Jurnal Gizi dan Dietetik Indonesia
(Indonesian Journal of Nutrition and Dietetics)
Vol 12, Issue 3, 2024:141-149

Available online at: https://ejournal.almaata.ac.id/index.php/IJND
p-ISSN 2303-3045 e-ISSN 2503-183X
DOI: https://dx.doi.org/10.21927/ijnd.2024.12(3).141-149

The sensory and nutrient analysis by the addition of Chia seed (*Salvia hispanica L.*) to Star fruit Juice (*Averrhoa carambola L.*) as a drink for hypertension patients

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ABSTRAK

Latar Belakang: *Hipertensi jika tidak dikendalikan dapat menyebabkan berbagai penyakit komplikasi hingga kematian. Pengendalian hipertensi dapat dilakukan dengan cara mengatur pola makan (diet) sehat, seperti meningkatkan konsumsi buah-buahan, biji-bijian, asupan kalium, kalsium, dan magnesium. Beberapa penelitian telah menunjukkan belimbing manis dan chia seed dapat mengontrol tekanan darah pada penderita hipertensi, akan tetapi kandungan gizi kalsium dan magnesium masih relatif rendah pada belimbing. Berdasarkan USDA chia seed memiliki kandungan kalsium, kalium, dan magnesium yang tinggi.*
Tujuan: *Tujuan penelitian ini untuk mengetahui daya terima secara sensori dan kandungan zat gizi jus belimbing dengan penambahan chia seed.*
Metode: *Jenis penelitian adalah eksperimental dengan desain Rancangan Acak Lengkap (RAL). Terdapat 4 formulasi jus belimbing dengan penambahan chia seed (0 g, 10 g, 15 g, 20g). Analisis sensori diuji menggunakan uji Kruskal Wallis dan dilanjutkan dengan uji Mann-Whitney. Selain itu, perbedaan zat gizi produk yang disukai panelis diuji dengan uji independent T-Test.*
Hasil: *Terdapat perbedaan yang signifikan (p<0,05) pada semua parameter sensori. Jus belimbing manis dengan penambahan chia seed sebanyak 10 g yang terpilih menunjukkan terdapat peningkatan zat gizi pada jus belimbing dengan penambahan chia seed, kecuali kadar air. Kadar air 89,21%, kadar abu 0,32%, kadar karbohidrat 7,14%, kadar lemak 1,75%, kadar protein 1,55%, kalium 206 mg/200 ml, kalsium 34,84 mg/200 ml, magnesium 17,80 mg/200 ml, natrium 2,46 mg/200 ml.*
Kesimpulan: *Jus belimbing manis dengan penambahan chia seed sebanyak 10 g merupakan formulasi jus belimbing dengan penambahan chia seed yang paling disukai oleh panelis dan dapat meningkatkan kandungan zat gizi terutama kandungan kalsium dan magnesium.*

KATA KUNCI*: kalsium; magnesium; jus belimbing manis; chia seed; hipertensi.*

ABSTRACT

Background: *Hypertension, when it is not controlled, can cause complications to many diseases and death. Hypertension control can be achieved by adjusting to a healthy diet, such as increasing the consumption of fruit, whole grains, potassium intake, calcium, and magnesium. Several studies have shown that star fruit and chia seeds can control blood pressure in people with hypertension. However, the nutritional content, such as calcium and magnesium, is still relatively low in star fruit. According to USDA, chia seeds contain high level of calcium, potassium, and magnesium.*

Objectives: *This research aims to determine the sensory acceptability and the nutritional content of star fruit juice by adding chia seeds.*

Methods: *This is an experimental study with a Completely Randomized Design (CRD). There were four formulations of star fruit juice with chia seeds additions (0 g,10 g,15 g, and 20 g). The sensory analysis was tested by the Kruskal Wallis test and Mann-Whitney test. While differences of the nutritional content from the product that preferred by panelists were tested by Independent T-test.*

