The effect of adding curcuma powder on the quality of the active components in instant cocoa drinks

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Abstract. Instant drinks in powder-shaped drinks are made from foodstuffs such as fruits, spices, grains, and leaves. The instant cocoa drink is made from cocoa powder with Curcuma powder which has a functional effect due to the content of polyphenols and curcumin in the ingredient. This study aims to determine the scope of polyphenols, curcumin, and antioxidant activity associated with the quality of cocoa instant drinks as functional drinks. The study was conducted using an experimental method, using a complete randomized design (CRD) of 1 factor with three-time repetitions. The results showed that the treatment with ginger as much as 18 grams had polyphenol levels of 13.11 ppm and curcumin levels of 3 ppm. The statistical tests showed an unreal influence on polyphenol levels and very noticeable differences in curcumin levels. The highest antioxidant activity was found in instant drinks without the addition of Curcuma at 11.42 ppm. Likewise, the acceptance rate of panelists for scent and taste has a score of 5 and 4, respectively. The three studies differ markedly at the 5% level. The highest water content is found in the addition of 12% ginger, with a moisture content of 4.65%.

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1 Introduction

Changes in people's perceptions encourage the development of cocoa products that lead to healthy food. The increase globally is driving the demand for cocoa products [1]. Cocoa products are exported in the form of whole or broken cocoa beans, raw or roasted cocoa beans by 7%, cocoa paste by 7%, nonfat cocoa paste by 5%, butter, cocoa fat, and oil by 65%, cocoa powder without added sugar or other sweeteners as much as 12%, and exports in different forms as much as 4%. The export is influenced by the character of cocoa beans owned by Indonesia in contrast to other countries, namely the low content of *free fatty acids* (FFA) and their high melting point [2].

The demands of the destination countries carry out Indonesian cocoa exports. These exports include cocoa beans, cocoa paste, cocoa butter, cocoa flour, and chocolate food products, even for special purposes such as baby porridge. Processed foods for baby porridge must contain cocoa as much as 5% or bigger but less than 10%. The number of exports for each type of cocoa bean is 30,853,065 kg; cocoa paste 19,847,964 kg; cocoa butter 144,985,412 kg; and cocoa flour 87,707,262 kg [2].

The instant cocoa drink is one type of drink that is much loved by all circles. The main ingredient in making instant cocoa drinks is a cocoa powder produced from cocoa fruit, one of the plantation commodities. Cocoa instant drinks have now been widely developed into instant drinks with functional value with the addition of spices [3]**.** Cocoa instant drinks continue to be developed due to sufficient market potential and the existing support of the food industry [4].

Cocoa seeds contain compounds that have health benefits, such as polyphenol compounds. Among the polyphenol compounds in cocoa beans are flavan-3-ols (catechin, epicatechin, and proanthocyanin) are the most dominant compounds. In cocoa beans, anthocyanins are found, derivatives of cyanidin, flavanols (quercetin and their products), flavones, and phenolic acids in small quantities [5].

Cocoa beans contain anthocyanins in the form of cyanidin 3-O arabinoside and cyanidin 3-O-galactosides [6]. Cocoa beans can be a source of polyamines, which contribute to the antioxidant activity of cocoa. Polyamines belong to the group of bioactive amines. Serves to prevent damage to DNA cell membranes and efficient scavengers of hydroxyl radicals at physiological concentrations [7].

Cocoa bean flavonoids are the main phenolic compounds identified. Most of the flavonoid compounds identified are flavan 3-of monomers (epicatechin and catechins), procyanidins dimers, and trimeric consisting of catechins as monomer units. Dimers and trimeric are followed by anthocyanins and flavanols. Flavan 3-ol is a flavonoid compound found in cocoa beans as much as 92% of the total phenolic compounds [6]. A. Rosidi *et.al* [8] found a high correlation between polyphenol content and antioxidant capacity.

Based on the functional properties contained in cocoa beans, it is known to have antioxidant properties as in temulawak rhizomes. Temulawak's active component is curcumin, which acts as an antioxidant with curcumin levels in the form of an extract of 27.19% with an antioxidant Activity IC_{50} 87.01 ppm. Curcumin in temulawak extract is an active antioxidant and has the opportunity to be used as a natural antioxidant [8]. This study aims to see the effect of the addition of temulawak powder on the quality of the active components of polyphenols in instant cocoa drinks as functional drinks.

