ANTIOXIDANT, DIETARY FIBER, AND ORGANOLEPTIC IN CHOCO DRINK FORMULA WITH ADDED SORGHUM FLOUR

Antioksidan, Serat Pangan, dan Organoleptik pada Formula Choco Drink dengan Penambahan Tepung Sorgum

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ABSTRAK

Pangan fungsional bermanfaat mencegah atau mengurangi risiko penyakit. Coklat dan sorgum mengandung polifenol sebagai antioksidan. Tujuan penelitian ini untuk menganalisis tingkat kesukaan dan kandungan gizi produk choco drink sebagai minuman alternatif yang mengandung antioksidan dan serat pangan. Produk choco drink terdiri atas 4 kelompok: choco drink tanpa tepung sorgum (C), choco drink dengan tepung sorgum 10 gr (S10), 20 gr (S20), dan 30 gr (S30). Penelitian ini terdiri dari pengujian kandungan zat gizi dan uji hedonik oleh 29 panelis tidak terlatih yang dipilih secara accidental sampling. Kandungan gizi produk dianalisis menggunakan uji One way ANOVA dan uji hedonik produk dianalisis menggunakan uji Kruskal wallis. Analisis uji kandungan gizi produk menunjukkan terdapat perbedaan kandungan energi, karbohidrat, protein, lemak, serat pangan, air, dan antioksidan pada keempat produk choco drink (ρ<0.05). Analisis uji hedonik keempat produk menunjukkan terdapat perbedaan tingkat kesukaan panelis dari segi rasa (ρ=0.002) dan tekstur (ρ=0.000), sedangkan hasil analisis segi warna dan aroma menunjukkan tidak terdapat perbedaan (ρ>0.05). Penelitian ini dapat disimpulkan bahwa sebagian besar panelis menyukai produk C yaitu tanpa penambahan tepung sorgum dengan kandungan serat pangan 0.28 gr dan aktivitas antioksidan 44.95%.

Kata kunci: *antioksidan, choco drink, coklat, pangan fungsional, sorgum*

ABSTRACT

Functional foods can prevent or reduce the risk of disease. Chocolate and sorghum contain polyphenols as antioxidants. This study aimed to analyze the product favorability and nutritional content of choco drink products as an alternative drink containing antioxidants and dietary fiber. The choco drink product consisted of 4 groups: choco drink without sorghum flour (C), choco drink with 10 g (S10), 20 g (S20), and 30 g (S30) sorghum flour. This study consisted of nutrient content testing and hedonic tests by 29 untrained panelists selected by accidental sampling. The nutritional content of the products was analyzed using One-way ANOVA test and the hedonic test of the products was analyzed using Kruskal-Wallis test. Analysis of product nutritional content showed that there were differences in the content of energy, carbohydrates, protein, fat, dietary fiber, water, and antioxidants in the four choco drink products (ρ<0.05). Hedonic test analysis of the four products showed that there were differences in the level of panelist preference in terms of taste (ρ=0.002) and texture (ρ=0.000), in contras the results of the analysis in terms of color and aroma showed no difference (ρ>0.05). This study can be concluded that most panelists liked product C without adding sorghum flour with a dietary fiber content of 0.28 g and antioxidant activity of 44.95%.

Keywords: antioxidant, choco drink, chocolate, functional food, sorghum.

INTRODUCTION

The development of globalization affects various kinds of innovations in food processing to be used as consumable products. Currently, there are popular beverage-based products that are in demand by the world community, namely *sugar-sweetened beverages* (SSB) [1]. Sugar-sweetened beverages (SSB) include drinks with high calories because there is added sugar to improve the drink's taste [2]. This requires innovation in food processing by using local food ingredients that can be an alternative to other drinks with food fiber and antioxidant content.