Results: *There were significant differences ($p<0.05$) in all sensory parameters. The selected sweet star fruit juice with the addition 10 g chia seed formulation showed an increase in nutrients except for the water content. Water content of 89.21 %, ash content of 0.32 %, carbohydrate content of 7.14 %, fat content of 1.75 %, protein content of 1.55%, potassium content of 206 mg/200 ml, calcium content of 34.84 mg/200 ml, magnesium content of 17.80 mg/200 ml, and sodium content of 2.46 mg/200 ml.*

Conclusions: *Sweet start fruit juice with the addition of 10 g of chia seed is the most liked star fruit juice formulation with chia seed addition by the research panellists, and it can increase the nutritional content, especially calcium and magnesium content.*

KEYWORD*:* *calcium; magnesium; sweet star fruit juice; chia seed; hypertension.*

Article info:
Article submitted on February 15, 2024
Articles revised on March 3, 2023
Articles received on March 23, 2024

INTRODUCTION

Hypertension is the leading cause of mortality and morbidity of cardiovascular disease worldwide. Data from the World Health Organization (WHO) in 2015 showed that approximately 1.13 billion people in the world suffer from hypertension, meaning that 1 in 3 people in the world is diagnosed with hypertension. The number of people suffering from hypertension continues to increase every year; by 2025, it is estimated that there will be 1.5 billion people affected by hypertension, and it is estimated that every year there are 9.4 people die from hypertension and its complications (1). Hypertension is also often called the silent killer because, in the initial phase, it does not show symptoms but can suddenly cause subclinical organ damage within the body (2).

If hypertension not be controlled in proper ways, it can cause complications to other dangerous diseases such as the risk of stroke, coronary heart disease, kidney disease and vision problems (3). The control of hypertension is divided into two ways; by pharmacological treatment and non-pharmacological treatment. the pharmacological treatment is involving antihypertensive drugs; such as angiotension corventing enzyme (ACE), inhibitors (captopril, lisinopril, enalapril), ACE receptor blockers (amlodipine), diuretics (hydrochlorothizide), renin inhibitors (aliskiren) and so on, while non-pharmacological treatment conducted by arranging a healthy eating pattern (diet) such as consuming vegetables, fruit, whole grains, low-fat dairy products, lean meat, reducing sodium intake, increasing the intake of potassium, calcium and magnesium (4–6).

Excessive fat intake affects high cholesterol deposits within the blood. These fat deposits will accumulate in the blood vessels, which later decrease the elasticity of blood vessels so that the

blood volume and blood pressure will increase. This mechanism will trigger hypertension (7). Meanwhile, excessive sodium intake will make the body retain fluid, which can increase blood volume. Excessive sodium intake can reduce the diameter of arteries and cause the heart to pump harder to increase the blood volume, so the blood pressure rises and triggers hypertension (8).

High potassium intake can reduce blood pressure substantially for people with hypertension who consume high sodium intake. Potassium has the function of lowering blood pressure so that it can prevent high blood pressure or even stroke. A high concentration of potassium in intracellular fluid can relax the vascular smooth muscle cells and then reduce peripheral vascular resistance to reduce blood pressure (9). Besides lowering blood pressure, potassium can reduce calcium excretion in the urine and benefit bone health. Blood pressure is regulated by intracellular calcium mechanisms in vascular smooth muscle cells through vasoconstriction and variations in vascular volume (10). Whereas magnesium plays a role in regulating blood pressure by modulating vascular smooth muscle tone and contractility by controlling the concentration and the availability of calcium ions (11).