2 Methodology

2.1 Materials and tools

The cocoa fruit is taken directly from community plantations in Mamuju Regency, West Sulawesi Province. Temulawak used is temulawak which is obtained from a traditional

market in Makassar. The additional ingredients used in sucrose and milk powder are obtained from a shop selling baking ingredients in Makassar City. The chemicals used are methanol, ion-free water, acetone, acetonitrile, acetic acid, DPPH, Na2CO3, aqua dest, and additives in kappa-carrageenan obtained from chemical stores.

The tools used are cocoa fruit crackers, tarpaulins, and nets for drying cocoa beans, vacuum ovens, cocoa bean roasters (mpr type 54), stone mills (type STM 100), ball mills (type BMV 10), cocoa fat presses (type CBP 30), cutter knives, centrifugation tools, analytical balances, photometer Spectro equipment and several supporting tools needed in the implementation of research. The study was conducted from April – October 2018.

2.2 Research sample preparation

2.2.1 Cocoa powder manufacturing process

Research samples in the form of cocoa fruit, taken and distorted directly in farmers' plantations. The cocoa fruit that has been sorted is then silenced for five days. The purpose of hardening is to facilitate the installation of cocoa beans from the placenta. Cocoa fruits that have been silenced and then are separated from the peel and dried in the sun directly (hot weather) for ± 3 -4 days with a thickness of ± 2 cm. Dried cocoa beans are then roasted at a temperature of 100^{o}C for 45 minutes until the moisture content reaches 6%. The cocoa beans are further separated between the epidermis and nib manually.

Cocoa beans (cocoa nib) that have been separated with an epidermis are then mashed using a stone mill until a cocoa paste (cocoa liquor) is produced. The resulting cocoa paste is then separated between the fat and the solids using a cocoa fat press equipped with a 140-mesh filter at a temperature of 60 atm and 50^{o}C for 5 minutes. The resulting cocoa solids are then sifted using an 80-mesh sieve to obtain a uniform cocoa powder.

2.2.2 Temulawak Powder Manufacturing Process

Temulawak is washed thoroughly and then sliced with a thickness of ± 1-2 mm. The temulawak is then dried using a vacuum oven with a temperature of 60^{o}C for ± 2-3 days. The dried Temulawak is then mashed using a *food processor* and sifted until temulawak powder is obtained.

2.3 Instant brew making

The temulawak cocoa instant drink is then mixed until homogeneous. These ingredients are temulawak (0 gr (IK), 6 gr (IKT1), 12 gr (IKT2), and 18 gr (IKT3)), cocoa powder 50 gr, sugar powder 109 gr, milk powder 296 gr, kappa carrageenan 4.68 gr.

2.4 Analysis procedure

The observation parameters carried out in this research activity include polyphenol levels, curcumin levels, antioxidant activity, and panelist acceptance of scent and taste.

2.4.1 Polyphenol levels of the folin coaciteau method [9]

Cocoa powder is weighed as much as 50 gr, freed from fat by adding 200 ml of hexane solvent, and allowed to stand at room temperature for 24 hours. The sample that had been settled was then centrifuged at a speed of 2,500 rpm for 10 minutes. The treatment was

repeated three times in the same sample using a hexane solvent until it reached 600 ml. Extraction of fat-free cocoa mash as much as 1 gram using acetone and water (70: 30) and repeated three times and centrifuged at a speed of 3,000 rpm for 15 minutes. The total extracted solvent is put into a 100 ml measuring flask and pitted with acetone: water to the limit mark. Acetone extract: 0.25 ml of water is put into a 50 ml measuring flask, and 20 ml of equates is added; 2 ml of Folin – Calciteau reagent is then homogenized and let stand for 5 minutes. Add Na_2CO_2 7% as much as 20 ml, then let stand and incubate for 90 minutes at room temperature. It was then measured using spectrophotometry at a wavelength of 750 nm.

