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# The Effect of Foaming Agent and Maltodextrin Concentrations on the Characteristics of Bidara Fruit Powder Drink, Strawberry and Butterfly Pea Flower

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**A B S T R A C T**

This research aimed to determine the effect of the concentration of foaming agent and maltodextrin on the characteristics of bidara fruit powder drink, strawberry, and butterfly pea flower. The study used a completely randomized design (CRD) with two factors and three replications. Data analysis used ANOVA followed by the Duncan multiple range test (DMRT) at a 5% confidence level. The first factor was the concentration of the foaming agent (egg white) (5% (F1), 6% (F2), 7% (F3)). The second factor was the concentration of maltodextrin 7.5% (M1), 10% (M2) and 12.5% (M3)). Parameters observed included moisture content, ash content, yield, pH value, antioxidant activity, vitamin C, solubility, color, and organoleptic analysis, including taste, aroma, and color. The results of the treatment of egg white and maltodextrin concentrations had a significant effect on water content, yield, pH, antioxidant activity, vitamin C, solubility, and color. The best treatment in this research was bidara fruit powder drink with a concentration of foaming agent (7%) and 12.5% maltodextrin with 35% water content, 0.88% ash content, pH 5.95, 68.86% antioxidant activity, vitamin C 141 mg/100g, color L 3.15, a -0.20, b -2.55 and yield 25.33%, taste score 3.94 (like), aroma 1.19 (immensely dislike ), color 4.38 (like), and anthocyanin content 8.60 mg/L.

## 1. INTRODUCTION

### *1.1. Research Background*

Powder drinks are drinks in powder or fine granules made from spices, seeds, fruits, or even flowers and are usually served quickly by brewing. The advantages of powdered drinks are that they are more practical in the serving process, extend shelf life because they have a low water content, and have a smaller volume, making packaging and distribution easier. The characteristics of powdered drinks include taste, color, smell, and appearance comparable to fresh products, good nutritional characteristics, and storage stability [1]. One source that can be processed into a powdered drink is bidara fruit.

Bidara fruit (Ziziphus mauritiana) is widely used in traditional medicine, including all its parts (leaves, fruit, seeds, roots, and stems). Bidara fruit contains flavonoids, saponins and tannins, which can repair body cells damaged by free radicals [2]. Appearance is an important factor in a food product. Bidara fruit has good nutritional content for the body, but the resulting color is not attractive, so the butterfly pea flower extract is added to improve the color quality of the resulting powder drink. Butterfly pea flowers are widely used as a food coloring or natural drink safe for the body [3].

Powdered instant drinks can be manufactured using the foam mat drying method. This method was chosen because it is relatively simple and inexpensive. Foam-mat drying is useful for producing dry products from liquid materials sensitive to heat or containing high sugar content. The foam-mat drying method is largely determined by the foaming agent used. Foaming agents or foamers are food additives that function to form or maintain homogeneity of the gas phase dispersion in liquid or solid food ingredients [4]. The foaming agent used is egg white.

Egg white is one of the foaming agents that is often used. The advantage of using egg whites as a foam is that they are affordable, easy to obtain, and natural. Besides that, maltodextrin is also used as a filler (bulking agent) to coat flavor components, increase total solids, increase volume, speed up drying, and prevent material damage due to heat [5]. Based on these conditions, this research was needed to determine the effect of the concentration of foaming agent and maltodextrin on the physicochemical and organoleptic characteristics of the bidara fruit powder drink.

### *1.2. Literature Review*

#### *1.2.1. Powder drink*

Instant powder drink is a product that is popular with the public because of its refreshing taste and practical use. The manufacture of instant powdered drinks is carried out so that the quality of the product is maintained, it is not easily contaminated, it is not easily infected with disease, and the product is without preservatives. Instant powder drinks are very easy to serve, just enough to add hot or cold water. Through certain processing processes, instant powder drinks will not affect the properties contained in these ingredients, so they are good for the body's health [6].

