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Development of Local Banana-Based Wine Products Reviewed in Terms of Sugar Content and Dilution

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A B S T R A C T

Banana wine has high nutritional content and relatively high antioxidant levels. This study aims to test and analyze sugar concentration and the effect of optimal dilution to obtain banana wine with good characteristics and by SNI standards. The method used to achieve the objectives is the sugar content in the fermentation media and the amount of fermentation media dilution. In this study, several sugar levels were tested (10%, 15%, 20%, and 25%) and diluted fermentation media (1:3, 1:4, and 1:5). The data obtained were then analyzed using one-way ANOVA. Based on the results of objective observations of the banana wine produced, treatment with 20% sugar content produced the best banana wine with the characteristics of total sugar 10.66%, alcohol content 8.03%, total acid 0.26%, acidity level (pH) 2.37, and total microbes 1.4 x 101 CFU/g, with the highest panelist assessment and typical odor and taste. Subjective research results with organoleptic tests showed that the treatment of sugar content and dilution amount did not change the color and aroma of banana wine. The highest wine taste assessment was obtained in treating 20% sugar at a dilution of 1:4, which was 5.67 (somewhat like it). The highest overall wine acceptance assessment was obtained in the treatment of 20% sugar at a dilution of 1:4, which was 5.73 (somewhat like it). The methanol content test results were <0.0036% so in making banana wine from local bananas, it is recommended to use 20% sugar with a dilution of 1:4 fermentation media.

Contribution to Sustainable Development Goals (SDGs):

SDG 2 – Zero Hunger
SDG 3 – Good Health and Well-being
|**SDG 8 –** Decent Work and Economic Growth
SDG 9 – Industry, Innovation and Infrastructure
SDG 12 – Responsible Consumption and Production

1. INTRODUCTION

1.1. Research Background

Indonesia is the sixth largest banana producer in the world. Even in Asia, Indonesia is the largest banana producer because almost 50% of banana production in Asia is produced by Indonesia. The Central Statistics Agency (BPS) noted that banana production in Indonesia reached 8.18 million tons in 2020. This number increased by 12.39% from 7.38 million tons in 2019 [1]. Bananas have high nutritional content and quite high antioxidant levels. Bananas are a fruit that is often consumed more than other fruits. Not only the fruit but also other parts of the banana tree. Like the banana heart, which can be processed into vegetables. The banana heart is the tip of the banana flower that remains when the other parts grow into bananas. This part is the remaining banana flower that can no longer produce bananas. The banana heart is also one part of the banana plant that is still underutilized; people only know that the banana heart can only be processed as a vegetable, even though besides the cheap price, the banana heart has many health benefits [1].

One of the high-value banana derivative products is Wine. Wine is an alcoholic beverage made from fermented fruit. However, bananas contain various polysaccharides, pectin, starch, and xylan, which can cause the color to be cloudy and thick when processed into juice or Wine. Processing of bananas

with enzymes is carried out before the wine fermentation process. In general, making banana wine with enzymes is divided into two stages, namely clarifying banana juice with lignocellulolytic enzymes such as pectinase and cellulase and breaking down starch into simple sugars by amylase and glucanase [2].

The health benefits of Wine from grapes are that it can warm the body and treat several diseases, such as cancer, heart disease, ischemic stroke, neurodegenerative disorders, aging, hypertension, and hyperlipidemia, prevent Alzheimer's, and lower cholesterol levels [3]. Bananas have excellent nutritional content, including providing quite high energy compared to other fruits. Bananas have a variety of nutritional content and are needed by the body. According to Ekayani (2020) , bananas are naturally free of fat, cholesterol, and sodium [4]. According to Putri (2023), bananas can be processed into processed products such as "Arak Bali" based on bananas [5].

The Governor of Bali has ratified the Bali Governor Regulation Number 1 of 2020 which regulates the Management of Fermented and/or Distilled Beverages Typical of Bali. Through the governor's regulation, "Wine and Arak Bali" which were previously distributed illegally, are now legal and have legal protection, while still following the methods and management that have been regulated in the policy. This reality certainly opens up a very big opportunity for arak craftsmen to produce, distribute, and promote the existence of arak as a traditional drink typical of Bali. In addition, Wine has the potential to be used as a commodity marketed to tourists visiting Bali [6].

This study aims to overcome problems related to the development of local banana-based Wine. Some problems that are often encountered in making fruit wine, including bananas, are the optimal sugar content and the selection of the right diluent. Sugar levels that are too high or too low can affect the quality of taste and fermentation, while unsuitable diluents can change the characteristics of the Wine. The objectives of this study include determining the effect of sugar content on the characteristics of local banana fruit wine. In addition, to determine the effect of dilution on the characteristics of local banana fruit wine and to determine the effect of sugar content and dilution to obtain the characteristics of local banana fruit wine that consumers like.