2.4.2 Kadar Curcumin [10]

Every 0.1 gram of dry extract from the extraction results with solvents of acetone, ethanol, and ethyl acetate is dissolved in 96% ethanol and put in a 10 ml measuring flask (mother liquor). Take each mother liquor of 1 ml and dilute it into a 10 ml measuring flask with the same solvent (solution 1). Take 2.5 ml of soluble one and cut in a 10 ml measuring flask with the same solvent (solution 2), carry out a dilution of 3 – 4 in the same way at dilutions 1 and 2, then measure its absorbance at a maximum wavelength of 427 nm. The results of curcuminoid quantization using UV appear to be expressed as total curcuminoids. Polyphenol levels are calculated using the equation:

$$Curcumin\ (\%) = \frac{Concentration\ (y)}{Sample\ Weight}\ x\ 100\% \quad (1)$$

2.4.3 Antioxidant activity [9]

A 1 mm DPPH solution and a 1,000 ppm BHT solution with concentrations of 200 ppm, 300 ppm, 400 ppm, and 500 ppm, respectively, were made. Extract 2.5 gr of polyphenols from cocoa powder by dissolving them in 25 ml of methanol. The mixture was then homogenized using a *vortex,* then separated between the filtrate and sample residue using a centrifugation device at4000 rpm for 10 minutes. The steering filtrate is concentrated using a *rotavapor* and, after concentrating, is added methanol until it reaches a volume of 5 ml. The filtrate is then put into a test tube of 20 µl and added a one mM DPPH solution in methanol as much as 500 µl. The volume is sufficient to 5 ml by adding water to the ions and incubating at a temperature of 37ºC for 30 minutes. Absorption was measured at a wavelength of 517 nm (as a positive control and comparison used BHT (concentration 0.125; 0.250; 0.500; and 0.750 ml)). The percentage of antioxidant activity expressed by IC_{50} is then calculated to obtain the value of IC_{50} by regression (x,y). Where x is the concentration (µg / ml) and y is the presentation of antioxidant activity (%).

$$\%antioxidant\ activity = \frac{Control\ absorbance - Sample\ absorbance}{Control\ absorbance}\ x\ 100\% \quad (2)$$

$$Y = Bx + A \quad (3)$$

2.4.4 Moisture content [11]

The cup and lid are first dried using an oven at 50ºC for 30 minutes and cooled in a desiccator for 20 minutes. Weigh the sample by 5 gr and store it in a dry saucer of kemudian homogenized. Dry the sample in the oven at 70ºC with a pressure of 25 mbar for 6 hours. After 6 hours, put the petri dish, relax in a desiccator, and weigh. The process is carried out repeatedly until a constant weight is obtained. The moisture content in the material is calculated by using the percentage of the dry base with the equation:

$$\% \text{ Moisture Content} = \frac{b-(c-a)}{(c-a)} x100\% \quad (4)$$

Where: a = weight of the dry dish (constant)
b = initial sample weight
c = weight of the cup containing the sample (constant)

2.4.5 Panelist's acceptance of scent and taste [12]

Testing related to the liking for the scent and taste of instant chocolate drinks produced using the hedonic method (liking test). The test was carried out using scoring based on the panelists' assessment, (1) Very fond; (2) Dislike; (3) Somewhat dislike; (4) Neutral; (5) Kinda like it; (6) Likes; and (7) like it. The test was conducted on 25 panelists.

2.5 Statistical Analysis [13]

The study was conducted experimentally and using a literature study, using a Complete Randomized Design (RAL) consisting of 4 treatments with three repeats.

