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# Characteristics of Aloe-Buni Drink with Proportion Treatment of Aloe-gel and Buni Extract at Different Temperatures

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***Abstract***

*The combination formulation of aloe vera gel (Aloe-gel) and buni fruit extract (EB) into a functional drink will optimize its function as a drink rich in fiber, antioxidants, and flavonoids which are good for health. The purpose of this study was to determine the characteristics of aloe-buni functional drink with the proportions of aloe vera gel and buni fruit extract at different storage temperatures. This study used a factorial Completely Randomized Design (CRD) with two factors, namely the proportion of Aloe-gel and EB consisting of 3 levels, namely 75%: 25%, 50%: 50%, and 25%: 75%, and storage temperature consisting of over temperatures of 6±1°C, 11 ±1°C, and 27±1°C. The results showed that the proportion of Aloe-gel and EB affect the characteristics of Aloe-Buni drink. Meanwhile, the storage temperature and its interactions did not affect the characteristics of the Aloe-Buni drink. There was a decrease in the characteristics of Aloe-Buni drink during 3 days of storage. The best characteristics of Aloe-buni drink were obtained from the treatment of Aloe-gel 50%: EB 50% at a storage temperature of 6±1°C, where vitamin C content was 171, 62mg/100gr, pH was 3.29, total dissolved solids was 19, 18°Brix, viscosity of 7.75 m.Pa.s, and antioxidant activity of 28.14%.*

*Keywords: aloe vera gel, buni fruit extract, functional drink, antioxidant*

## 1. Introduction

Functional food products are very popular products today. The advantage of functional food is that in addition to its high nutritional content, it is also beneficial for health. Functional drinks are one part of functional food that is developing and in demand by the public. Functional drinks are made from natural ingredients that are easy to find in everyday life such as leaves, roots, stems, flowers and other plant parts [1]. The process of processing herbal plants into functional drinks requires knowledge of the active ingredients contained in the ingredients and proper formulation techniques because beverage formulation is the most important part so that the taste of the drink can be accepted in the community [2].Several factors need to be considered to maintain bioactive compounds, namely the effectiveness of extracting phytochemical components from beverage ingredients, beverage processing processes such as heating and pasteurization processes and storage conditions[3].The development of innovative products from natural ingredients of aloe vera combined with buni fruit is an alternative to meet people's needs for functional drinks.

Aloe vera is a functional plant because all parts of the plant can be used for food, body care and to treat various diseases [4]. In the manufacture of aloe vera-based drinks, the part that is used is the parenkin part of the aloe vera leaf which is called the gel. Aloe-gel naturally contains antibacterial compounds, namely saponins, anthraquinones, tannins, aloin and acemannan [5]. Aloe vera gel contains a lot of fiber so Aloe-gel is believed to be used as a laxative or facilitate digestion. In addition, aloe-gel can also lower blood sugar levels. Aloe vera gel has shown a blood glucose

lowering effect in clinical and preclinical studies [6]. In this study, panelists consumed 10-20 ml of Aloe-gel per day and got 15% lower cholesterol, 30% triglycerides, and hyperlipidemia in panelists by lowering low-density lipoprotein cholesterol up to 18%.[7]. Aloe vera gel has a weakness, namely the sensation of a bitter taste, so to cover this weakness, other ingredients can be added, one of which is buni fruit.

Buni fruit is known to have pharmacological activity as anti-dysentery [8], antioxidant [9], anticancer [8], and antidiabetic [10][11]. The part that is most often processed is the fruit. Buni fruit is commonly consumed as salad in Indonesia [12]. In addition, buni fruit is usually processed into drinks such as syrup, fermented drinks (wine), coloring agents, and can even be consumed directly because of its sour and sweet taste [13]. Buni fruit is believed to be able to overcome kidney disease by the people of the Philippines. Buni fruit contains flavonoids which function to improve kidney performance [14].

The combination formulation of aloe vera gel with buni fruit into a functional drink will optimize its function as a drink rich in fiber, antioxidants, and flavonoids which are good for health. Aloe vera gel which is rich in fiber and buni fruit extract (EB) which is rich in flavonoids and antioxidants can be combined into a functional drink. To find out the best characteristics of Aloe-gel functional drinks with EB or Aloe-buni, a study will be conducted on "Characteristics of Aloe-Buni Drink with Proportion Treatment of Aloe-Gel and Buni Fruit Extract at Different Temperatures". The purpose of this study was to determine the characteristics of Aloe-Buni drink with the proportions of Aloe-gel and EB at different storage temperatures.