Sweet star fruit (Averrhoa carambola L.) is a fruit that can control blood pressure because it contains high levels of potassium. According to the 2020 Indonesian Food Composition Table (Table Komposisi Pangan Indonesia/TKPI), the nutritional content of 100 grams of star fruit is 130 mg of potassium and 4 mg of calcium. However, the calcium content of starfruit is still relatively low compared to 100 g of milk (143 mg calcium) (12). Data from the Central Statistics Agency (BPS) 2021 showed that star fruit production in Indonesia in 2016 was 78,762 tons, increasing to 137,450 tons in 2021 (13). In addition, research from the National Health and Nutrition Examination Survey (NHANES) from 2005 to 2010 reported that whole fruit consumption decreases with age; thus, it requires food modifications that are acceptable to all ages (14). Research by Agarwal et al. (2019) in the analysis of NHANES cohort data stated that 100 % fruit juice was positively associated with diet quality and equivalent to whole fruit consumption at the nutrient intake level, except for less dietary fibre (15).

Research by Febriani and Zulfah (2016) compared tomato juice and star fruit juice (16). It stated that the average difference in blood pressure after giving tomato juice decreased by 9.75 (systolic) and 9.94 (diastolic), while for sweet star fruit juice was 20.19 (systolic) and 13.44 (diastolic). This finding aligns with the research of Arza and Irawan (2018) that consuming 200 ml of sweet star fruit juice once a day for seven days can reduce blood pressure from 175/92 mmHg to 135/79 mmHg (17). In addition, research by Khusuma et al. (2020) also stated that the consumption of sweet star fruit juice (± 150 grams) once every day after a meal for a day in the afternoon can reduce blood pressure from 149.65/94.87 mmHg to 139.61/89.52 mmHg in 28 people with hypertension (18).

Adequate nutrition is an essential element for preventing various diseases. Nutritionists and food technology experts stated that there has been broad interest in plant products, including chia seeds, in recent years. Chia seeds are often consumed as an ingredient or additional toppings to food such as baked products, muesli, milk drinks, fruit smoothies, or salads (19). Chia seeds are small grains from the Salvia hispanica L. plant. Research by Alwosais et al. (2021) stated a significant reduction of systolic blood pressure in people with type 2 diabetes mellitus (T2DM) and hypertension when consuming 40 g of chia seeds for 12 weeks (20). Chia seeds also have a complete nutritional content to help control blood pressure. According to the United States Department of Agriculture (USDA) 2011, the nutritional content in every 100 g of chia seeds is 407 mg of potassium, 631 mg of calcium and 335 mg of magnesium (21).

Research by Arza and Irawan (2018) and Alwosais et al. (2021) has shown a positive effect on reducing blood pressure. Starfruit has high potassium but relatively low calcium content, so additional foods such as chia seeds are needed to increase calcium and magnesium. Apart from that, research has yet to combine starfruit juice and chia seeds in terms of their acceptability and nutritional content. Therefore, this study aims to analyze the sensory and nutritional properties of star fruit juice by adding chia seeds, which the panellists prefer.

MATERIALS AND METHODS

The type of research is experimental research with Completely Randomized Design (CRD) research design. Product development and sensory analysis were conducted at the Food Processing and Experimentation Laboratory and the Organoleptic Laboratory, Department of Public Nutrition, Faculty of Human Ecology, IPB University. Meanwhile, the nutrient content analysis was conducted at the Chemistry and Nutrient Analysis Laboratory, Department of Community Nutrition, Faculty of Human Ecology, IPB University.

Ingredients used in this research were star fruit, chia seeds, water and honey. Type of star fruit was Paris type, the chia seeds used was Neo Oliva organic chia seeds, and the honey used was pure honey. Then, instrument or tools for making the star fruit juice with chia seeds addition was a digital food scale (Camry:eF973, capacity 5 kg and an accuracy of 0.1 g) for weighing starfruit and chia seeds, a measuring cup for measuring the volume of raw materials, a plastic bottle for drink container, a blender (Phillips), a filter, spoon, and a place to hold the filter results.

As the formula and stages in making star fruit juice refers to the research by Arza & Irawan, (2018) by the addition of chia seeds. Formula for star fruit juice with additional of chia seeds is displayed in **Table 1**.