3 Results and discussion

3.1 Polyphenol Content

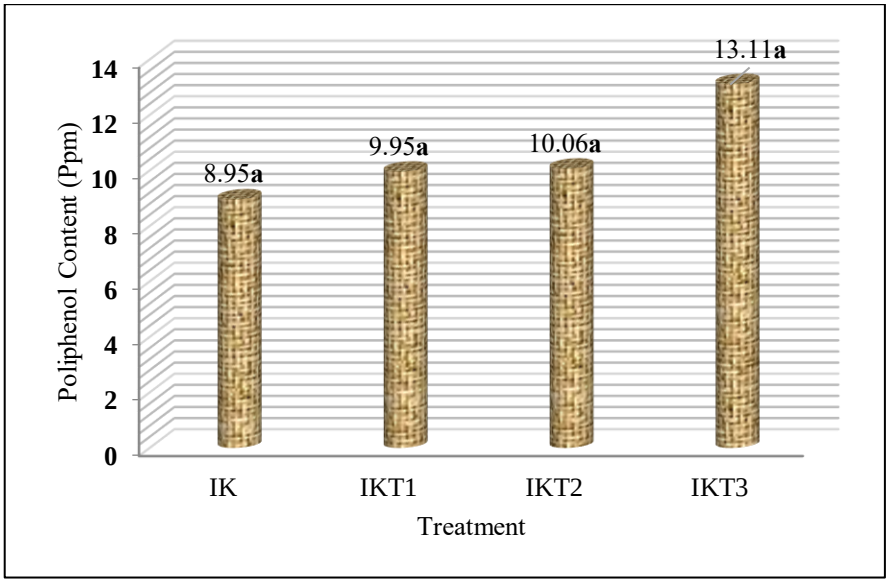

Fig. 1. Polyphenol Content of Instant Cocoa Drink with the Addition of Temulawak

Cocoa instant drinks have different content of polyphenols for each treatment. From the analysis results, the highest polyphenol content was obtained in 18 gr of temulawak powder, compared to cocoa instant drinks, the addition of temulawak. The high content of polyphenols is influenced by a large amount of temulawak powder added to the drink's formulation. According to the research conducted by Wasmun, *et.al* [14], many additions of cocoa husk pods will increase the high polyphenols content in the resulting drinks. The

amount of polyphenol content increases in each branch of temulawak powder at 6 gr, 12 gr, and 18 gr is one ppm, 0.11 ppm, and 3.05 ppm, respectively.

Treatment without the addition of temulawak powder (IK) has low content because polyphenols in cocoa beans will experience shrinkage during the drying and roasting process. Polyphenol levels in dried cocoa beans are 5–18% or equivalent to 0.5–1.8 mg/g but can decrease by ± 20% in the roasting process [15.16]. Polyphenols during the roasting process will degrade enzymatically and non-enzymatically, with the heat of polyphenols evaporated or may also be damaged during the processing process [16].

The results of statistical tests on the polyphenol content of cocoa instant drinks with and without the addition of temulawak powder had no noticeable effect on the level of 5% in each treatment. This can be caused by the average contribution of temulawak powder added to polyphenol levels of 0.1150 ppm. The more temulawak added, the more polyphenol content produced in the instant cocoa drink. The protection of phenol compounds in instant cocoa drinks made is no higher than in functional drinks produced from instant drinks extract *pod husk* cocoa (123.20 mg) and teabag drinks (142.85 mg) [14].