The criteria for powder drink products must have nutritional characteristics, good organoleptic quality, and good storage stability. Ref [7], based on the five senses, the characteristics of a good powder drink include:

a. Powder: not agglomerated and dry, when shaken inside the package, you hear a sound.
b. Solubility in water: The powder dissolves very quickly when added to water, with only 2-3 times of stirring.
c. Taste: generally sweet and has a distinctive taste according to the basic ingredients used and a little bit of other flavors that come from the ingredients added.
d. Aroma: according to the characteristic aroma of the basic ingredients used and the typical sweet aroma of granulated sugar.
e. Color: according to the base material used.

In the manufacture of powdered drinks, several materials are needed, including fillers and foaming agents. The type of filler that is most often used in the manufacture of instant powder drinks is maltodextrin. Maltodextrin was chosen because it has a good ability to bind water, thereby preventing agglomeration of the product. In addition, it also has a high solubility value [7].

The use of foaming agents aims to enlarge the pores of the slurry so that it can increase the volume. Foaming agents cause the material to become more sensitive to excess heat and speed up the drying process. The most commonly used foamers are egg whites or albumin. The use of egg white as a foaming agent is because it is cheap, easy to obtain, and natural [5]. The mechanism for the formation of foam begins with the opening of protein molecule bonds so that the chains become longer. The next stage is the adsorption process, namely the formation of a monolayer or film of denatured protein. Air is captured and surrounded by a film and forms bubbles. The formation of a second monolayer is continued around the bubble to replace the coagulated portion of the film. The protein film of the adjacent bubbles will contact and prevent the liquid from escaping. Egg whites that are beaten too long or stretched as wide as possible will lose their elasticity [8].

#### *1.2.2. Foam-mat drying*

The foam-mat drying method is a drying method that involves the material going through the drying process and adding a foaming agent to produce stable froth which is dried with hot air at a temperature of 50-80℃. Drying using the foam-mat drying method is considered advantageous compared to other methods due to the large surface area with the help of a foaming agent which functions to bind air or gas during the drying process [9].

The mechanism that occurs during the drying process of the foam mat drying method is that when the foam has been formed, the hydrophilic filler will bind the water contained in the material, and the water dispersed in the foam. The foam will thicken, and the evaporation process will go faster. The filler (bulking agent) will coat the foam in the lamella area so that it becomes more stable. During the drying process, water vapor will evaporate, but the color and aroma will not be retained due to the presence of a filler layer that holds the foam surface wall [10].

### *1.3. Research Objectives*

This research aimed to determine the effect of the concentration of foaming agent and maltodextrin on the physicochemical and organoleptic characteristics of bidara fruit powder drink.

## 2. MATERIALS AND METHODS

### *2.1. Materials and Tools*

The main ingredients used in this research were the ripened white fruit of the variety (Ziziphus mauritiana), maltodextrin, egg white, sugar, butterfly pea flowers, strawberries, and water. The materials used for chemical analysis were adalah $Na_2CO_3$, HCl, NaOH, Iod solution, Fehling A solution, Fehling B solution, 0.2 M DPPH, Methanol, Anilum, Follin ciocalteu and Aquades.

The tools used include a cabinet dryer, spectrophotometer, oven, furnace, desiccator, burette, analytical balance, mixer, and blender.

### *2.2. Design Experiment and Analysis*

The research design used in this study was a completely randomized design (CRD) with 2 treatments and 3 replications. The treatments used were the concentration of the foaming agent (egg white) (5%, 6%, 7% (w/v)) and the concentration of maltodextrin (7.5%, 10%, 12.5% (w/v)). Observational variable data were tested statistically using analysis of variance at $\alpha = 5\%$ using the DMRT follow-up test.

**Table 1.** Formulation of powder drink

| Concentration of foaming agent (egg white) | Maltodextrin concentration | | |
|---|---|---|---|
| | **M1** | **M2** | **M3** |
| **F1** | F1M1 | F1M2 | F1M3 |
| **F2** | F1M2 | F2M2 | F2M3 |
| **F3** | F1M3 | F3M2 | F3M3 |