Functional food has a role that is important in the nutritional content of a food or beverage product that has health benefits by preventing or reducing the risk of a disease [3]. One of the functional foods that are popular and widely consumed by the world community is chocolate. In Indonesia, chocolate production continues to increase yearly and becomes an opportunity for trading [4]. Currently, chocolate consumption is becoming popular and in demand by the world community because flavonoid compounds that have a role as antioxidants by increasing nitric oxide and theobromine content in chocolate can stimulate the central nervous system [5]. In addition, chocolate has become popular among the world community because it can be processed into contemporary sweet drinks or sugar-sweetened beverages (SSB) with unique characteristics and taste but contains more calories, high sugar, and high fat [6]. Chocolate contains 10% polyphenolic compounds derived from the dry weight of cacao seeds. Chocolate also has other compounds such as flavonoids, catechins, and anthocyanins [7]. Chocolate has distinctive sensory properties in terms of texture and aroma because it is influenced by chocolate such as volatile compounds and fatty acids [8]. The polyphenol in chocolate has a higher antioxidant capacity than tea or red wine [9]. In addition, chocolate also contains crude fiber around 33.19-39.45% [10].

Other functional foods besides chocolate are sorghum which belongs to the group of cereals or grains with nutritional content such as protein, starch, bioactive compounds and high dietary fiber [11]. In Indonesia, sorghum has a fairly high production and some regional people make sorghum as a substitute for rice [12]. Sorghum has a low digestibility of starch compared to other types of cereals, polyphenolic compounds contained in sorghum can reduce oxidative stress [13]. Sorghum contains resistant and gluten-free starch, and phenolic compounds are six times higher than whole wheat so that it can be used as functional food [14].

Chocolate and sorghum include local foods with polyphenol compounds which are phytochemical compounds as antioxidants [15]. In addition to antioxidants, chocolate and sorghum also contain dietary fiber which is included in complex carbohydrates [16]. The content of antioxidants and dietary fiber in chocolate and sorghum can be used as an innovation in processing drink-based products that are beneficial to health. Currently, sugar-sweetened beverages sold at every outlet contain high calories such as boba milk tea (352 kkal), coffee frappe (493 kkal) [17], and use additional sweeteners such as high fructose corn syrup [18]. This "Choco Drink" product processing innovation uses the basic ingredients of cocoa powder which contains antioxidants, and is added with sorghum flour which contains antioxidants and food fiber so that it is hoped that the choco drink formulation can become a functional drink because of the presence of antioxidants and food fiber. The choco drink products were then subjected to laboratory tests to determine the nutritional content and organoleptic tests using a hedonic scale to see which products were most favored by the panelists. The purpose of this study was to analyze the nutritional content and level of favorability of Choco Drink products as an alternative drink containing antioxidants and dietary fiber.

METHODS

Material

The composition in this choco drink processing innovation is made from local food, namely cocoa powder and sorghum flour. The cocoa powder used comes from a local plantation in the city of Blitar, Indonesia. The cocoa powder used is a finished product from the "Kampoeng Cokelat" brand. The sorghum used comes from a local farm in the city of Mojokerto, Indonesia. The sorghum used is red sorghum that has been cleaned and can be processed directly. The sorghum obtained is in the form of sorghum seeds which are then washed and heated in the sun and then ground to become sorghum flour. Making *choco drink* using pure cocoa powder as much as 50 g and sorghum flour, granulated sugar as much as 80 g and added water 800 ml. The serving size in one formula recipe is for 4 servings of 200 ml each. The process of processing choco drink is by heating it on a fire of 80-85^{oC} then cooled at room temperature. Choco drink products are divided into 4 groups, choco drink C (without the addition of sorghum flour), choco drink S10 (with the addition of sorghum flour 10 gr), choco drink S20 (with the addition of sorghum flour 20 gr), and choco drink S30 *(with the addition of sorghum flour 30 gr*). The presence of antioxidant compounds and dietary fiber in sorghum flour is expected that the choco drink formula has better antioxidants and dietary fiber as sorghum flour is added to the choco drink.

Nutrient Content's Choco Drink

The product nutritional content test was conducted at the nutrition laboratory of Airlangga University Surabaya, Indonesia in January 2022 including proximate tests, antioxidant activity, and crude fiber tests which was repeated 2 times in product testing. Proximate test consists of carbohydrate analysis, protein analysis, fat analysis, water analysis.