## 2. Material and Methods

This research was conducted from November 2021 – January 2022 at the Food Processing and Analysis Laboratory, Faculty of Agriculture, Warmadewa University. DesignThe research used was a completely randomized design (CRD) with a two-factor factorial pattern. Factor I proportionAloe-gel and EB are: 75%: 25%, 50%: 50%, and 25%: 75%. Factor II: storage temperature 6±1°C, 11 ±1°C, and 27±1°C. Each treatment combination was repeated three times to obtain 27 experimental units.

### 2.1 Sample preparation

The implementation of the research begins with the manufacture of Aloe-Buni drink. Aloe vera used comes from trees that are over 1 year old. There are no white spots on the skin of the aloe vera leaf. Then the midrib is washed until it is clean of dirt that sticks to the skin. If it is clean, soak it in chlorine water for 5 minutes. This soaking is done to reduce the sap contained in the midrib. Then the aloe vera leaf is cut and peeled so that a clear gel is obtained. The gel was blanched with hot water for ± 5 minutes. After that the gel was crushed with a blender without using water and then filtered. The filtrate from the filtering was then heated at 80°C for ± 5 minutes. The purpose of this heating is to deactivate the enzymes contained in the gel. After being heated, filtered again.

The next process is the manufacture of buni fruit extract. The first step is to remove the buni from the bunch. Then wash the buni fruit with water as much as ± 3-4 times until the water produced from washing the fruit looks clear. After that, it is drained and sorted to separate the unripe, ripe, and very ripe fruit. The fruit used in this drink is a ripe fruit, which is red. Buni fruit that has met the criteria is then crushed using a blender with added water and then filtered. The filtrate from the filtering is then heated with temperature 80°Cfor ± 5 minutes. After that, wait for it to cool and filter it again. Another ingredient in the Alo-buni functional drink is sugar. The sugar used as a natural sweetener in this drink is granulated sugar. Sugar is heated with water until the sugar dissolves and boils.

Aloe vera gel, buni fruit extract, and cold sugar water are packaged in 100 ml bottles. Before the bottle is used, the bottle is sterilized by using hot steam first. Aloe-Buni drink is packaged in 3 different formulations, namely: 75%: 25%, 50%: 50% and 25%: 75%. The amount of sugar added in the drink is the same. After being packaged, the Aloe-Buni functional drink was placed at 3 different temperatures, namely6±1°C, 11 ±1°C, and 27±1°C.Observations and analysis of beverages were carried out on day 0 and day 3.

### 2.2 Analysis

To determine the characteristics of Aloe-Buni drink, several tests were carried out. The test parameters of this drink are vitamin C using UV-Vis spectrophotometer 695nm [15], measurement of acidity (pH) was carried out using a pH meter, viscosity (viscosity) with a viscometer, total dissolved solids (TSS) with a hand refractometer, antioxidant activity of the DPPH method was read using a UV-Vis 517 nm spectrophotometer, and subjective observations were carried out with organoleptic assessment which includes a preference test.

The data obtained were analyzed by ANOVA variance. The results of a single treatment variance that showed a significant effect ($P < 0.05$) to very significant ($P < 0.01$) then continued with the BNT test and if the results of the treatment variance showed an interaction, it was continued with the Duncan's Multi Range Test.

## 3. Results and Discussion

### 3.1 Vitamin C Level

Analysis of variance showed that the proportion of Aloe-gel and EB, storage temperature and interactions had no significant effect on vitamin C levels of Aloe-Buni drink on day 0 and day 3. The results of the analysis of vitamin C levels of Aloe-Buni drink can be seen in Table 1.

Table 1.
Vitamin C Level of Aloe-Buni Drink Based on Aloe-gel Proportion and EB At Different Storage Temperature

| Treatment | Storage temperature | | | | | | Average | |
|---|---|---|---|---|---|---|---|---|
| | 6±1°C | | 11 ±1°C | | 27±1°C | | | |
| Day 0 | | | | | | | | |
| aloe-gel75%: EB 25% | 145.74 | | 181.85 | | 117.18 | | 148.26 | a |
| aloe-gel50%: EB 50% | 180.71 | | 151.80 | | 165.81 | | 166.11 | a |
| aloe-gel25%: EB 75% | 176.36 | | 200.58 | | 191.30 | | 189.41 | a |
| Average | 167.60 | a | 178.08 | a | 158.10 | a | | |
| 3rd day | | | | | | | | |
| aloe-gel75%: EB 25% | 134.92 | | 166.78 | | 120.88 | | 140.86 | a |
| aloe-gel50%: EB 50% | 171.62 | | 160.41 | | 145.89 | | 159.30 | a |
| aloe-gel25%: EB 75% | 132.48 | | 133.77 | | 146.50 | | 137.58 | a |
| Average | 146.34 | a | 153.65 | a | 137.76 | a | | |

Note: The average value followed by the same letter means that it is not significantly different in the 5% BNT Test

The vitamin C content of Aloe-buni drinks tends to be high. The highest levels of vitamin C were obtained in the proportion ofaloe-gel25% : EB75% of 189.41 mg/100gr. The more EB, the Aloe-Buni drink has a higher vitamin C content. Buni fruit contains vitamin C of 8 mg[16]. Aloe vera gel also contains vitamin C but the vitamin C content of aloe vera gel is smaller than that of buni fruit. Aloe vera gel's vitamin C content is 0.50-4.20 mg [17].