Information:
F1M1 = Concentration of 5% egg white and 7.5% maltodextrin
F1M2 = Concentration of 5% egg white and 10% maltodextrin
F1M3 = Concentration of 5% egg white and 12.5% maltodextrin
F2M1 = Concentration of 6% egg white and 7.5% maltodextrin
F2M2 = Concentration of 6% egg white and 10% maltodextrin
F2M3 = Concentration of 6% egg white and 12.5% maltodextrin
F3M1 = Concentration of 7% egg white and 7.5% maltodextrin
F3M2 = Concentration of 7% egg white and 10% maltodextrin
F3M3 = Concentration of 7% egg white and 12.5% maltodextrin

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### *2.3. Implementation of Research*

#### *2.3.1. Material preparation*

Ripe bidara fruit is washed, peeled, and separated from the seeds. After that, the bidara fruit is weighed to determine the initial weight of the material used. Then the bidara fruit is washed under running water until clean and cut into small sizes. Next, lanching was carried out at 80°C for 7 minutes. Then the bidara fruit is crushed using a blender with the addition of water (1: 1) for 3 minutes. After that, it is filtered using a filter cloth to separate the dregs from the bidara fruit juice.

#### *2.3.2. Manufacture of butterfly pea flower essence*

The butterfly pea flower used is fresh and not wilted, then it is separated from the base, and the petals are taken. The butterfly pea flowers are then washed in running water until clean and then drained. After that, size reduction is performed using a knife. Then the butterfly pea flowers are soaked in water (1:6), which has been heated to 80°C for 15 minutes. Next, the boiled water of the butterfly pea flowers is filtered using a nylon cloth.

#### *2.3.3. Production of strawberry juice*

The strawberries used are fresh fruit, then separated from the leaves, and the fruit is taken. The strawberries are then washed in running water until clean and drained. The washed fruit is then reduced in size using a knife. Strawberries are mashed in a blender with the addition of water (1:1) for 3 minutes. Then, it was filtered using a filter cloth to separate the pulp from the strawberry juice.

#### *2.3.4. Manufacturing of powdered drinks*

Bidara fruit and butterfly pea flower juice is added with maltodextrin (7.5%, 10%, 12.5%) (w/v), beaten egg whites (5%, 6%, 7%), and 10% sugar sand (w/v). Then the dough is stirred with a mixer for 3 minutes. After that, the dough is flattened to form a thin layer on a baking sheet that has been lined with plastic. Furthermore, drying using a cabinet dryer with a temperature of 60°C for 7 hours. After drying, crushing was carried out with a blender until smooth and a sieving process with a size of 80 mesh.

### *2.4. Observations*

#### *2.4.1. Raw material analysis*

The raw materials used are bidara fruit juice, strawberry juice, and butterfly pea flower juice. The analyses performed were antioxidant activity (%), vitamin C levels (mg/100g) and anthocyanin levels (mg/L).

#### *2.4.2. Physical analysis*

Physical analysis parameters of bidara fruit powder drink include solubility analysis (%), color L, a, b using a color reader, and yield (%).

#### *2.4.3. Chemical analysis*

Parameters for chemical analysis of bidara fruit powder drink incde analysis of water content (%), ash content (%), pH value, antioxidant activity (%), and vitamin C (mg/100g).

#### *2.4.4. Sensory analysis*

Organoleptic testing was carried out on samples of sheet jam. In this organoleptic test, 20 panelists assessed the color, taste, aroma, and texture of the powder drink. The analysis was continued with the effectiveness index test to determine the best treatment based on physicochemical and organoleptic properties. Then the best treatment will be analyzed for anthocyanin levels.

## 3. RESULTS AND DISCUSSION

### *3.1. Raw material analysis*

Preliminary analysis of bidara fruit juice and strawberry juice included analysis of the antioxidant activity of the DPPH method and levels of vitamin C, while for the extract of the butterfly pea flower, namely the antioxidant and anthocyanin activities which can be seen in Table 2.

