hydrophilic polysaccharide capable of forming viscous and mucilaginous solutions. Rindengan [40] reported that galactomannan forms hydrogen bonds with water, thereby increasing solution viscosity. Mittal [18] stated that lamtoro gung contains approximately 20–25% galactomannan.

Pineapple juice also contributed to viscosity due to its pectin content of approximately 2.3%, which is capable of forming gels [17]. Anggreini [37] reported that pectin can interact with galactomannan and carrageenan during gel structure formation. The addition of carrageenan played a crucial role in increasing the viscosity of the jelly drink, as carrageenan is a gel-forming hydrocolloid that binds water and reinforces the gel matrix. Sugiarso [41] stated that higher carrageenan concentrations result in greater water binding, leading to increased solution thickness. Furthermore, Agustin [36] explained that increasing carrageenan concentration results in a denser gel structure, thereby enhancing product viscosity.

3.3. Sensory Evaluation

The organoleptic analysis included color, aroma, taste, and texture. The results are presented in Table 3.

3.3.1. Color

The results of the Friedman test presented in Table 3 indicate that the proportion of lamtoro gung extract to pineapple extract and the addition of carrageenan had no significant effect ($p>0.05$) on the color attribute of the jelly drink. Nevertheless, there was a tendency for panelists to prefer jelly drinks with a higher proportion of pineapple extract and higher carrageenan addition. This preference is presumably related to the brownish-orange color of lamtoro gung extract, which may reduce the visual appeal of the product. Bakewell-Stone [42] reported that this color originates from mature lamtoro gung seeds, which are brownish in appearance. Pineapple extract has a bright yellow color; therefore, its combination with lamtoro gung extract produces a jelly drink with a brighter and less brownish appearance. The addition of carrageenan did not cause significant color changes because carrageenan is colorless. Novidahlia [43] stated that carrageenan has no inherent color and therefore does not affect the final product color.

3.3.2. Aroma

The results of the Friedman test presented in Table 3 indicate that the proportion of lamtoro gung extract to pineapple extract and the addition of carrageenan had no significant effect ($p>0.05$) on the aroma attribute of the jelly drink. However, the analysis showed a tendency for panelists to prefer the aroma of jelly drinks with a higher proportion of pineapple extract and higher carrageenan addition. Pineapple extract has a strong and pleasant characteristic aroma derived from volatile compounds such as terpenes, aldehydes, ketones, and esters, which are able to mask the undesirable odor of other ingredients. Amelia [15] reported that the addition of pineapple extract can increase aroma preference by masking off-flavors. In contrast, lamtoro gung extract has a characteristic beany off-odor that is less preferred by panelists. Soenardjo [44] explained that the off-odor of lamtoro gung is caused by its tannin content. The addition of carrageenan did not affect aroma because carrageenan is odorless. Vania et al. [11] stated that carrageenan does not influence the aroma of the final product.

3.3.3. Taste

The results of the Friedman test presented in Table 3 indicate that the proportion of lamtoro gung extract to pineapple extract and the addition of carrageenan had no significant effect ($p>0.05$) on the taste attribute of the jelly drink. However, the analysis showed a tendency for panelists to prefer jelly drinks with a higher proportion of pineapple extract. This preference is attributed to the beany off-flavor of lamtoro gung extract caused by its tannin content, whereas pineapple extract has a strong and characteristic taste. Rosida (2022) reported that tannins in lamtoro gung contribute to an off-flavor, while Amelia (2023) stated that the addition of pineapple extract can increase panelists' preference. The addition of carrageenan did not affect taste because carrageenan is tasteless. Vania et al. (2017) reported that carrageenan does not influence the taste of the product. Nevertheless, differences in the proportion of lamtoro gung extract to pineapple extract did not result in a significant effect on the taste of the jelly drink, as the overall taste of the product was still dominated by pineapple flavor.