Table 1. Star fruit juice with addition of chia seed formulation

Material	F1	F2	F3	F4
Star fruit (g)	150	150	150	150
Water (ml)	100	100	100	100
Honey (g)	5	5	5	5
Chia seed (g)	-	10	15	20

The stages in making sweet star fruit juice with chia seeds addition are: 1). Prepare the tools and raw ingredients, 2). Wash starfruit until it clean, 3). Cut the starfruit into several pieces and cut off the top part of the starfruit, 4) Weigh the pieces of cut star fruit, 5). Put the cut starfruit into a blender and added with water, blend the mixture for one minute, 6). After blending, filter the starfruit mixture and give addition of honey, 7). Pour the filtered starfruit into a plastic bottle and added with chia seeds. The volume of starfruit juice produced is 200 ml. This research was held from August to December 2023. The sensory analysis was tested by the Kruskal Wallis test and Mann-Whitney test. While differences of the nutritional content from the product that preferred by panelists were tested by Independent T-test.

RESULTS AND DISCUSSIONS

Sensory Analysis

The sensory analysis is conducted to consider and determine the star fruit juice formulation that the panellists like most, which will then be analyzed for its nutritional content. The sensory analysis carried out in this study included a hedonic test and a hedonic quality test. The hedonic test sensory parameters assessed in this research were the color, aroma, taste, viscosity, aftertaste, mouth feel, and overall. Assessment from the hedonic test is taken based on a hedonic scale from 1 (very much dislike) to 9 (very much like it), while the hedonic quality test parameters (by assessing through color, aroma, taste and viscosity parameters) are conducted on 30 panellists. The result data from the hedonic test is presented in **Table 2**, and the hedonic quality test result data is presented in **Table 3.**

The average value from panellists' preferences to the sensory parameters of the hedonic test showed that panellists tend to like (>5) or can accept all sensory parameters from the addition of chia seeds to starfruit juice. The hedonic test and hedonic quality showed that the Kruskal Wallis results for all sensory parameters in the four juice formulations were significantly different ($p<0.05$), so research analysis was continued with the Mann-Whitney test to find out which formulation was different.

Table 2. Result of hedonic test star fruit juice with the addition of chia seed

Parameter	Mean of Hedonic Test			
	F1	F2	F3	F4
Color	7,20 ± 1,028[a]	5,40 ± 1,277[b]	5,22 ± 0,986[b]	5,05 ± 1,228[b]
Flavor	6,80 ± 1,566[a]	6,59 ± 0,805[a]	6,45 ± 0,856[ab]	6,01 ± 1,116[b]
Aroma	6,97 ± 0,925[a]	6,74 ± 0,731[ab]	6,69 ± 0,735[ab]	6,30 ± 0,951[b]
Viscosity	6,83 ± 1,033[a]	6,39 ± 0,924[b]	6,09 ± 1,024[bc]	5,77 ± 1,199[c]
Aftertaste	6,79 ± 0,934[a]	6,34 ± 1,257[ab]	6,27 ± 1,151[ab]	6,01 ± 1,274[b]
Mouthfeel	6,71 ± 1,017[a]	6,20 ± 1,175[ab]	6,10 ± 1,015[b]	5,92 ± 1,105[b]
overall	7,01 ± 1,057[a]	6,42 ± 0,991[b]	6,39 ± 0,856[b]	6,19 ± 1,087[b]

Description: F1= Star fruit, F2= Star fruit with addition of chia seed (10 g), F3= Star fruit with addition of chia seed (15 g), F4= Star fruit with addition of chia seed (20 g). [a-b] = Different letter notations mean there is a significant difference at the Mann-Whitney test (p<0,05).