**Table 2**. Raw material analysis results

| Parameter | Raw material | | |
|---|---|---|---|
| | **Bidara fruit juice** | **Strawberry juice** | **Butterfly pea flower essence** |
| Antioxidant activity (%) | 49.92 ± 0.3 | 67.68 ± 1.6 | 59.86 ± 0.4 |
| Vitamin C (mg/100g) | 71.62 ± 0.0 | 63.29 ± 0.0 | - |
| Anthocyanin levels (mg/L) | - | 27.54 ± 0.0 | 20.30 ± 0.0 |

Note: (-) no analysis was carried out

Based on the data in Table 2, it can be seen that there is a difference in the antioxidant activity of bidara fruit juice, strawberry fruit, and butterfly pea flower, where strawberry juice has the highest antioxidant activity, namely 67.68%. This is because strawberries are a source of bioactive compounds, rich in ascorbic acid, anthocyanins, and phenolic compounds, and have a high antioxidant capacity [11]. Based on the analysis of vitamin C levels, it was found that bidara fruit juice was 71.62 mg/100g higher than strawberry juice, which was 63.29 mg/100g. This is because bidara fruit has the potential to be a source of vitamin C, which is very important in boosting the immune system and counteracting free radicals [12]. In the analysis of anthocyanin levels, strawberry extract was 27.54 mg/L higher than butterfly pea flower extract, which was 20.30 mg/L. This is because anthocyanins are pigments that give red color to strawberries, including the class of polyphenolic compounds. In strawberries, anthocyanin is a derivative of pelargonidin (Pg) and cyanidin (Cy) aglycone [11].

### *3.2. Physical analysis*

Physical analysis of bidara fruit powder drink with the effect of concentration of foaming agent (egg white) and maltodextrin consists of analysis of solubility, color L, a, b, and yield.

#### *3.2.1. Solubility*

Solubility is one of the important things in determining the quality of powder drink-based products. The results of the solubility analysis of bidara fruit powder drink with the treatment of egg white and maltodextrin concentrations ranged from 66.07 to 81.56%. The results of the solubility analysis can be seen in Table 3.

**Table 3.** Physical analysis result of powder drink

| Physical analysis | Treatment | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **F1M1** | **F1M2** | **F1M3** | **F2M1** | **F2M2** | **F2M3** | **F3M1** | **F3M2** | **F3M3** |
| Solubility (%) | 66,07 ± 0,4$^{a}$ | 69,94 ± 0,2$^{b}$ | 70,12 ± 0,2$^{b}$ | 76,90 ± 0,2$^{c}$ | 77,60 ± 0,0$^{d}$ | 78,06 ± 0,3$^{d}$ | 79,91 ± 0,2$^{e}$ | 80,31 ± 0,0$^{e}$ | 81,56 ± 0,4$^{f}$ |
| Color (L) | 1,65 ± 0,1$^{a}$ | 1,90 ± 0,0$^{b}$ | 2,15 ± 0,1$^{c}$ | 2,35 ± 0,1$^{d}$ | 2,55 ± 0,1$^{e}$ | 2,85 ± 0,1$^{f}$ | 3,00 ± 0,0$^{g}$ | 3,05 ± 0,1$^{gh}$ | 3,15 ± 0,1$^{h}$ |
| Color (a) | 0,45 ± 0,1$^{h}$ | 0,40 ± 0,0$^{fg}$ | 0,35 ± 0,1$^{fh}$ | 0,30 ± 0,0$^{def}$ | 0,25 ± 0,1$^{cde}$ | 0,20 ± 0,0$^{bcd}$ | 0,15 ± 0,1$^{bc}$ | 0,10 ± 0,0$^{b}$ | -0,20 ± 0,0$^{a}$ |
| Color (b) | -0,2 ± 0,1$^{g}$ | -0,4 ± 0,1$^{ef}$ | -0,6 ± 0,1$^{de}$ | -0,85 ± 0,1$^{d}$ | -1,45 ± 0,2$^{c}$ | -1,65 ± 0,1$^{c}$ | -1,50 ± 0,1$^{c}$ | -1,95 ± 0,1$^{b}$ | -2,55 ± 0,1$^{a}$ |
| Yield (%) | 15,39 ± 0,2$^{a}$ | 17,41 ± 0,3$^{b}$ | 19,32 ± 0,2$^{c}$ | 17,78 ± 0,3$^{d}$ | 21,61 ± 0,1$^{e}$ | 22,27 ± 0,1$^{e}$ | 21,55 ± 0,1$^{f}$ | 23,56 ± 0,1$^{g}$ | 25,33 ± 0,1$^{h}$ |

The average value accompanied by different letters shows a significant difference at $p \leq 0.05$.