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3.3.4. Texture

The results of the Friedman test presented in Table 3 indicate that the proportion of lamtoro gung extract to pineapple extract and the addition of carrageenan had a significant effect ($p \leq 0.05$) on the texture attribute of the jelly drink. The analysis showed a tendency for panellists to prefer jelly drinks with an equal proportion of lamtoro gung extract and pineapple extract, as well as higher levels of carrageenan. This preference is presumably due to the combination of galactomannan from lamtoro gung extract and pectin from pineapple extract, which is able to form a thick and balanced texture, thereby increasing panelists' acceptance. The addition of carrageenan contributed to the formation of a jelly drink texture similar to that of commercial jelly drinks, characterized by a sufficiently firm gel while remaining soft and easy to be sucked through a straw. Herawati (2018) reported that the texture of jelly drinks is influenced by hydrocolloid ingredients, and Gani (2014) stated that increasing carrageenan concentration forms a stronger gel structure while remaining suitable for jelly drink characteristics.

Table 3. Sensory Evaluation of Jelly Drink

Lamtoro gung juice : pineapple juice	Carrageenan	Color	Aroma	Taste	Texture
60 : 40	0.2%	3.52±0.92	3.60±0.87	3.80±1.00	2.60±1.29
	0.3%	3.68±0.95	3.20±1.08	3.56±0.87	3.64±0.76
	0.4%	3.24±0.83	3.20±0.91	3.56±1.04	3.80±1.00
50 : 50	0.2%	3.52±0.87	3.48±0.82	3.80±0.76	2.88±0.73
	0.3%	3.72±0.68	3.32±0.95	3.52±0.96	2.92±1.04
	0.4%	3.76±0.78	3.36±0.91	3.68±0.90	4.00±0.71
40 : 60	0.2%	3.64±0.81	3.52±1.16	3.64±1.04	2.92±1.15
	0.3%	3.32±0.75	3.32±0.99	3.72±0.89	3.08±1.04
	0.4%	3.84±0.69	4.00±0.87	4.04±0.73	3.84±0.80

4. CONCLUSION

The best treatment of jelly drink was obtained in A3B3, namely jelly drink with a proportion of lamtoro gung extract to pineapple extract of 40 : 60 and the addition of 0.4% carrageenan. This treatment exhibited the most favorable physicochemical and sensory characteristics, including moisture content of 77.575%, total solids of 22.675%, pH value of 4.69, total soluble solids of 21 °Brix, protein content of 0.935%, antioxidant activity of 63.12%, vitamin C content of 17.89%, syneresis of 39.345%, and viscosity of 630 mPa.s. Based on the sensory evaluation hedonic test, treatment A3B3 achieved sensory scores of 3.84 for color, 3.36 for aroma, 3.84 for taste, and 3.84 for texture, which were categorized as neutral to slightly liked, indicating good panelist acceptance.

REFERENCE

[1] Febrianti, S. & Y. Yunianta. (2015). Pengaruh Konsentrasi Karagenan Dan Rasio Sari Jahe Emprit (Zingiber Officinale Var. Rubrum) Terhadap Sifat Fisik, Kimia, Dan Organoleptik Jelly drink Jahe. *Jurnal Pangan Dan Agroindustri*, 3(2): 542-550

[2] Haryani, V. M., Putriana, D., & Hidayati, R. W. (2023) Animal-Based Protein Intake Is Associated With Stunting In Children In Primary Health Care Of Minggir: Asupan Protein Hewani Berhubungan Dengan Stunting Pada Balita Di Wilayah Kerja Puskesmas Minggir. *Amerta Nutrition*, 7(2sp), 139–146.

[3] Ekawati, R., Rahmawati, W., Paramita, F., Berliana, D., & Fariadi, A. (2022). Gambaran Tingkat Kecukupan Energi Dan Tingkat Kecukupan Protein Ibu Hamil Di Kota Malang. *Preventia: The Indonesian Journal Of Public Health*, 7(2): 1–7

[4] Rosida, D. F. (2022). *Lamtoro Gung, Produk, Sifat Fungsional Dan Manfaatnya*. Indomedika Pustaka.

[5] Badan Pusat Statistik. (2022). *Produksi lamtoro di Indonesia 2022*. Badan Pusat Statistik..