Carbohydrate analysis using the Luff Schoorl method is by adding 25 ml of Luff Schoorl solution and then boiling the sample for 10 minutes. Next, the sample was cooled, then added 15 ml of 20% KI and 25 ml of 25% H2SO4. The sample was covered and kept in a dark place for 30 minutes. The liberated iodine is titrated with 0.1 N Na2S2O3 solution using 2-3 ml of starch indicator [19].

Protein analysis using the semi-micro kjedhal method is by adding 1 spatula of Na2SO4-HgO catalyst and 2 ml of H2SO4, then boiling the sample for 2.5 hours until it becomes clear. Next, the sample was cooled, then 15 ml of distilled water and 10 ml of NaOH solution were added to the distillation tube. Erlenmeyer 125 ml containing 10 ml H2BO4 is placed under the condenser, then distilled until about 15 ml of greenish distillate is collected in Erlenmeyer. Titrate with 0.2 N HCL solution until the color turns pink [19].

Fat analysis using the soxlet method is by drying the fat bottle and filling it using 20 ml of n-benxene solvent. Next, pairing the fat bottle with an 800C soxlet connected to a reverse cooler, then extracting for 2-3 hours. The fat bottle containing the oil is mixed with the solvent in a 100^{o}C oven, then cooled in a desiccator for 15 minutes [19].

Water analysis using the oven method is by crushing the sample using a mortar and pestle and transferring it to a porcelain crucible, then heating it in an oven at 100^{o}C for 3-5 hours. Then the porcelain crucible was cooled in a desiccator for 15 minutes [19].

Analysis of antioxidant activity using the DPPH method is by making 3 ml of DPPH dissolved in 100 ml of methanol then covered with aluminum foil. Furthermore, 10 ppm and 5 ppm DPPH solutions were made and tested using a UV-Vis spectrophotometer with a maximum wavelength of 517 nm. The sample was mixed with 2 ml of DPPH solution, then the absorbance value was measured. The antioxidant activity of the sample was determined by the magnitude of the DPPH radical absorbance inhibition [20], [21].

Analysis of food fiber using the Coarse Fiber method based on SNI 01-2891-1992, namely the sample was added 50 ml of 1.25% H2SO4 solution which was boiled for 30 minutes, then added 50 ml of 3.25% NaOH and boiled again for 30 minutes. In the hot state the sample was filtered with a Bucher funnel containing Whatman 541 filter paper, then the precipitate was washed successively using hot 1.25% H2SO4, hot distilled water, and 96% ethanol. Next, the filter paper was dried at 105^{o}C, cooled and weighed to a fixed weight [22].

Hedonic Test

Hedonic testing or favorability test is one part of organoleptic testing by asking panelists to express their opinion on the product being tested. The observed hedonic test parameters are color, taste, aroma, and texture. Panelists were asked to the hedonic test in this study were 29 untrained panelists. Respondents who became panelists were adolescents who were still attending high school. Untrained panelists were selected with a minimum number of 25 laypeople based on gender and education [23] So the panelists of this study were teenagers who are determined by *accidental sampling*. This hedonic test scoring scale used a scale of strongly dislike, dislike, like, and strongly like [24].

Analysis

Hedonic test data was analyzed descriptively to see the average level of preference of panelists in terms of color, aroma, taste, and texture of *choco drink*. Furthermore, the data was statistically analyzed using the Kruskal wallis test to see the difference in the panelists' level of favorability for the four products in terms of color, aroma, taste, and texture of *choco drink*, ρ-values ≤ 0.05 were considered statistically significant using the Mann Whitney test instead of the post hoc test.

Data on the nutrient content test was analyzed descriptively to see the highest and lowest nutritional content of the four *choco drink products*. Furthermore, the data was analyzed statistically using *One Way ANOVA* to see significant differences in nutritional content between products, ρ-values ≤ 0.05 were considered statistically significant using Tukey (HSD) test. Statistical data analysis using IBM SPSS version 24.