Based on the results of the analysis, the results showed that the concentration of 7% egg white and 12.5% maltodextrin resulted in the highest solubility of 81.56%, while the treatment of 5% egg white concentration and 7.5% maltodextrin produced the lowest solubility value of 66.07%. The more concentration of egg whites can increase the solubility of bidara fruit powder drink. This is because egg white foam can increase the surface area of the material and the resulting final product is very porous and absorbs water [13].

The higher the concentration of maltodextrin used, the solubility of the resulting powder drink will also be higher. This is because maltodextrin is an oligosaccharide which is very soluble in water, capable of binding hydrophilic substances so as to form an evenly dispersed system and improve the texture of food ingredients. The hydroxyl groups contained in maltodextrin will interact with water when dissolved so that the solubility of the powder will increase [14].

### *3.2.2. Color*

Color testing is done using a color reader. The measurement results are divided into three parameters, namely L, a and b. Lightness (L) shows the brightness level of the color. The higher the lightness value (L) means the product is brighter or whiter and vice versa. Redness (a) indicates a red or green color scale. Yellowness (b) shows the intensity of the yellow color of a product [15]. The results of color analysis can be seen in Table 3.

Based on the results of the analysis, it was found that the average value (L) in the treatment of egg white and maltodextrin concentrations ranged from 1.65 to 3.15. The higher the concentration of maltodextrin, the brighter the color of the powder drink produced. This is caused by the basic color of maltodextrin which is white so that the higher the addition of maltodextrin, the value (L) will also increase. Ref [16], maltodextrin has a white color with a brightness of L* 90, so if it is added in large concentrations it will increase the brightness value of the bidara fruit powder drink. The higher the addition of egg white, the brighter the resulting color. This is because the higher the concentration of egg white, the surface area will increase which causes the water reduction process to be faster so that the brightness level increases (fades) [17].

The average value (a) of the powdered drink with the concentration of egg white and maltodextrin ranged from -0.20 to 3.10. The higher the maltodextrin concentration, the lower the a* value. The addition of maltodextrin can reduce the sour taste of instant drinks made from acids, because maltodextrin is a compound that contains many hydroxyl groups (OH), so it can neutralize the acidic nature of the raw material. Ref [18], the reaction that occurs during a color change due to the influence of pH occurs due to the color degradation of anthocyanins. At low pH most of the anthocyanins are in the red colored flavium cation form, while at high pH the flavium cations turn into blue carbinol bases and when it gets closer to neutral pH it degrades into colorless chalcone. The higher the addition of egg white, the color possessed by the powder drink raw material can be maintained. The addition of high egg whites can protect the drink powder from the Maillard reaction due to the heating process so that the color of the constituent ingredients can be maintained [19].

The average value (b) of bidara fruit powder drink ranges from -0.2 to -2.55. The higher the concentration of maltodextrin added, the b value will decrease. The addition of maltodextrin in large quantities is thought to cause a decrease in the b* value in the color of the bidara fruit powder drink, which means a decrease in the intensity of the blue color (brighter or paler) due to the addition of white-based maltodextrin. This is according to Ref [20], maltodextrin has a white base color and when added in large quantities the resulting product color will be paler. The addition of high egg whites will cause more foam to form, the foam will speed up the drying process so that the blue color carrier component (anthocyanin) is not degraded and the blue color in powdered drinks can be maintained [21].

### *3.2.3. Yield*

Yield is the overall output resulting from the production process produced. Where in this case, the yield in question is the powder produced from the process. The yield analysis results for the treatment of egg white and maltodextrin concentrations ranged from 15.39 to 25.33%. The results of the yield analysis can be seen in Table 3.

Based on the results of the analysis, it can be seen that the treatment with a concentration of 7% egg white and 12.5% maltodextrin produced the highest yield, namely 25.33%, while the treatment with a concentration of 5% egg white and 7.5% maltodextrin produced the lowest yield, namely 15.39%. The higher the concentration of egg white and maltodextrin used, the higher the yield of bidara fruit powder drink. This is because egg white and maltodextrin can increase the total amount of solids. Maltodextrin is a good binder because it produces a low viscosity at a high total solids. This facilitates the drying process and will produce a high yield [22].