Aloe-Buni drink at 6±1°C have higher levels of vitamin C compared to other temperatures. In line with research [18], where vitamin C tends to be stable at a storage temperature of 5°C. At a storage temperature of 5°C, ascorbic acid oxidase activity was seen, the reaction of the solubility of vitamin C by the enzyme was still continuing but running slowly [18]. Vitamin C is a vitamin that is very easily oxidized, especially at high temperatures. Storage at a temperature of 27±1°C maximum ascorbic acid reaction so that the oxidation process is high [19].

During storage, Aloe-Buni drink decreased on the 3rd day. This may be due to microbial activity against vitamin C. Vitamin C plays a role in growth and affects the intracellular transport mechanism of microorganisms[20]. In addition to this, there are other factors that cause damage to vitamin C, namely oxidation, reduced amino acids, or the occurrence of tissue damage in the materials used [21].

### 3.2 pH

Analysis of variance showed that the proportion of Aloe-gel and EB, storage temperature and interactions had a very significant effect on the pH level of Aloe-Buni drink on day 0 but on day 3 the interaction showed no significant effect. The results of the analysis of the pH of the Aloe-Buni drink can be seen in Figure 1.

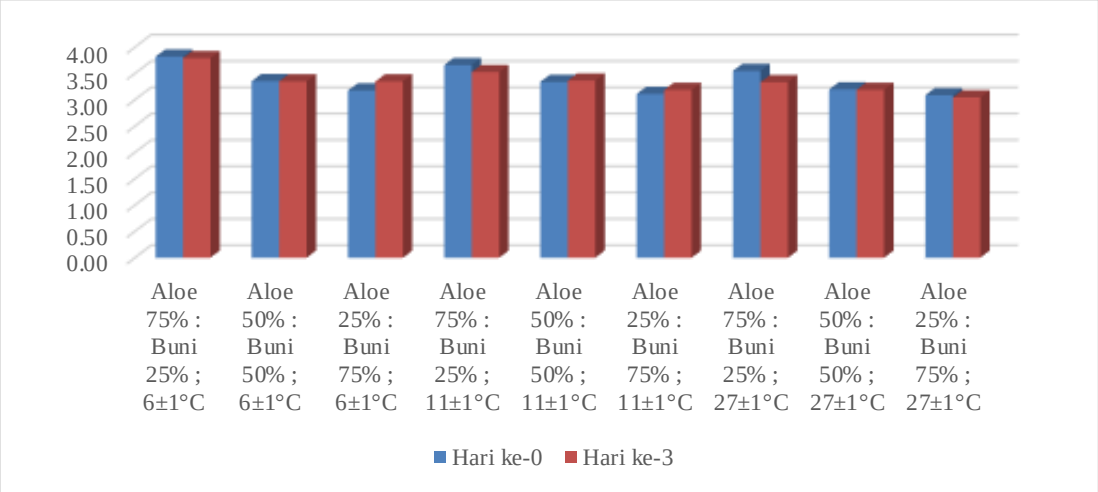


Figure 1
The pH value of Aloe-buni drink is based on the proportion of aloe vera gel and buni fruit extract at different storage temperatures

Aloe-Buni drink with proportion 25% Aloe-gel: 75% EB has a lower pH than Aloe-Buni drink with proportion 75% Aloe-gel: 25% EB. The lowest degree of acidity of Aloe-buni drink was at 25% Aloe-gel proportion: 75% EB with an average of 3.09. The degree of acidity indicates that the higher the proportion of EB, the the lower the pH value of the Aloe-Buni drink. This data is supported by the high levels of vitamin C in this proportion. Buni fruit contains several organic acid compounds that affect pH [22]. Buni fruit contains several types of organic acids such as gallic acid, ferulic acid, caffeic acid, ellagic acid and ferulic acid [23][24]. The content of these organic acids causes the Aloe-Buni drink with a proportion of 75% EB to have the lowest pH value.