RESULTS

The results of the choco drink nutritional content test are contained in table 1, tested in doses per 100 ml of products known to sample product C is choco drink without the addition of sorghum flour, sample S10 with the addition of sorghum flour 10 gr, sample S20 with the addition of sorghum flour 20 gr, sample S30 with the addition of sorghum flour 30 gr. The highest calorie content in S30 products is 188.5 kcal compared to other products. The highest carbohydrate content of choco drink products is in S30 products, which is 38.16 grams compared to other products. Protein in choco drink the highest content in S10 products is 3.04 grams compared to other products. The fat contained in choco drink is highest in S10 products, which is 2.79 grams compared to other products. The highest dietary fiber in choco drink in S30 products is 2.44 grams compared to other products. The antioxidant activity contained in choco drink has the highest results in product C, which is 44.95% compared to other products.

Table 1. Choco Drink Nutritional Content Test Results

Nutrients	Choco drink products				ρ-value
	C	S10	S20	S30	
Energy (kcal)	147.86±0.070	128.75±0.282^{abc}	165.75±0.042^{ab}	188.5±0.127^{abc}	0.000*
Carbohydrates (gr)	27.8±0.014	22.86±0.02 ^{abc}	33.2±0.007^{ab}	38.16±0.014^{abc}	0.000*
Protein (gr)	2.91±0.028	3.04±0.035^{abc}	2.61±0.028^{ab}	2.8±0.014^{bc}	0.000*
Fat (gr)	2.78±0.014	2.79±0.056^{c}	2.49±0.014^{ab}	2.74±0.01^{c}	0.002*
Water (%)	52.6±0.021	58.64±0.021^{abc}	47.62±0.000^{ab}	42.58±0.007^{abc}	0.000*
Dietary Fiber (gr)	0.28±0.007	0.77±0.028^{abc}	1.68±0.049^{ab}	2.44±0.014^{abc}	0.000*
Antioxidant Activity (%)	44.95±0.167	38.6±0.119^{abc}	30.6±0.049^{ab}	25.5±0.091^{abc}	0.000*

C: Choco drink without sorghum flour; S10: Choco drink with sorghum flour 10 gr; S20: Choco drink with sorghum flour 20 gr; S30: Choco drink with sorghum flour 30 gr. ρ-value using the using *One Way ANOVA* test (ρ≤ 0.05). (a,b,c) difference sign indicates significant difference using Tukey (HSD) test (ρ≤ 0.05).

Table 1 is the results of statistical analysis of choco drink nutritional content test which shows that there are differences in the nutritional content of each choco drink product per 100 ml based on the categories of energy, carbohydrates, proteins, fats, water, dietary fiber, and antioxidant activity with a value of ρ<0.05. The nutritional content of the four formulas has differences from all aspects, namely in terms of energy, carbohydrates, protein, fat, water, dietary fiber, and antioxidant activity. In choco drink with the addition of sorghum flour, there was an increase in energy, carbohydrates, and dietary fiber (formulas S20 and S30), but formula S10 decreased. A decrease in protein and fat occurred in formula S20, but formulas S10 and S30 experienced an increase. Water content and antioxidant activity decreased in line with the addition of sorghum flour, the more weight of sorghum flour added, the more water content and antioxidant activity decreased. This study also analyzed organoleptic related using hedonic scale of choco drink products as shown in table 2.

Table 2. Hedonic Test Results of Choco Drink Products

Hedonic Test	Average				ρ-value
	C	S10	S20	S30	
Color	3.14±0.789	3.24±0.636	3.1±0.939	3.28±0.797	0.869
Aroma	2.69±0.967	2.79±0.675	2.62±0.728	2.79±0.902	0.646
Taste	2.79±0.902	2.59±0.907^{a}	2.76±0.739	2.62±0.728^{ab}	0.002*
Texture	3.38±0.820	2.83±0.711^{a}	2.72±0.841^{a}	2.31±1.004^{ab}	0.000*

C: Choco drink without sorghum flour; S10: Choco drink with sorghum flour 10 gr; S20: Choco drink with sorghum flour 20 gr; S30: Choco drink with sorghum flour 30 gr. ρ-value using the Kruskall Wallis test (ρ≤ 0.05). (a,b,c) difference sign indicates significant difference using Mann Whitney test (ρ≤ 0.05).