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In addition, the yield is also influenced by protein from egg white which binds water. The more water retained by the protein, the less water will come out so that the yield will increase [23].

**Table 4.** Chemical analysis result of powder drink

| Chemical analysis | Treatment | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | F1M1 | F1M2 | F1M3 | F2M1 | F2M2 | F2M3 | F3M1 | F3M2 | F3M3 |
| Water content (%) | $3.90 \pm 0.1^{g}$ | $3.74 \pm 0.0^{f}$ | $3.59 \pm 0.0^{e}$ | $3.41 \pm 0.1^{d}$ | $3.14 \pm 0.1^{c}$ | $3.03 \pm 0.0^{bc}$ | $2.92 \pm 0.1^{b}$ | $2.42 \pm 0.0^{a}$ | $2.35 \pm 0.1^{a}$ |
| Ash content (%) | $0.56 \pm 0.1^{a}$ | $0.55 \pm 0.0^{a}$ | $0.57 \pm 0.0^{a}$ | $0.76 \pm 0.1^{b}$ | $0.77 \pm 0.1^{b}$ | $0.76 \pm 0.0^{b}$ | $0.87 \pm 0.1^{c}$ | $0.86 \pm 0.0^{c}$ | $0.88 \pm 0.1^{c}$ |
| pH | $4.25 \pm 0.1^{a}$ | $4.70 \pm 0.0^{b}$ | $4.80 \pm 0.0^{bc}$ | $4.85 \pm 0.1^{bc}$ | $4.95 \pm 0.1^{cd}$ | $5.10 \pm 0.1^{d}$ | $5.10 \pm 0.0^{d}$ | $5.15 \pm 0.2^{d}$ | $5.95 \pm 0.1^{e}$ |
| Antioxidant activity (%) | $54.68 \pm 0.1^{a}$ | $55.44 \pm 0.2^{b}$ | $56.41 \pm 0.0^{b}$ | $60.85 \pm 0.3^{c}$ | $61.94 \pm 0.4^{d}$ | $63.99 \pm 0.1^{d}$ | $62.38 \pm 0.7^{e}$ | $64.15 \pm 0.2^{e}$ | $66.61 \pm 0.2^{f}$ |
| Vitamin C (mg/100g) | $141.00 \pm 0.3^{a}$ | $144.94 \pm 0.1^{b}$ | $146.18 \pm 0.1^{c}$ | $152.24 \pm 0.1^{d}$ | $156.78 \pm 0.1^{e}$ | $165.12 \pm 0.3^{f}$ | $165.84 \pm 0.3^{g}$ | $170.06 \pm 0.3^{h}$ | $182.00 \pm 0.3^{i}$ |

The average value accompanied by different letters shows a significant difference at $p \leq 0.05$.

## *3.3. Chemical analysis*

### *3.3.1. Water content*

Water content is a very important factor in powder products. Therefore, it is included in one of the prerequisites that must be met. The results of the analysis of the water content of bidara fruit powder drinks with the influence of egg white and maltodextrin concentrations ranged from 2.35% to 3.90%. The results of the analysis can be seen in Table 4.

Based on the results of the analysis, it can be seen that the treatment of egg white concentration of 5% and 7.5% maltodextrin produced the highest water content, namely 3.9%, while the treatment of egg white concentration of 7% and 12.5% maltodextrin produced the lowest water content, namely 2.35 %. The higher the concentration of egg white used, the lower the water content of the bidara fruit powder drink. This is because the froth from egg whites can increase the surface area of the material in contact with the drying air so that the greater the concentration of egg white used, the faster the process of removing water from the material will be and the product with a lower moisture content will result [24]. The concentration of maltodextrin used also affects the decrease in the resulting water content. This is because one characteristic of maltodextrin is that it can bind the free water of a material so that the addition of more and more maltodextrin can reduce the water content [25].

The results of the analysis show that the water content of the produced bidara fruit powder meets the established standards. Ref [26], the water content in traditional powder drinks ranges from 3-5%.