Storage of Aloe-Buni drink at 6±1°C and 11±1°C had a higher pH than Aloe-Buni drink stored at 27±1°C. This shows that the temperature of 6±1°C and 11±1°C can inhibit the rate of respiration so that the decomposition of the substrate into organic acids becomes slower [25]. In addition, cold storage also inhibits microbial activity which can also decompose glucose into acid through the fermentation process [26].

Aloe-Buni drink has a low pH value at storage temperature of 27±1°C due to increased antimicrobial activity resulting in the breakdown of sugar into organic acids [25]. When the metabolic process takes place, bacteria will remodel sucrose into glucose and fructose followed by the breakdown of glucose into organic acids and energy [27]. The increase in the amount of organic acids as a result of the reshuffling of sugar by microbes causes the pH of the drink to decrease.

### 3.3 Total Dissolved Solids (TSS)

Analysis of variance showed that the proportion of Aloe-gel and EB had a very significant effect on the total soluble solids of the Aloe-Buni functional drink. However, the storage temperature and the interaction of Aloe-Buni drink on day 0 and day 3 showed no significant effect. The results of the analysis of the total dissolved solids of Aloe-Buni drink can be seen in Table 2.

Table 2

Total Dissolved Solids of Aloe-Buni Functional Drink with Different Proportions of Aloe-gel and EB at Different Storage Temperatures

| Treatment | Storage temperature | | | | | | Average | |
|---|---|---|---|---|---|---|---|---|
| | 6±1°C. | | 11±1°C. | | 27±1°C. | | | |
| Day 0 | | | | | | | | |
| aloe-gel75%: EB 25% | 18.00 | | 17.63 | | 18.05 | | 17.89 | b |
| aloe-gel50%: EB 50% | 18.83 | | 19.15 | | 19.60 | | 19,19 | a |
| aloe-gel25%: EB 75% | 18.60 | | 18,20 | | 18.70 | | 18,50 | b |
| Average | 18,48 | a | 18.33 | a | 18.78 | a | | |
| 3rd day | | | | | | | | |
| aloe-gel75%: EB 25% | 18,20 | | 17.63 | | 17.33 | | 17.72 | b |
| aloe-gel50%: EB 50% | 19.18 | | 19.13 | | 19.60 | | 19.30 | a |
| aloe-gel25%: EB 75% | 18.18 | | 18.73 | | 18.25 | | 18.39 | b |
| Average | 18.52 | a | 18,50 | a | 18.39 | a | | |

Note: The average value followed by the same letter means that it is not significantly different in the 5% BNT Test

Aloe-Buni drink with the proportion of Aloe-gel 50%: EB 50% contains the highest total dissolved solids with an average of 19.19°Brix. Total soluble solids of Aloe-Buni drink has a tendency to drink with 25% EB proportion, the total dissolved solids content is lower than that of Aloe-Buni drink with 75% EB proportion. Total soluble solids of buni fruit extract 14.667°Brix[24] and the total soluble solids of Aloe-gel is 0.490°Brix [4]. The total dissolved solids content is affected by the change of complex compounds into simpler compounds. Aloe vera has water-soluble components such as carbohydrates, vitamin C, vitamin B1, vitamin B2, vitamin B6, and water-soluble amino acids [28]. The increase in total dissolved solids is caused by complex components such as carbohydrates breaking down into simpler compounds resulting in an increase in dissolved solids. The increase in total dissolved solids occurs at room temperature because high temperatures can accelerate chemical reactions, including the breakdown of carbohydrates by microbial activity. The rate of degradation of starch into simpler sugars is influenced by temperature, so the higher the temperature, the faster the degradation of starch to a certain extent [5]. Total soluble solids of Aloe-Buni drink with storage for 3 days tended to decrease. This can be caused by the degradation of sucrose into glucose and fructose under the influence of acid [28].

### 3.4 Viscosity

Analysis of variance shows the proportion treatment aloe-gel and EB had a very significant effect on the viscosity of Aloe-Buni drink. However, the storage temperature and the interaction of

Aloe-Buni drink on day 0 and day 3 showed no significant effect. The results of the analysis of the viscosity of the Aloe-Buni drink can be seen in Table 3.