3.2 Curcumin Levels

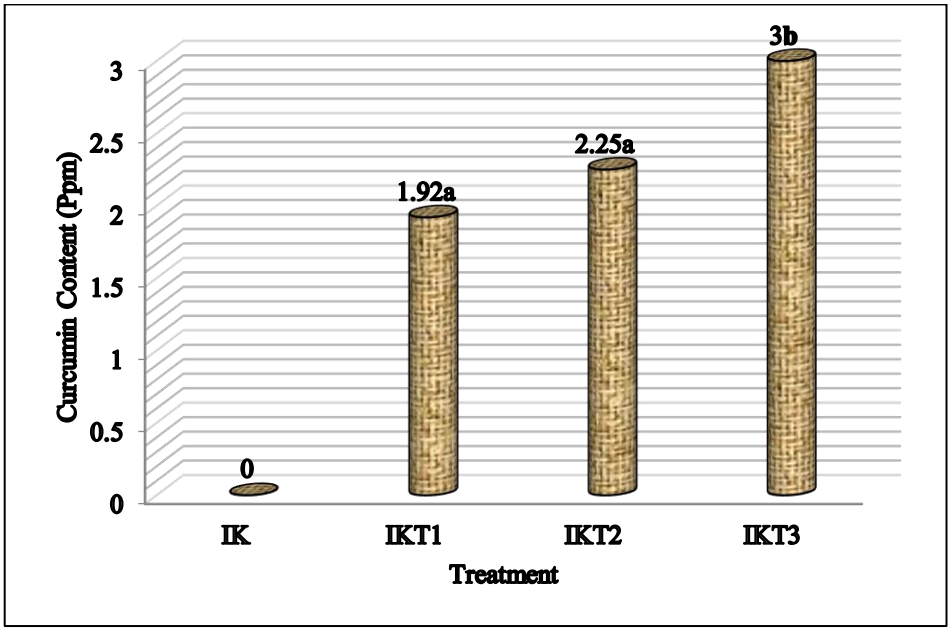

Fig. 2. Curcumin Content of Instant Cocoa Drink with the Addition of Temulawak

Curcumin in the resulting cocoa instant drink has different curcumin levels for each encroachment of temulawak powder. Curcumin is a compound that has the ability as an antioxidant with various functional groups [17]. The amount of temulawak powder added influences curcumin levels in the resulting instant drink. Curcumin levels were only found in the IKT1, IKT2, and IKT3 treatments, with the highest levels of curcumin found in the IKT3 treatment (Figure 2).

The high level of curcumin in cocoa stat drinks produced in the IKT3 treatment is absolute with the IKT1 and IKT2 treatment at a level of 5%. The addition of temulawak powder as much as 6 gr (IKT1) and 12 gr (IKT2) has a difference in curcumin cardigan of 0.3 ppm, while in addition to 18 gr (IKT3) it has a curcumin content of 0.75 ppm with IKT3 treatment.

Based on the average curcumin content and the total temulawak powder added, each gram of temulawak powder used increases curcumin content by 0.2247 ppm/gram.

Curcumin levels that continue to increase based on the amount of temulawak powder added are caused by the curcumin content. Curcumin content in temulawak powder is 27.19% [8] , as well as the results of a study conducted [18], found curcumin levels of 61-67% based on test results using HPLC. But it differs from the results of a study conducted by Rosidi et al. [8], which states curcumin levels of 2.02%. Meanwhile, there was a curcumin compound in control (IK) because the addition of temulawak powder was not carried out.

3.3. Antioxidant Activity

Curcumin in instant cocoa drinks has a role as an antioxidant that can protect membranes against peroxidative damage [17]. However, considerable amounts of curcumin in a product do not show the ability of antioxidant activity, so testing is needed related to its activity as an antioxidant. This can be seen in Figure 2, related to a large amount of temulawak powder addition to instant beverage products only affecting the total polyphenols (Figure 1). Still, the full size of polyphenols does not affect the high antioxidant activity, as seen in Figure 3. A result of research conducted by [19] found a high correlation between polyphenol content and antioxidant capacity. Polyphenols can cause this in temulawak powder that is not pure polyphenols or many other compounds.