The results of the hedonic test of choco drink products were carried out by 29 adolescents who were untrained panelists listed in Table 2. The results of the color-related hedonic test showed that panelists liked the color of the S30 product over other formulas indicated by an average value of 3.28. The results of the aroma-related hedonic test showed that panelists liked the aroma of S10 and S30 products compared to other formulas with an average value of 2.79. The results of the taste-related hedonic test showed that panelists liked the taste of product C over other formulas with an average value of 2.79. The results of the hedonic test related to texture showed that the panelists liked the texture of product C compared to other formulas with an average value of 3.37.

Table 2 of the hedonic test statistical analysis result showed that there are differences in the mean level of favorability in terms of taste (ρ=0.002) and texture (ρ=0.000) in the four formulas made. The results of statistical analysis of the hedonic test showed that there was no difference in the average level of favorability in terms of color and aroma in the four formulas made marked with a value of ρ>0.05. The addition of sorghum flour in choco drink can affect the taste and texture of the four formulas. The results of this hedonic test showed that panelists had different preferences in terms of

taste and texture, but had the same preferences in terms of color and aroma in all four formulations.

Table 3. Panelists' Preferred Product Results

Product	n	%
C	13	44.8
S10	6	20.7
S20	2	6.9
S30	8	27.6
Total	**29**	**100**

C: Choco drink without sorghum flour; S10: Choco drink with sorghum flour 10 gr; S20: Choco drink with sorghum flour 20 gr; S30: Choco drink with sorghum flour 30 gr.

In addition to conducting hedonic tests, panelists can choose the most preferred product. Table 3 shows that almost 50% of panelists liked product C without added sorghum flour. The addition of sorghum flour to the choco drink formula can affect taste, aroma, texture and color, so panelists prefer the choco drink formula without the addition of sorghum flour.

DISCUSSION

Changes in calorie content in Table 1 show that changes in calories of all product samples are in line with changes in the content of other nutrients such as carbohydrates, protein, and fat [25]. The energy content in product sample S10 decreased, which is thought to be related to the decrease in carbohydrates that occurred in product S10, this is in accordance with Asfiyah's research (2019), the increase and decrease in product nutrients can be influenced by product processing [26].

The decrease in carbohydrates in S10 occurs because the carbohydrate molecules are degraded which is affected by the process from the time of sanitization [27], so that carbohydrates are damaged which causes the polymer chain to break and hydrolyze,[28]. The decrease in carbohydrates is thought to be due to high nutrient components, the higher the other nutrient components, the lower the carbohydrates [29]. There was an increase in carbohydrate content in S20 and S30 products after adding sorghum flour. This can happen because sorghum contains about 55.6-70% starch sourced from amylose and amylopectin [30]. *Choco drink* those added with sorghum flour can increase carbohydrates. The increase in carbohydrates can be caused by the water content that evaporates in the cooking process at high temperatures [25].

Protein content increased in S10 products then there was a decrease in protein in S20 products. The increase in protein that occurs in product S10 may be due to other activities, according to Marchini (2021) the release of a high enough amount of free amino acids through the protein synthesis process can affect the increase in protein levels [31]. The decrease in protein that occurs in S20 products can be influenced by temperature and the duration of the cooking process. This happens due to protein denaturation due to the cooking process at a temperature of 80-85^{o}C so that high temperatures make the protein structure damaged [25]. Foods that have a higher protein content easily absorb water than low protein flour [32].