The results of hedonic test and hedonic quality to the color parameter showed a real difference between F1 and F2, F3, F4, but no real difference found between F2, F3 and F4. The average value from four tested formulations tended to decrease along with the addition of chia seeds. This decline was assumed came from chia seeds color that vary from black, gray, or black spots to white (22). The hedonic quality parameter of color assessed based on a hedonic quality scale from 1 (not yellow) to 9 (very yellow) F1 has a slightly yellow color, F2 and F3 have a slightly less yellow color and F4 has a non-yellow color. This research is in line with research of Lestari et.al. (2021) that reported the hedonic quality test on the color of herbal sherbet showed that its color without any additions was significantly different when compared to herbal sherbet with the addition of chia seeds. When added with chia seeds, herbal sherbet showed a darker color because of the grayish color from chia seeds (23).

Based on flavor parameter in the hedonic test, there is no real difference showed between F1,F2, and F3, but there is a real difference between F1,F2 and F4. This result is in line with research of Bhardwaj S and Saraswat S (2019) that reported the more chia seeds added to sport drink products the less taste value (reduce the flavor) of the product (24). Dislike flavor (unfavorable) towards products with added chia seeds was caused by bitter taste and water absorption quality from chia seeds that made the sport drinks products taste a little thick. According to the requirement of SNI 3719:2014, fruit juice drink has an ordinary or typical fruit taste, normal taste. Paris star fruit has a sweet taste (25). The hedonic quality test on taste parameters is assessed based on a hedonic quality scale from 1 (very not sweet) to 9 (very much sweet). The taste parameters of hedonic quality showed that F1 has a slightly sweet taste, while F2, F3, and F4 have a taste of between sweet and not sweet (neutral).

According to aroma parameters in the hedonic test and hedonic quality, it showed no real difference in aroma between F1, F2, and F3, but there is a real difference in aroma between F1 and F4. The characteristics of chia powder have a nutty aroma, brown color and sticky gum characteristics (26). Based on the requirements of SNI 3719:2014, the scent of fruit juice drink is ordinary or typical fruit aroma (normal) and the expected aroma of this product is the aroma of star fruit. The real difference in F4 is known due to addition of more chia seeds, so that the nutty aroma of chia seeds is stronger. This is in line with research of Bhardwaj S and Saraswat S (2019) where panelists preferred the aroma of sport drink with addition of 4 g of chia seeds compared to sport drink with the addition of 6 g chia seeds. From viscosity parameters in the hedonic test and hedonic quality, it showed a real difference between F1 and F2, F3 and F4, but there is no real difference between F2 and F3, F3 and F4. The viscosity parameter in hedonic quality is assessed based on hedonic quality scale from 1 (very not thick) to 9 (very much thick).

Table 3. Result of hedonic quality test star fruit juice with the addition of chia seed

Parameter	Mean of Hedonic Quality Test			
	F1	F2	F3	F4
Color	6,61 ± 0,953[a]	4,38 ± 1,445[b]	4,05 ± 1,209[b]	3,74 ± 1,343[b]
Flavor	6,01 ± 1,057[a]	5,42 ± 1,252[ab]	5,40 ± 1,312[ab]	5,24 ± 1,163[b]
Aroma	5,75 ± 1,489[a]	5,05 ± 1,264[ab]	5,03 ± 1,312[ab]	5,03 ± 1,093[b]
Viscosity	3,07 ± 1,299[a]	4,25 ± 1,474[b]	4,51 ± 1,551[bc]	5,24 ± 1,807[c]

Description: F1= Star fruit, F2= Star fruit with addition of chia seed (10 g), F3= Star fruit with addition of chia seed (15 g), F4= Star fruit with addition of chia seed (20 g). a-b = Different letter notations mean there is a significant difference at the Mann-Whitney test (p<0,05).

The hedonic quality results show that F1 is not thick, F2 and F3 are slightly thick, while F4 is between thick and not thick (neutral). The addition of chia seeds to star fruit juice affects the viscosity level of the juice, due to the gum-forming activity of chia seeds. When chia seeds are hydrated with water, a transparent capsule (gum) forms around the chia seeds (19,27). The result of this research is in line with research of Lestari et al. (2021) which states that texture quality characteristics of herbal sherbet without any additions are significantly different from herbal sherbet with chia seeds added, this is associated with a change in the viscosity of the drink in herbal sherbet with chia seeds added.