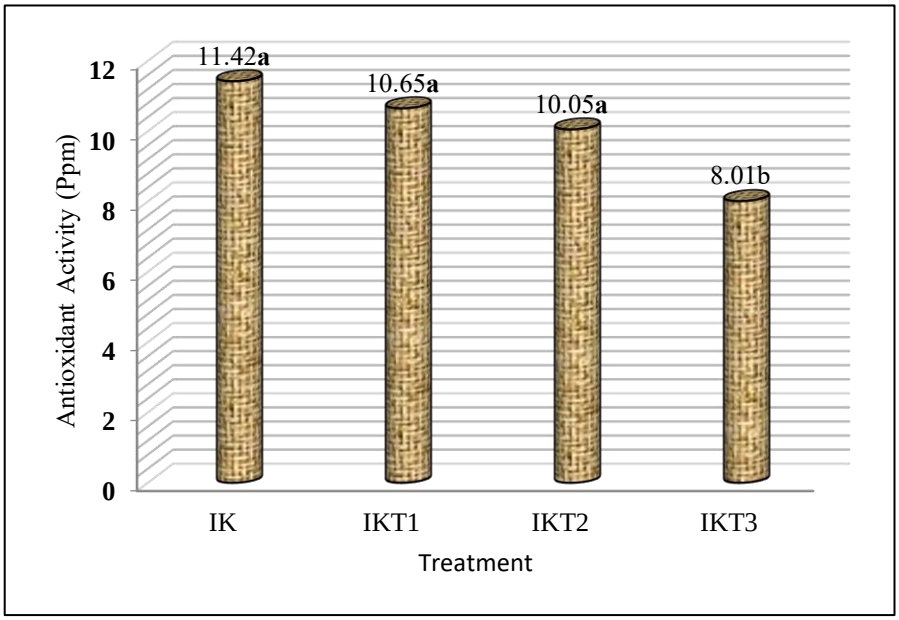

Fig. 3. Antioxidant Activity of Instant Cocoa Drink with the Addition of Temulawak

The highest antioxidant activity was found in the IK treatment (without the addition of temulawak powder/control) and the lowest in the IKT3 treatment (the addition of 18 gr of temulawak powder). The treatment of IK, IKT1, and IKT2 antioxidant activities possessed did not differ markedly from the IKT3 therapy at the level of 5%. High antioxidant activity in the IK treatment because cocoa is rich in polyphenol sources such as flavanols. Flavanols in non-fermented cocoa beans are about 60% consisting of monomeric, catechin, epicatechin, and oligomeric forms and their polymers, procyanidins [20,6]. In addition, epicatechin in cocoa flavanols is easily absorbed by the body due to its high bioavailability [16].

Antioxidant activity is influenced by the resulting IC_{50} value, which indicates the ability to free radicals. The higher the IC value of$_{50}$ suggests, the lower the antioxidant activity [8]. From Figure 3, it is known that the IK treatment has a lower IC valueof$_{50}$ compared to other treatments. This can be caused by low curcuminoid levels in the temulawak powder used. Low curcuminoids in temulawak powder can be caused by temulawak obtained in the market having a younger harvest age and the variety used. Research conducted by Hatmi, and Rosidi [21, 8] showed that the level of curcumin in temulawak is influenced by the age of harvest, the cultivation techniques carried out, and the availability of nutrients for plants, as well as the type or variety, used.

3.4 Moisture Content

The moisture content in dry foodstuffs is more associated with the stability of the products produced during the storage period. The moisture content of the cocoa instant drink made for all treatments did not differ markedly at 5%. The moisture content created from the product is still lower than the moisture content requirement of dried spices by 10% [22], and lower than the established product standard by 12%.

The low moisture content of the resulting instant beverage product can extend the product's shelf life because microbes that may grow in products containing spices can be inhibited so that the compounds that can be in effect are not damaged [24,23]. The high moisture content of the IKT2 treatment compared to other treatments can be affected by the storage conditions of the resulting product.

The low moisture content of the resulting product can be affected by the temperature and duration of drying, surface area, and thickness of the dried material so that more water is released from the material. Low water content can inhibit the occurrence of damage enzymatically to allow the resulting product not to lose its pharmacological effect [24].

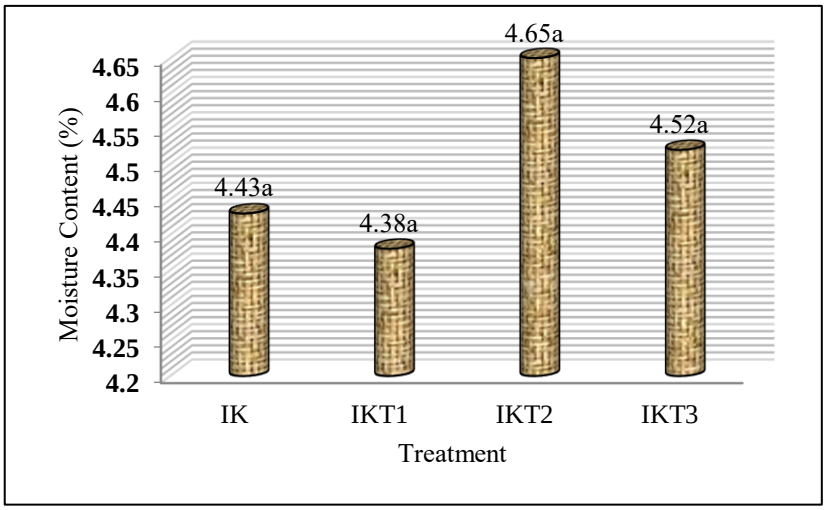

Fig. 4. Moisture Content of Instant Cocoa Drink with the Addition of Temulawak

3.5 Panelists' Acceptance of Taste and scent

Hedonic tests of instant cocoa drinks with temulawak were carried out for the taste and scent parameters produced with various concentrations of temulawak expansion. The test results show that the response of the panelists' acceptance of the drink gave different results. Instant cocoa drink without the addition of temulawak powder (IK) has a preferred acceptance rate