[6] Isnanda, D., Novita, M., & Rohaya, S. (2016). Pengaruh Konsentrasi Pektin Dan Karagenan Terhadap Permen Jelly Nanas (Ananas Comosus L. Merr). *Jurnal Ilmiah Mahasiswa Pertanian*, 1(1), 912-923.

[7] Mohan, R., Sivakumar, V., Rangasamy, T. & Muralidharan, C. (2016). Optimization Of Bromelain Enzyme Extraction From Pineapple (Ananas Comosus), And Application In Process Industry. *American Journal Of Biochemistry And Biotechnology*, 12(3):188-195.

[8] Yulia, Ruka & Handayani, Noni & Juliani, Juliani. (2020). Pengaruh Buah Kundur (Benincasa Hispida) Dan Buah Nanas (Ananas Comosus L. Merr) Rasio Serta Konsentrasi Gula Terhadap Mutu Fruit Leather. *Jurnal Serambi Engineering*. https://doi.org/10.32672/jse.v5i2.1927

[9] Kumayanjati, B., & Dwimayasanti, R. (2018). Kualitas Karaginan Dari Rumput Laut Kappaphycus Alvarezii Pada Lokasi Berbeda Di Perairan Maluku Tenggara. *Jurnal Pendidikan Biologi Kelautan Dan Perikanan*, 13(1), 21-32. http://dx.doi.org/10.15578/jpbkp.v13i1.490

[10] Al-Baarri, A. N., Legowo, A. M., Rizqiati, H., Widayat, Septianingrum, A., Sabrina, H. N., & Mochtar, R. C. P. R. (2018). Application of iota and kappa carrageenans to traditional several food using modified cassava flour. *IOP Conference Series: Earth and Environmental Science*, 102, 012056.

[11] Vania, J., Utomo, A. R., & Trisnawati, C. Y. (2017). Pengaruh Perbedaan Konsentrasi Karagenan Terhadap Karakteristik Fisikokimia Dan Organoleptik Jelly drink Pepaya. *Jurnal Teknologi Pangan Dan Gizi (Journal Of Food Technology And Nutrition)*, 16(1), 8-13.

[12] Ressa, Y. (2018). Pembuatan jelly drink nanas (Ananas comosus L): *Kajian tingkat kematangan buah nanas dan*

konsentrasi penambahan karagenan terhadap sifat fisik, kimia, dan organoleptik (Sarjana thesis). Universitas Brawijaya.

[13] Putra, Y. P., Adiguna, G. S., Nugroho, T. S., & Masi, A. (2021). Karakterisasi mutu fisik dan organoleptik jelly drink berbasis rumput laut (Eucheuma cottonii) dan buah mangrove pidada (Sonneratia caseolaris). *Manfish Journal*, 2(1).

[14] Maslahah, N., & Nurhayati, H. (2023). Kandungan Senyawa Bioaktif Dan Kegunaan Tanaman Kayu Manis (Cinnamomum Burmannii). *Warta Bsip Perkebunan*, 1(3).

[15] Amelia, J. R., Pujilestari, S., Hamidatun, H., & Monica, P. (2024). Karakterisasi mutu minuman jeli okra nanas dengan kombinasi karagenan-konjak. *Jurnal Teknologi & Industri Hasil Pertanian*, 28(2), 140-150

[16] Panjaitan, R. A. M., Putra, H. S. D., & Setiawati, A. (2024). Isolasi Dan Karakterisasi Pektin Kulit Nanas Madu (Ananas Comosus L): Tinjauan Tingkat Kematangan Buah. *Prosiding Seminar Nasional Sains Dan Teknologi Seri 02*, 1(2).