Table 3
The Viscosity of Aloe-Buni Functional Drink With Different Proportions Of Aloe-gel And EB At Different Storage Temperatures

| Treatment | Storage temperature | | | | | | Average | |
|---|---|---|---|---|---|---|---|---|
| | 6±1°C. | | 11±1°C. | | 27±1°C. | | | |
| Day 0 | | | | | | | | |
| aloe-gel75%: EB 25% | 8.88 | | 12.50 | | 10.25 | | 10.54 | a |
| aloe-gel50%: EB 50% | 7.75 | | 7.75 | | 6.38 | | 7.29 | b |
| aloe-gel25%: EB 75% | 5.13 | | 5.50 | | 5.50 | | 5.38 | b |
| Average | 7.25 | a | 8.58 | a | 7.38 | a | | |
| 3rd day | | | | | | | | |
| aloe-gel75%: EB 25% | 7.63 | | 12.50 | | 11.25 | | 10.46 | a |
| aloe-gel50%: EB 50% | 7.75 | | 7.37 | | 6.88 | | 7.33 | b |
| aloe-gel25%: EB 75% | 6.25 | | 6.25 | | 5.75 | | 6.08 | b |
| Average | 7.21 | a | 8.71 | a | 7.96 | a | | |

Note: The average value followed by the same letter means that it is not significantly different in the 5% BNT Test

Aloe-Buni drink with 75% Aloe-gel proportion: 25% EB tends to have a high viscosity value. Aloe-Buni drink which has the highest viscosity at 75% Aloe-gel proportion: 25% EB with an average of 10.54 m.Pa.s. The higher the proportion of Aloe-gel in the drink, the thicker the drink. Aloe-gel has glucomannan which causes a very good polymerization process so that the components are easily attached to produce a thicker drink [29]. Buni fruit extract has a viscosity close to that of water, so the more EB added, the lower the viscosity of the drink. Storage temperature has no effect on the viscosity of Aloe-Buni drink.

### 3.5 Antioxidant Activity

Analysis of variance showed that the proportion of Aloe-gel and EB, storage temperature and interactions had a very significant effect on the antioxidant activity of Aloe-Buni drink on day 0 but on day 3 the storage temperature and interaction showed no significant effect. The results of the analysis of the antioxidant activity of Aloe-Buni drink can be seen in Figure 2.

Aloe-Buni drink with the proportion of Aloe-gel 25%: EB 75% has the highest tendency of antioxidant activity with an average of 16.31%. The higher the proportion of EB, the higher the antioxidant activity. Buni fruit is a fruit that is rich in vitamin C which has high antioxidant properties. This is in line with the research results [24], indicating that the extract of buni fruit has various antioxidant activities in vitro. Other compounds detected in ripe buni fruit include epicatechin, rutin, reveratrol, quercetin, naringenin, kaempferol, luteolin, gallic acid, ferulic acid, and caffeic acid, although the presence of these bioactive compounds depends on the variety of buni fruit[24]. Besides buni fruit, aloe-gel also has antioxidants but not as much as buni [30].

Storage temperature of Aloe-Buni drink tends to have no effect on antioxidant activity. This is probably due to the highest storage of beverages at room temperature. Aloe vera gel and buni fruit contain many phytochemical compounds such as phenols, flavonoid tannins and anthocyanins which tend to be stable at room temperature. This agrees with [31] and [32], at a temperature of 30°C flavonoids tend to be stable.

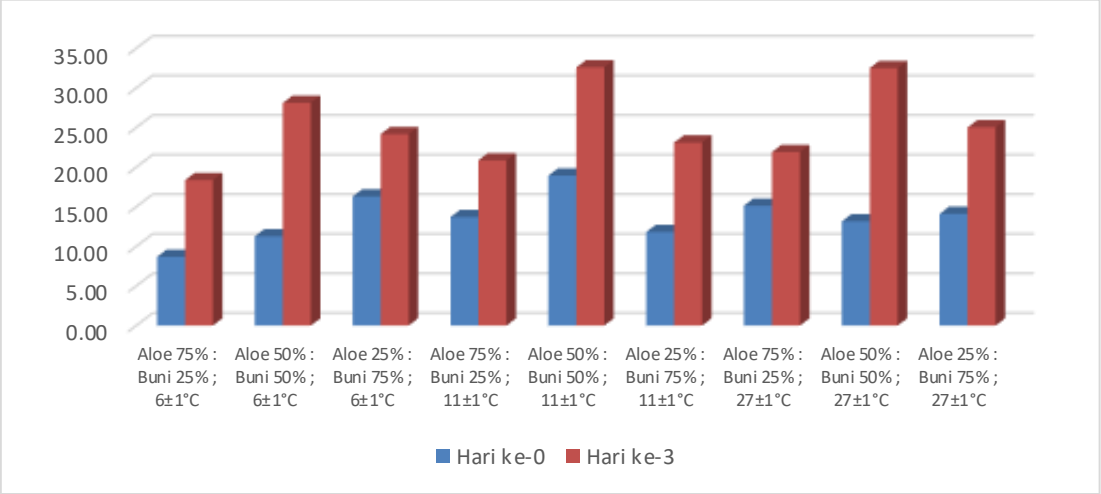


Figure 2
The antioxidant activity value of Aloe-Buni drink is based on the proportion of Aloe-gel and EB at different storage temperatures