### *3.3.2. Ash content*

Based on the results of the analysis, it can be seen that there was no significant interaction ($p \geq 0.05$) between the concentration of egg white and maltodextrin on bidara fruit powder drink. However, the egg white concentration treatment had a significant effect on the resulting ash content, while the maltodextrin concentration treatment did not. The results of the analysis of ash content can be seen in Table 4.

The higher the concentration of egg white used, the ash content will increase. This is due to the presence of mineral content in egg whites. Ref [23], the ash content in egg albumin is 5.7% so that it can cause the ash content in the bidara fruit powder drink to increase.

The higher the maltodextrin concentration, the higher the ash content of the bidara fruit powder drink but not significantly different. In general, the properties and components of maltodextrin will not affect the ash content of powdered beverage products because maltodextrin has a small mineral content. The ash content of bidara fruit powder drinks meets the standards, namely the maximum ash content of 1.5% [26].

### *3.3.3. pH*

The pH test was carried out to determine the acidity level of the produced bidara fruit powder drink. The results of pH analysis of bidara fruit powder drink with treatment of egg white and maltodextrin concentrations ranged from 4.25 to 5.95. The results of the pH analysis can be seen in Table 4.

Based on the results of the analysis, the results showed that the concentration of 5% egg white and 7.5% maltodextrin produced the lowest pH value of 4.25, while the treatment of 7% egg white concentration and 12.5% maltodextrin produced the highest pH value of 5.95. The higher the concentration of egg white, the pH value will increase. This is because egg whites have a higher pH than product raw materials. The pH value of fresh egg whites ranges from 7.64-7.93 and will continue to increase during storage [27]. The higher the concentration of maltodextrin can increase the pH value of bidara fruit powder drink. This is because the addition of maltodextrin can reduce the sour taste of instant drinks made from acids because maltodextrin is a compound that contains many hydroxyl groups (OH) so that it can neutralize the acidic nature of the raw material [28].

### *3.3.4. Antioxidant activity*

The ingredients used in manufacturing powdered drinks contain antioxidants that are beneficial to the body. Antioxidant activity analysis was carried out to determine the antioxidant content of the final product. The results of the analysis of the antioxidant activity of the bidara fruit powder drink with the treatment of egg white and maltodextrin concentrations ranged from 54.68-66.61%. The results of the analysis of antioxidant activity can be seen in Table 4.

Based on the results of the analysis, it was found that the concentration of 5% egg white and 7.5% maltodextrin gave the lowest antioxidant activity value of 54.68%, while the treatment of 7% egg white and 12.5% maltodextrin gave the highest antioxidant activity value of 66.61%. The higher the concentration of egg white and maltodextrin used, the higher the antioxidant activity of the bidara fruit powder drink. Egg white as a foaming agent acts as a bubble former, so that when egg white is applied to the foam mat drying method it will form bubbles so that the surface area of the material will be larger and dry easily during the drying process. With a fast drying rate of the material, it is able to protect the antioxidant content contained in the material [21].

Maltodextrin is also influential in maintaining the antioxidant activity of bidara fruit powder drink. Maltodextrin is one of the fillers that is usually added to a product using the foam mat drying method because apart from being a filler, maltodextrin is able to play a role in protecting volatile compounds that cannot stand heat. The thin layer that is formed when the addition of maltodextrin to the material will coat heat-sensitive compounds such as antioxidants rather there is no significant reduction [29].

#### *3.3.5. Vitamin C*

The results of vitamin C analysis of bidara fruit powder drink with treatment of egg white and maltodextrin concentrations ranged from 141-182 mg/100g. The results of the analysis of vitamin C can be seen in Table 4.

Based on the results of the analysis, the results showed that the concentration of 7% egg white and 12.5% maltodextrin produced the highest vitamin C level, namely 182 mg/100g, while the treatment of 5% egg white concentration and 7.5% maltodextrin produced the lowest vitamin C level, namely 141 mg/ 100g. The higher the concentration of egg white and maltodextrin used, the higher the vitamin C content of the bidara fruit powder drink. The high addition of eggs will cause more foam to form, the foam will speed up the drying process so that the vitamin C content in powdered drinks can be maintained [21]. In addition, the use of maltodextrin in the encapsulation process can bind nutritional elements to the dried material, because maltodextrin has a strong bond that helps reduce the loss of volatile components during the drying process [30]. Maltodextrin has reliable binding ability with coated compounds to protect bioactive components and sensitive components from oxidation such as vitamins.