The decrease in fat content that occurs in S20 products may occur due to the drying temperature process in sorghum before being made into flour due to inactivation of lipase activity [31]. A 30% reduction in fat content can be influenced by the milling process to make sorghum flour [33]. In S10 and S30 products experience an increase in fat content, it can be affected by the water content in *Choco Drink* [34]. A study explains that the fat content increases due to low water content which can cause the fat of a product to oxidize easily, if the quality of the water content decreases it will affect the

rate of chemical reactions of the product such as the occurrence of oxidation processes [35].

The water content of each product decreases further as more and more sorghum flour is added. This happens because of the gelling process in sorghum which has a gelatinization temperature at 68-78^{o}C So that there is a re-formation of starch structure or high retrogradation and low viscosity in Choco Drink products [30]. Chocolate that has low water activity can affect the water content of choco drink products. The addition of components that contain fiber and polyphenols that are high enough also affects changes in texture in the product [36]. The absorption rate is related to the gelatinization process of starch into a gel that affects the increase in viscosity [32]. Dietary fiber contained in food has an influence on oil absorption capacity, the higher the fiber content, the more water and oil absorbed [32]. Temperature and length of cooking time can affect the evaporation of water in the product, resulting in a decrease in moisture content [37].

The dietary fiber content of each product has increased after adding sorghum flour as in table 2. A study of research results explains that sugar-free dark chocolate contains Dietary fiber [38]. Sorghum contained in *Choco Drink* It has a fiber content of 6.7 gr consisting of water-insoluble fiber around 75% - 90% and water-soluble fiber around 10% - 25%, as well as starch content consisting of amylose and amylopectin. The fiber content of sorghum is unextractable glucuronoarabinoxylans water which has a proportion of insoluble dietary fiber of 94-96%, so that the proportion of insoluble dietary fiber becomes 90% when decortication is 10% [33]. In addition, Sorghum starch component is amylopectin and amylose affects the process of starch gelatinization, paste viscosity, gelation, retrogradation or structure reformation. The starch structure of sorghum seeds is relative to flour after the grinding process [30]. A high enough drying temperature affects the moisture content to decrease and causes the crude fiber component to increase because the powder from carbohydrates increases [16]. The length of cooking time and temperature do not affect the fiber content of food because crude fiber is difficult to decompose, because it is insoluble in cold and hot water [37]. This is in accordance with the sample of choco drink products with sorghum flour added, the more the amount of sorghum flour added, the thicker the texture of choco drink.

Each product has different antioxidant activity after adding sorghum flour as in Table 1. The composition of the inner ingredients *Choco Drink* Cocoa powder is generally containing antioxidants such as polyphenols and flavonoids which are five times higher than milk chocolate and white chocolate [7]. But food processing with high temperatures and takes a long time can cause a decrease in antioxidant activity. Processing with high temperatures can affect the decrease in antioxidant activity, this happens because there is damage to antioxidants that act as secondary metabolites [16]. A study explains that wet cooking can reduce phenolic levels by 12-21%. In addition, extruded processing can also reduce the total phenolics in sorghum by 33-57% [33]. Processing done on chocolate can also reduce the bitter taste in chocolate products [39]. A study explains that lower or higher content of bioactive compounds is related to plant species, tissues, environmental factors such as temperature, water pressure as well as light conditions [40]. Hot temperatures can change metabolism and structural levels, in extreme temperatures there will be a decrease in the regulation of transcriptional activity of rbcL and rbcS genes which causes the formation of ROS so that the influence of temperature pressure affects antioxidant activity [41]. Increased pH can affect antioxidant activity through oxidation and interaction between polyphenolic compounds with polysaccharides, proteins, maillard products, but also affect the oxidase activity of polyphenols [42].

This study showed that there was an increase in fiber content followed by a decrease in antioxidant activity levels. This occurs due to the interaction between dietary fiber and phenolic compounds present in choco drink products. The addition of fiber to the methanol extract of phenolic compounds can reduce antioxidant activity, the

reduction depends on the type of dietary fiber added such as soluble or insoluble fiber [43]. Complex polysaccharides as a constituent of dietary fiber can affect physicochemical interactions with phenolic compounds, such interactions occur through hydrogen and ester bonds with ferulic and cinnamic acids, or through hydrophobic interactions and covalent bonds [44]. In addition, the color of sorghum seeds is thought to affect antioxidant properties through DPPH values. This happens because phenolic compounds present in red sorghum are the main contributors to antioxidant activity. Meanwhile, the absorption spectrum in DPPH can cause color interference with DPPH chromogen, so that the value produced by DPPH is relatively lower [45].