Based on aftertaste parameter, the hedonic test result showed there is no real difference between F1, F2, and F3 but there is a real difference between F1 and F4. This difference is caused by addition of more chia seeds in F4. According to research of Adawiyah et al. (2022), chia seeds that are absorbed by water have sticky or thick characteristic.

Based on mouthfeel parameters, the result from the hedonic test showed no real differences between F1 and F2, F2 and F3, F3 and F4, but there are real differences between F1 and F3, F1 and F4. From the opinion of the panellists, the more chia seeds added, the more dominant the chia seeds taste compared to star fruit juice taste since there is a change in the viscosity aspect of the star fruit juice.

From the overall parameters, results showed there are no real differences between F2, F3 and F4, but there are real differences between F1 and F2, F3 and F4. Based on the overall assessment, there was a decline in the sensory value of star fruit juice with the addition of chia seeds. According to the Commission Implementing Regulation of the European (EU) 2017/2470 on the list of new foods, the recommended consumption of chia seeds in a day should not be more than 15 g (19). The research of Bhardwaj S and Saraswat S (2019) also states that more chia seeds added to sports drink products reduce the overall sensory assessment.

Nutrient Analysis

According to the statistical results of sensory analysis from the four formulations, thebest products are F1 and F2. The analysis of nutritional content from the best products consisted of macronutrient content (moisture, ash, protein, fat and carbohydrate content) and micronutrient content (potassium, calcium, magnesium and sodium). The results of the analysis of nutritional content are presented in **Table 4.**

In this study, the macronutrient content (water content, ash content, carbohydrates, protein and fat) showed a significant difference ($p<0.05$) between the two formulations. The addition of 10 g of chia seeds to starfruit juice has an average value that increases the macronutrient content except for the water content. Water content of star fruit juice with chia seeds addition is lower than the water content of starfruit juice without any addition of chia seeds. The water content of star fruit juice has a percentage of 93.15 % meanwhile the water content of star fruit juice with chia seeds has a percentage of 89.21 %. Chia seeds are able to absorb water up to several times their dry weight (28). This statement is in line with research of Paramita et al. (2022) which showed that adding 7.5 g of chia seeds can reduce the water content in smoothies (29). The ash content of star fruit juice with chia seeds addition is higher

than only starfruit juice. Ash content in starfruit juice is 0.18 % while in starfruit juice with chia seeds addition is 0.32 %. This result is aligned with research of Costa et al., 2022 which showed that ash content in fermented milk is influenced by the amount of added syrup and chia seeds (30). Ash content describes the remaining of total mineral content after the combustion process or acid-facilitated oxidation of organic compounds in food (31).

Carbohydrate content obtained with by difference method showed the carbohydrate content in star fruit juice is 5.69 % while the carbohydrate content in star fruit juice with chia seeds addition is 7.14 %. This is in line with research of Bhardwaj S and Saraswat S (2019) which stated the addition of 2 g, 4 g, and 6 g of chia seeds increases the carbohydrate level in sport drinks.

Table 4. The Nutritional Content Analysis

Nutrient	Unit	F1	F2	p-value[1)]
		Mean ± SD		
Water Content	(%)	93,158 ± 0,250	89,219 ± 0,070	0,000*
Ash Content	(%)	0,189 ± 0,026	0,325 ± 0,053	0,017*
Carbohydrate	(%)	5,699 ± 0,218	7,146 ± 0,037	0,000*
Fat	(%)	0,365 ± 0,032	1,754 ± 0,030	0,000*
Protein	(%)	0,588 ± 0,023	1,555 ± 0,017	0,000*
Potassium	mg/ml	163,384 ± 11,522	206,640 ± 9,554	0,055
Calcium	mg/ml	5,320 ± 0,009	34,843 ± 6,289	0,022*
Magnesium	mg/ml	5,383 ± 0,424	17,803 ± 0,200	0,001*
Sodium	mg/ml	2,361 ± 0,488	2,469 ± 0,555	0,856

Description: SD = Standard deviation; F1 = Star fruit juice, F2 = Star fruit juice with the addition of chia seed 10 g; [1)]Uji *independent sample t-test*, shows that there is a significant difference in the nutritional content of F1 and F2 (**p* <0,05).