compared to other treatments, where the treatment has a taste and scent that is almost the same as other instant cocoa drinks.

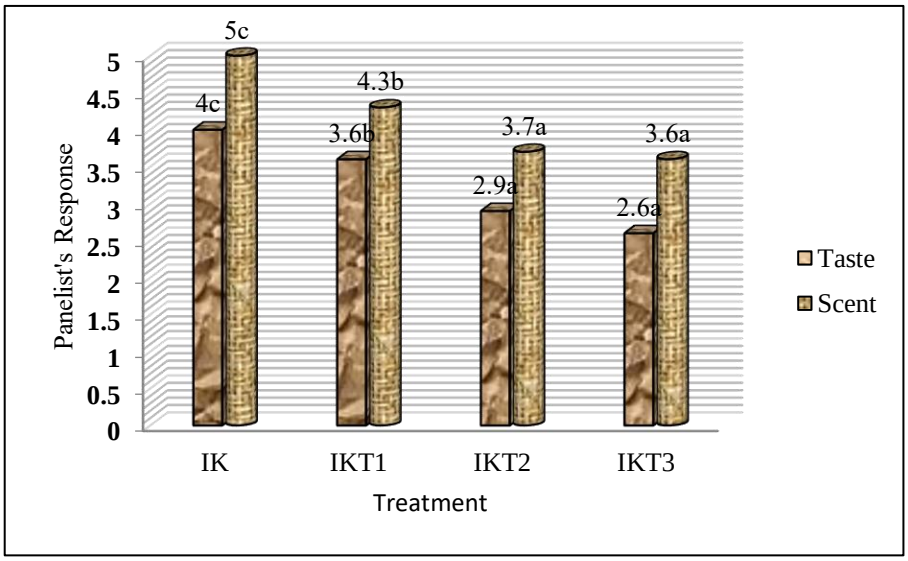

Fig. 5. Panelist's Response to the Taste and Scent of Cocoa Instant Drink with the Addition of Temulawak

The panelists did not like the response of the panelists' acceptance of the IKT3 treatment. Based on the data that appears to be known, the addition of temulawak powder will reduce the level of panelists' approval of the taste and scent of the resulting product. The panelists' response to IK's treatment had a tepid reception and was somewhat favored by the panelists. This is because cocoa beans have a distinctive flavor and flavor [16], although not as strong as the flavor and flavor of fermented cocoa beans.

The test results statistically showed that the panelists' test results for taste and scent differed markedly at 5%. The IK treatment differs very markedly from the IKT2 and IKT3 treatment and does not differ markedly from the IKT1 treatment. The difference in the reception level of panelists was influenced by a large amount of temulawak powder added. The more temulawak that is added, the aroma and taste produced will be dominated by temulawak. The strong aroma and taste are due to the taste and aroma possessed by temulawak are very strong, which can mask the taste and aroma of cocoa powder.

4 Conclusion

The addition of temulawak powder to cocoa instant drinks has no effect on the level of 5% for each treatment. The curcumin levels produced differed between the IKT1 and IKT2 treatments and the IKT3 treatment. A large amount of temulawak powder addition and the high level of curcumin is negatively correlated with the activity of the antioxidants produced; the highest level of antioxidant activity is found in the IK treatment (11.42 ppm). The average moisture content for all treatments is smaller than the product standard (≤ 12%). The panelists' acceptance rate for taste and scent tends to be less preferred by panelists. A large number of additions of temulawak powder reduces the level of favorability of the panelists in the resulting product, compared to cocoa instant drinks without the addition of temulawak powder (IK) with acceptance scores for taste (4) and scent (5).

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