Table 2, the color of the product that is more preferred by panelists is S30 compared to the color of other products. Formulation S30 is added with the most sorghum flour among other formulations, so the color of the sorghum seeds used can affect the color of the choco drink formulation and produce a brown color with a slight red color. Color changes occur depending on the color of the sorghum seed which comes from the level of skin thickness, pigments in the testa layer, and the color of the sorghum endosperm [46]. This is also comparable to a study that explains that color changes occur by several chemical reactions such as changes in temperature, oxygen, the formation of maillard reactions, oxidation, and polymerization of polyphenols which are alkaline [42].

Products S10 and S30 had the same score in terms of aroma compared to the aroma of the other products. Although S20 had been added with sorghum, some panelists gave the same mean score to formulations S10 and S30. The results of this assessment are not in line with the research of Sukarminah et al (2017), sorghum seeds before crushing have a negative influence on the aroma of the processing into flour [46]. Formulations S10 and S30 have a sweet chocolate aroma that is quite different, the distinctive aroma present in both products comes from cocoa powder that has formed from degradation during the fermentation process. This occurs due to the release of seed protein from the dual activity of aspartic endoprotease and carboxypeptidase [47].

The product flavor that most panelists liked was C compared to other product flavors. Product C has a sweet and bitter taste peculiar to cocoa powder. The bitter taste in chocolate comes from polyphenolic compounds, where fresh cocoa beans contain 5-6% polyphenol compounds [7]. The product texture that most panelists liked was product C compared to other products. Product C has a liquid texture, and there is a relationship between taste and texture in chocolate products which is influenced by the rheological properties of cocoa itself. Rheological properties are molecular changes that occur due to the processing process, rheological properties can be determined based on the mass of fluid at the end of a product by looking at the viscosity level of the product. The viscosity level of chocolate also affects the taste caused by a deformation change process that changes the shape of chocolate from solid to liquid [48].

This study has product test parameters to see the nutritional content and the level of preference of panelists on choco drink (Table 3), as well as presenting other parameters, such as dietary fiber and antioxidants present in the product. There is the best formulation that looks at the expected value based on product characteristics *Choco Drink* [49]. This research has product test parameters to see the nutritional content and the level of panelists' liking for choco drink, as well as presenting other parameters, such as antioxidants and dietary fiber present in the product. There is the best formulation by looking at the expected value based on the characteristics of Choco Drink products [37]. The product preferred by panelists with product sample C without the addition of sorghum flour, product C contains 44.95% antioxidant activity which is included in the moderate level and dietary fiber of 0.28 g which can meet the daily fiber requirement of 0.93%. The results of this study are in accordance with the expectations of researchers to determine the nutrients and organoleptic tests of the four formulas, choco drink without the addition of sorghum and choco drink with the addition of sorghum flour. This study

has several research limitations, so it is hoped that further research can develop products using natural sweeteners, measure the heating process time, and can conduct detailed antioxidant tests such as flavonoids, polyphenols and others.

CONCLUSION

Hedonic tests of the four choco drink products conducted by panelists showed that there were differences in taste and texture preferences ($\rho<0.05$), but no differences in color and aroma ($\rho>0.05$) of the four products. The most preferred product by most panelists was product sample C (44.8%), without the addition of sorghum flour with 0.28 g of dietary fiber and 44.95% antioxidant activity.The results of the nutritional content test analysis showed that there were differences in the content of energy, protein, fat, carbohydrates, dietary fiber, water, and antioxidant activity in the four choco drink products. The difference in nutrient content can be influenced by cooking temperature, cooking time, and chemical reactions that occur during the product cooking process.

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