The addition of 6 g of chia seeds can increase carbohydrate level by 4.8 %. Paramita et al (2022) also stated the addition of 7.5 g of chia seeds increased the carbohydrate content in smoothies by 13.05 %. The carbohydrate content in both formulations is also assumed due to honey addition. According to TKPI (2020) the carbohydrate content in 100 g of honey is 79.5 %. The fat content in 200 ml of star fruit juice is 0.36 % while the fat content in star fruit juice with addition of chia seeds is 1.75 %. This is in line with research of Rasbawati and Irmayani (2021) that stated 10 % chia seeds addition increases the fat content in pasteurized milk (32). Chia seeds contain essential fatty acid, component that build fat, and essential fatty acid is a type of fatty acid that is really needed by the body (33).

The protein content in star fruit juice is 0.58 % while the protein content in starfruit juice with chia seeds addition is 1.55%. This result is in line with research of Bhardwaj S and Saraswat S (2019) which stated by adding 6 grams of chia seeds to sport drinks will increase the protein content by 2 %. While Rasbawati and Irmayani (2021) stated that adding 10 % of chia seeds increasing the protein content in pasteurized milk. Another study by Paramita et al (2022) also stated by adding 7.5 gr of chia seeds increasing the protein content in smoothies by 1.43 %.

The analysis of micro mineral content showed there is no significant difference in potassium and sodium level between two formulations. Sodium content in star fruit juice with no addition is 2.36 mg/200 ml, while sodium content in star fruit juice with chia seeds addition is 2.46 mg/200 ml. Value of sodium content within the product showed still meets the recommended limit for sodium intake (2000 mg/day or 5 g/day). The average of potassium level in star fruit juice is 163.38 mg/200 ml whereas the potassium level in star fruit juice with chia seeds addition is 206.64 mg/200 ml. Potassium level in star fruit juice with chia seeds addition tend to increase, however, no significant difference is found between the two formulas. It assumed that in 100 g of star fruit has a potassium level of 130 mg, while in 100 g of chia

seeds has a potassium level of 407 mg (27,28). This result is in line with the research of Kibui et al (2018) which showed there is no significant difference in the potassium level of yoghurt added with chia seeds (34).

The calcium level and magnesium level in this study showed a significant difference (p,0.05) between the two formulations. The average calcium level in star fruit juice was 5.32 mg/200 ml, while in star fruit juice with chia seeds addition is 34.84 mg/200 ml. the average of magnesium content in star fruit juice is 5.38 mg/200 ml while in star fruit juice with chia seeds addition is 17.80 mg/200 ml. Increase of calcium and magnesium level in star fruit juice known is present due to addition of 10 g of chia seeds. According to USDA (2011), 100 g of chia seeds contains 632 mg of calcium and 335 mg of magnesium. This result is in line with research of Alwi et al (2023) which showed the addition of chia seeds can increase the calcium and magnesium level in 200 ml of coconut water (35).

CONCLUSIONS AND RECOMMENDATIONS

F2 is the star fruit juice with chia seed addition selected as the most preferred formulation by the panellists. Star fruit juice with chia seeds addition can be consumed as a drink for people with hypertension because it contains good nutrients. The nutritional content of star fruit juice with chia seeds addition tends to increase in selected products. The calcium content in F2 is 34.84 mg/200 ml, and the magnesium content in F4 is 17.80 mg/200 ml.

Further research needs to be carried out to determine the effectiveness of star fruit juice with chia seeds addition on the blood pressure of people with hypertension.

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