### 3.6 Organoleptic

#### a. Flavor

The taste of the Aloe-Buni drink with proportion aloe-gel 50% : EB 50% tends to be preferred compared to the proportion of other drinks with a range of values of 5.00 – 5.30 (somewhat like – like). The taste value of Aloe-Buni drink can be seen in Figure 3.Drinks with a storage temperature of 27±1°C cannot last more than 3 days because after 3 days mold has formed in the drink. Damage to highly acidic packaged foods with a pH < 4 is usually caused by micrococci, non-sporing rods, molds and yeasts[33].

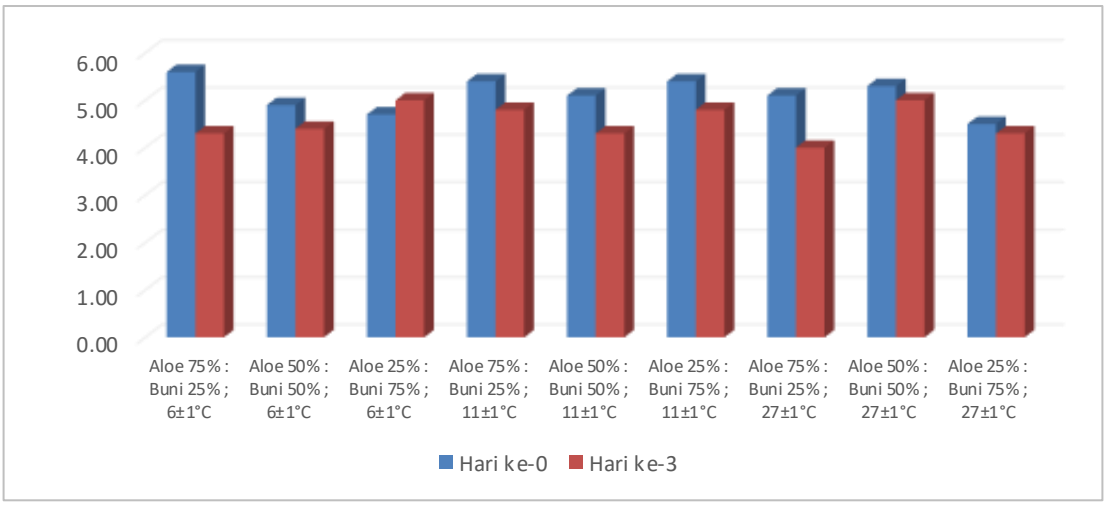


Figure 3
The taste value of Aloe-buni drink is based on the proportion of Aloe-gel and EB at different storage temperatures

#### b. Thickness

Aloe-Buni drink with Aloe-gel proportion 75% : EB 25% viscosity tends to be preferred with a hedonic value of 5.20-5.70 (somewhat like - like). Proportion aloe-gel in the drink affects the viscosity. The decrease in the viscosity of aloe vera gel is due to the hydrolysis of polysaccharides by enzymes which still have high activity and microbial activity[34]. We need to add additives to

make the viscosity of drink stable [35]. The taste value of the Aloe-Buni functional drink can be seen in Figure 4.

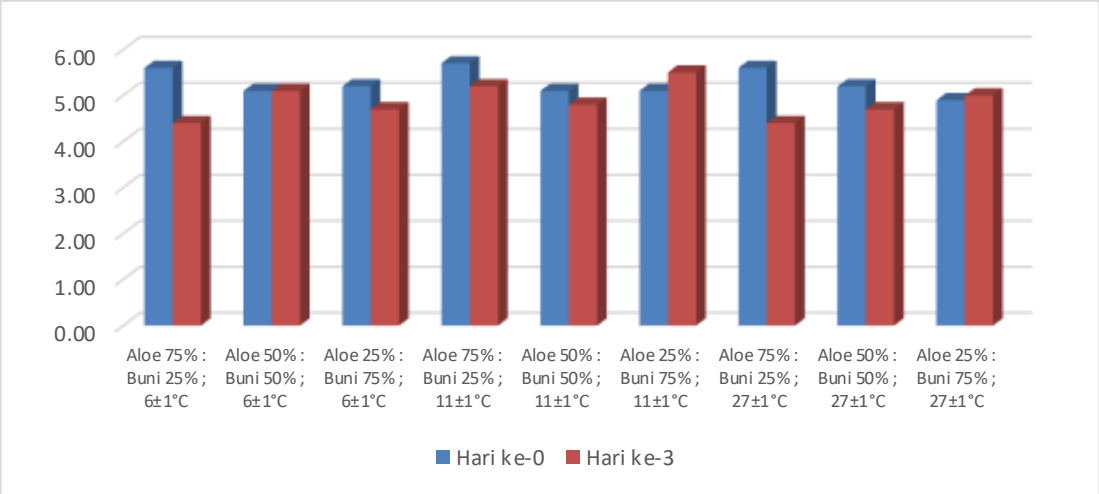


Figure 4
The viscosity value of Aloe-buni drink is based on the proportion of Aloe-gel and EB at different storage temperatures