### *3.4. Sensory analysis*

To determine the effect of egg white and maltodextrin concentration on the sensory properties of bidara fruit powder drink on taste, color, and aroma, a questionnaire was conducted to 20 panelists using the ranking test method. The higher the number of rankings, the more preferred bidara fruit powder drink.

From Table 5 it is known that the taste of bidara fruit powder drink with the treatment of egg white and maltodextrin concentrations has a significant effect. Treatment of egg white concentration of 7% and 7.5% maltodextrin resulted in the lowest rank, namely 96 with an average of 3.69 (likes). In comparison, the treatment of egg white concentration of 6% and 12.5% maltodextrin produced the highest rank, namely 104.5, with average 3.94 (likes).

**Table 5.** Number of panelist preference rankings for sensory attributes of bidara fruit powder drink

| Treatment | Taste | Colour | Aroma |
|---|---|---|---|
| F1M1 | 95.5 ± 0.8 | 59 ± 0.8 | 171.5 ± 0.0 |
| F1M2 | 93.5 ± 0.8 | 62.5 ± 0.8 | 163 ± 0.4 |
| F1M3 | 102 ± 0.7 | 82.5 ± 0.9 | 134 ± 0.4 |
| F2M1 | 106 ± 0.6 | 81.5 ± 0.6 | 126.5 ± 0.5 |
| F2M2 | 103.5 ± 0.8 | 101.5 ± 0.8 | 99.5 ± 0.4 |
| F2M3 | 104.5 ± 0.8 | 110.5 ± 0.8 | 74 ± 0.5 |
| F3M1 | 96 ± 0.7 | 130 ± 0.8 | 62 ± 0.4 |
| F3M2 | 99 ± 0.6 | 125.5 ± 0.9 | 39 ± 0.6 |
| F3M3 | 100 ± 0.6 | 147 ± 0.9 | 30 ± 0.5 |

From Table 5 it is known that the treatment with 5% egg white concentration and 7.5% maltodextrin produced the lowest color value, namely 59 with an average of 2.69 (rather like it), while the 7% egg white concentration and 12% maltodextrin produced the highest color value, namely 130 with an average of 4.38 (likes). The higher the concentration of egg white and maltodextrin used, the higher the color value of the resulting powder drink. The resulting bidara fruit powder drink has a bright color and is not too thick, so it is liked by the panelists.

From Table 5 it is known that the treatment with a concentration of 7% egg white and 12.5% maltodextrin produced the lowest aroma ranking value of 30 with an average of 1.19 (very much dislike), while the treatment with a concentration of 5% egg white and 7.5% maltodextrin produced the highest aroma ranking value is 171.5 with an average of 5 (very like). The higher the concentration of egg white and maltodextrin used, can cause the value of the aroma to decrease.

Based on the effectiveness index test results on the physicochemical and organoleptic characteristics of powdered drinks, the best treatment results were obtained with the treatment of 7% egg white concentration and 12.5% maltodextrin. The best treatment results were then followed by testing the anthocyanin levels. Based on the analysis of anthocyanin levels, the best bidara fruit powder drink treatment was 8.60 mg/L. These results indicate that there is a decrease in anthocyanin levels. The raw material used, butterfly pea flower extract, has an anthocyanin content of 20.30 mg/L. This decrease is thought to be caused by processing processes such as drying and adding other materials.

## 4. CONCLUSION

There was a significant interaction between the concentration of egg white and maltodextrin on water content, pH, antioxidant activity, vitamin C, solubility, color, and bidara fruit powder drink yield. The best treatment in this study was bidara fruit powder drink with a concentration of foaming agent (7%) and 12.5% maltodextrin with 35% water content, 0.88% ash content, pH 5.95, 68.86% antioxidant activity, vitamin C 141 mg/100g, L color 3.15, a* -0.20, b* color -2.55 and yield 25.33%, taste score 3.94 (like), aroma 1.19 (very dislike ), color 4.38 (like), and anthocyanin content 8.60 mg/L.

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