[17] Siregar, R., Santoso, J., & Uju, S. (2016). Karakteristik fisikokimia kappa karaginan hasil degradasi menggunakan hidrogen peroksida. *Jurnal Pengolahan Hasil Perikanan Indonesia*, 19(3), 256–264. https://doi.org/10.17844/jphpi.2016.19.3.256

[18] Mittal, N., Mattu, P., & Kaur, G. (2016). Extraction and derivatization of Leucaena leucocephala (Lam.) galactomannan: Optimization and characterization. *International Journal of Biological Macromolecules*, 92, 831–841. https://doi.org/10.1016/j.ijbiomac.2016.07.046

[19] Bieniek, A., & Buksa, K. (2023). Properties and functionality of cereal non-starch polysaccharides in breadmaking. *Applied Sciences*, 13(4), 2282. https://doi.org/10.3390/app13042282

[20] Selviana, S. (2016). *Pengaruh konsentrasi karagenan dan gula pasir terhadap karakteristik jelly black mulberry (Morus nigra L.) (Skripsi)*. Universitas Pasundan, Bandung.

[21] Marpaung, T. E., & Rahayuni, T. (2023). Formulasi penambahan kacang hijau pada susu nabati biji cempedak (Artocarpus integer) instan. *FoodTech: Jurnal Teknologi Pangan*, 6(1), 35–42.

[22] Baskara, M. F., Suprapta, I. N., & Tenaya, I. G. N. P. (2020). Pengaruh total solid terhadap akumulasi tekanan biogas termofilik. *Teknik Desain Mekanika*, 9(1).

[23] Muyonga, J. H., Natocho, J., Kigozi, J., Baidhe, E., & Nansereko, S. (2022). Drying behaviour and optimization of drying conditions of pineapple puree and slices using refractance window drying technology. *Journal of Food Science and Technology*, 59(7), 2794–2803. https://doi.org/10.1007/s13197-021-05302-2

[24] Hossain, M. F., Akhtar, S., & Anwar, M. (2015). Nutritional value and medicinal benefits of pineapple. *International Journal of Nutrition and Food Sciences*, 4(1), 84–88.

[25] Djufri, K. U. A., & Talebong, F. D. (2020). *Pengaruh kapasitas buffer sitrat dan perlakuan awal terhadap ekstraksi pektin dari apel manalagi (Malus sylvestris) [Skripsi sarjana, Universitas Brawijaya]*. Universitas Brawijaya Repository.

[26] Widowati, E. H., & Larasati, D. (2018). Konsentrasi Karagenan Terhadap Fisitokimia Dan Organoleptik Jelydrink Krai. *Jurnal Litbang Provinsi Jawa Tengah*, 16(2), 153-164.

[27] Irawan, D., & Hudi, L. (2021). The effect of concentration of caragenan and sucrose on characteristics of palmyra palm (Borassus flabellifer) seed juice jelly drink. *Journal of Tropical Food and Agroindustrial Technology*, 2(2). https://doi.org/10.21070/jtfat.v2i02.1580

[28] Jaywant, S. A., Singh, H., & Arif, K. M. (2022). Sensors and instruments for Brix measurement: *A review. Sensors*, 22(6), 2290. https://doi.org/10.3390/s22062290

[29] Maleki, M., Mortazavi, S. A., Yeganehzad, S., & Nia, A. P. (2019). Effect of basil seed gum, xanthan gum and carrageenan on rheological and sensory properties of suspended barberry pulp in syrup. *Ukrainian Food Journal*, 8(4), 840–850. https://doi.org/10.24263/2304-974x-2019-8-4-14

[30] Masnita, Y., Khomsiyah, & Triyowati, H. (2020). Peningkatan daya saing usaha mikro (UMi) melalui keuangan inklusi. *Dinamisia: Jurnal Pengabdian Kepada Masyarakat*, 4(2), 255–262.

[31] Hardoko, H., & Tajuddin, K. (2019). Subtitusi Agar-Agar Dalam Pembuatan Jelly drink Cincau Hijau (Cyclea Barbata) Untuk Menurunkan Sineresis. *FaST - Jurnal Sains dan Teknologi (Journal of Science and Technology),* 3(2), 45-56.

[32] Jamil, S. N. A. (2016). Pengaruh penambahan tepung karagenan terhadap sifat kimia otak-otak ikan gabus (Ophiocephalus striatus). *Jurnal Ilmu Diwa*, 4(1), 25–31.