**c. Aroma**

Aloe-Buni drink with 25% Aloe-gel proportion: 75% EB tends to be favored with a hedonic value of 5.00 (somewhat like). The aroma of Aloe-Buni drink changes during storage. On the 3rd day, the Aloe-Buni drink with the proportion of Aloe-gel 75%: EB 25% experienced a change in aroma. The aroma produced is a sour aroma. This change in aroma is due to the fermentation process caused by the sugar content in the drink. Lactic acid bacteria are able to break down glucose into lactic acid and other sugars such as lactose, galactose, fructose, sucrose, maltose so that the aroma of the drink becomes more acidic[36]. The taste value of Aloe-Buni drink can be seen in Figure 5.

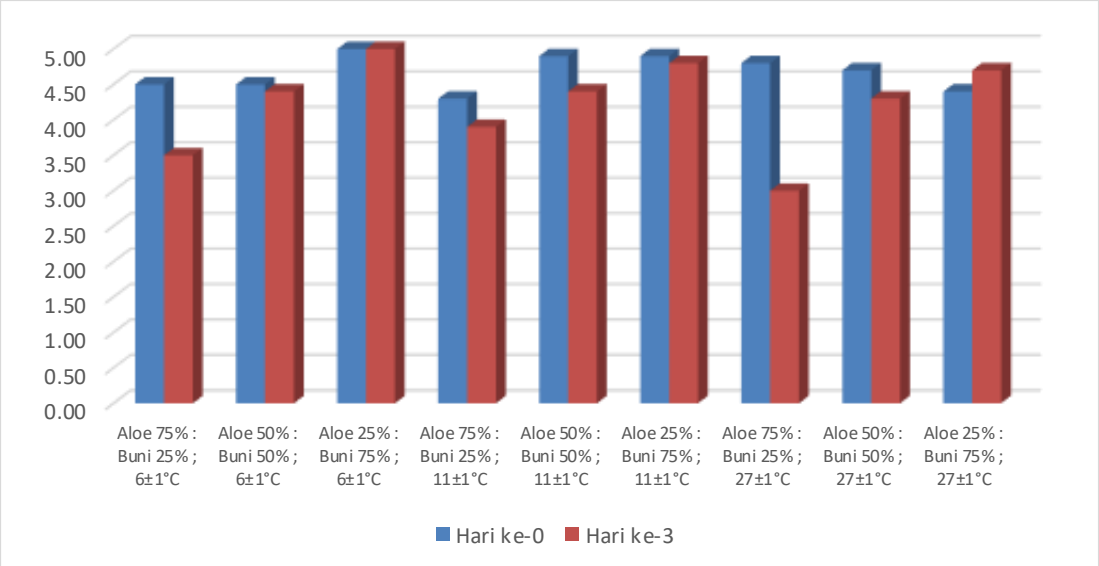


Figure 5
Aroma value of Aloe-buni drink based on the proportion of Aloe-gel and EB at different storage temperature

**d. Color**

Aloe-Buni drink with 25% Aloe-gel proportion: 75% EB tends to be preferred by the panelists. The higher the proportion of EB, the redder the color of the drink. The hedonic value of Aloe-Buni drink color is 5.00 – 6.50 (slightly like – very like). The color of Aloe-Buni drink with the proportion of Aloe-gel 75%: EB 25% has a lighter color. In this proportion the browning reaction was also seen on the 3rd day already starting to brown because in aloe-gel there is carbohydrates, its very sensitif with temperature [37][38]. The color value of Aloe-Buni drink can be seen in Figure 6.