[33] Atmaka, W., et al. (2021). Pengaruh variasi konsentrasi kappa karagenan terhadap karakteristik fisik dan kimia gel cincau hijau (Cyclea barbata L. Miers). *Jurnal Riset Industri*, 38(1), 25–35. https://doi.org/10.32765/wartaihp.v38i1.6093

[34] Kementerian Kesehatan Republik Indonesia. (2018). *Tabel komposisi pangan Indonesia 2017*. Kementerian Kesehatan RI.

[35] Haryu, A. S. P., Parnanto, N. H. R., & Nursiwi, A. (2016). Pengaruh penambahan karagenan terhadap karakteristik fisik, kimia dan sensoris fruit and vegetable leather berbasis albedo semangka (Citrullus vulgaris Schard.) dan labu siam (Sechium edule). *Jurnal Teknosains Pangan*, 5(3).

[36] Agustin, F. & Widya D. R. P. (2014). Pembuatan Jelly drink Averrhoa Blimbi L. (Kajian Proporsi Belimbing Wuluh: Air Dan Konsentrasi Karagenan*). Jurnal Pangan Dan Agroindustri* Vol.2: P.1-9. No.3.

[37] Anggraeni, F. (2022). *Pengaruh konsentrasi kappa karagenan terhadap sifat fisik, kimia dan sensori permen jelly albedo kulit jeruk bali (Citrus grandis L. Osbeck)* [Skripsi sarjana, Universitas Semarang].

[38] Hughes, M. H., Brugnoni, L. I., & Genovese, D. B. (2024). Mixed κ/ι-carrageenan–LM pectin gels: Relating the rheological and mechanical properties with the capacity for probiotic encapsulation. International *Journal of Biological Macromolecules*, 273, 133009. https://doi.org/10.1016/j.ijbiomac.2024.133009

[39] Sunyoto R. K., Suseno, T.I.P. & Utomo, A. R. (2017). Pengaruh konsentrasi agar batang terhadap karakteristik fisikokimia dan organoleptik selai murbei hitam (Morus nigra L.) lembaran. *Jurnal Teknologi Pangan dan Gizi* 16(1) 1-7. https://doi.org/10.33508/jtpg.v16i1.1384

[40] Rindengan, B. (2015). Ekstraksi Galaktomanan Pada Daging Buah Kelapa Dan Ampasnya Serta Manfaatnya Untuk Pangan. *Perspektif*. 4(1):.37-49.

[41] Sugiarso, A., & Nisa, F. C. (2015). Pembuatan minuman jeli murbei (Morus alba L.) dengan pemanfaatan tepung porang (A. muelleri blume) sebagai pensubtitusi karagenan. *Jurnal Pangan dan Agroindustri*, 3(2).

[42] Bakewell-Stone, P. (2022). Leucaena leucocephala (leucaena). *CABI Compendium*. https://doi.org/10.1079/cabicompendium.31634

[43] Novidahlia, N., Rohmayanti, T., & Nurmilasari, Y. (2019). Karakteristik fisikokimia jelly drink daging semangka, albedo semangka, dan tomat dengan penambahan karagenan dan tepung porang (Amorphophallus muelleri Blume). *Jurnal Agroindustri Halal*, 5(1), 57–66.

[44] Soenardjo, N., & Supriyantini, E. (2017). Analisis Kadar Tanin Dalam Buah Mangrove Avicennia Marina Dengan Perebusan Dan Lama Perendaman Air Yang Berbeda. *Jurnal Kelautan Tropis*, 20(2), 90-95.

[45] Herawati, H. (2018). Potensi hidrokoloid sebagai bahan tambahan pada produk pangan dan nonpangan bermutu. *Jurnal Penelitian dan Pengembangan Pertanian*, 37(1), 17–25. https://doi.org/10.21082/jp3.v37n1.2018.p17-25

[46] Gani, Y. F., Idarto, T. P. S., & Sutarjo, S. (2014). Perbedaan konsentrasi karagenan terhadap sifat fisikokimia dan organoleptik jelly drink rosela-sirsak. *Jurnal Teknologi Pangan dan Gizi*, 13(2), 87–93.