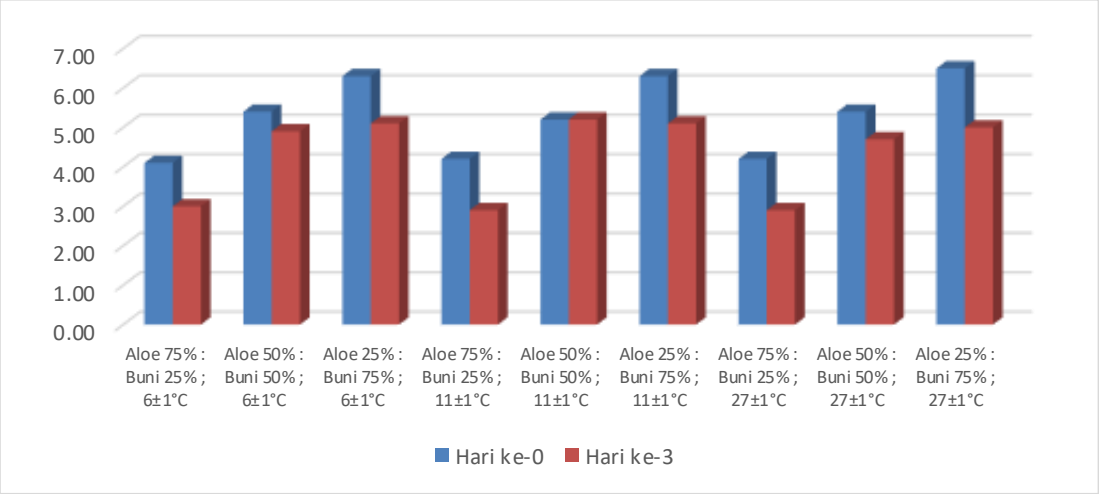


Figure 6

Color value of Aloe-buni drink based on the proportion of Aloe-gel and EB at different storage temperatures

**e. General Admission**

Aloe-Buni drink with the proportion of Aloe-gel 25% : EB 75% showed the highest general acceptance hedonic value of 4.90-5.20 (neutral - like). Aloe-Buni drink with a proportion of 75% EB has a more refreshing taste and aroma, is not thick and has a more attractive color so that it is preferred by panelists. The general acceptance value of Aloe-Buni drink can be seen in Figure 7.

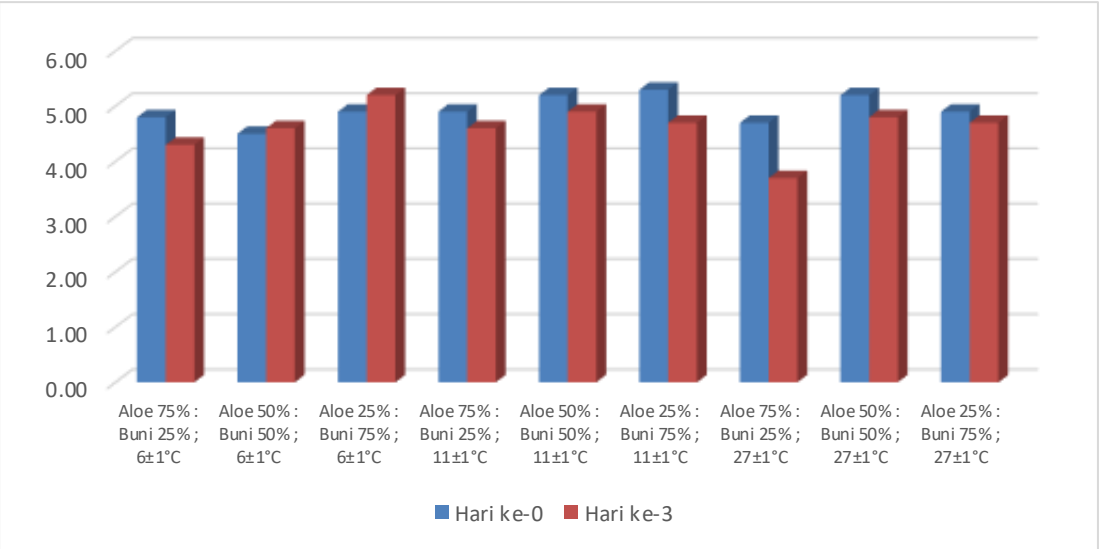


Figure 7

The general acceptance value of Aloe-Buni drink is based on the proportion of Aloe-gel and EB at different storage temperatures

## 4. Conclusion

The proportion of Aloe-gel and EB affect the characteristics of Aloe-Buni drink. Meanwhile, the storage temperature and its interactions did not affect the characteristics of the Aloe-Buni drink. There was a decrease in the characteristics of Aloe-Buni drink during 3 days of storage. The best characteristics of Aloe-buni drink were obtained from the treatment of Aloe-gel 50%: EB 50% at a storage temperature of 6±1°C, where vitamin C content was 171, 62mg/100gr, pH was 3.29, total dissolved solids was 19, 18°Brix, viscosity of 7.75 m.Pa.s, and antioxidant activity of 28.14%.

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