The novelty of this research is that the optimal sugar concentration and dilution volume will be known to obtain banana-based Wine with good characteristics and by SNI standards and to add to the wealth of innovative alcoholic beverage products supporting ecotourism and to develop appropriate technology in the field of agricultural technology. Target Achievement (Product/Result of Research) is to obtain optimal sugar concentration and dilution as well as the joint influence of sugar concentration and dilution to obtain banana wine with good characteristics and by SNI standards. It is expected that ongoing research will be carried out on fruit wine with other more in-depth and complex test results to produce fruit wine products that can be sold on the market to increase the shelf life and attractiveness of innovative food products based on local agricultural products.

Based on the above matters, it becomes a starting point for the author's thinking to determine the effect of sugar concentration and dilution factors on the characteristics of local banana wine produced so that banana-based Wine is expected to contribute to supporting ecotourism.

1.2. Literature Review

Ethanol is the main characteristic of Wine, but the uniqueness of the chemistry, physical appearance (appearance), taste, aroma, mouthfeel properties, and nutraceutical effects of one Wine with another lie in the chemical composition of each Wine. Which depends on several factors, namely the type of fruit/wine-making material, fruit ripeness, other ingredients added in the fermentation process, yeast and non-yeast strains, the combination of organisms involved in fermentation, the fermentation process, and post-fermentation processing and storage. The Wine that we generally know is made from grapes. However, the use of other fruits or a mixture of other ingredients has been practiced [3].

Fermented products are products produced with the help of beneficial microorganisms or bacteria. Wine is also a type of fruit juice-based beverage with high sugar content, which is produced from the fermentation process with the help of yeast microbes in anaerobic conditions. The selection of raw materials, sugar content, and also the addition of different volumes of Wine and starters can determine the difference in taste and quality of a wine drink [7].

Wine fermentation is the process of breaking down sugar into alcohol and CO2 gas, due to enzymes produced by yeast cells, or, in some cases, it can occur without the presence of living cells or microbes. Factors that affect the fermentation process are the type of yeast, sugar content, nutrients, temperature, aeration, dilution, and pH.

2. MATERIALS AND METHODS

2.1 Place and Time of Research

Place and time of research, This research was conducted at the Agricultural Analysis Laboratory, Faculty of Agriculture, Warmadewa University, Denpasar, from May to August 2024.

2.2 Research Method

The method used in this study is a Completely Randomized Design (CRD) factorial pattern with three factors, namely:

Treatment 1: Sugar content in the fermentation media

G1: Sugar content 10%
G2: Sugar content 15%
G3: Sugar content 20%
G4: Sugar content 25%

Treatment 2: amount of dilution in the fermentation media

P1 = 1:3
P2 = 1:4
P3 = 1:5

From these treatments, the combination treatment becomes 4x3 = 12 treatments. Each treatment was repeated 2 times so that 24 treatment units were obtained.

2.3 Making Starter

Before making banana fruit wine, a starter solution was first prepared as a yeast growth medium. The raw materials are sorted, peeled, washed, sliced, crushed, and filtered; then water is added so that the ratio between water and banana fruit is 1:1 v/v. After that, the pH is adjusted to 4.0, then the fruit pulp is pasteurized at 60°C for 30 minutes and then cooled. After cooling, it is bottled, and 2.5% bread yeast is added and then

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incubated for 24 hours. After incubation, the media can be used as a starter.

2.4 Making Banana Fruit Wine

Bananas are sorted, peeled, washed, sliced, crushed, and filtered with a filter cloth and measured according to the treatment (each treatment 500 ml). Then water is added with a ratio of 1:3, 1:4, and 1:5, and sugar is added according to the treatment (10%, 15%, 20%, 25%); the pH is adjusted to 4.0, then pasteurized at 60°C for 30 minutes, then cooled to room temperature.

Banana juice that is ready to be used as a substrate for yeast growth is put into a bottle with the addition of 2.5% starter, then fermented at room temperature (31.2°C), then heated at a temperature of 60°C for 5 minutes. Heating aims to end the fermentation process. After fermentation is complete, the aging process is carried out for one month. The aging process is carried out by leaving the fermented banana wine for one month by removing the plastic tube from the bottle cap, which is found in the banana wine and is very necessary for the formation of the taste and aroma of the banana wine itself (Saputra, 2020).

Observation and Analysis

To determine the effect of the tested treatment, objective and subjective observations were carried out with sensory tests. Objective observations include alcohol content, total sugar, total acid, acidity (pH), and yield. Measurement of methanol levels was carried out on samples that had been analyzed objectively and subjectively as the best treatment. Subjective observations with a seven-scale hedonic (preference) test include color, odor, aroma, taste, and overall acceptance.

2.5 Data Analysis

The data obtained in this study were analyzed quantitatively with analysis of variance (ANOVA). If the data obtained showed a significant difference, then continue with the Duncan's Multiple Range Test (DMRT). Statistical analysis with the help of SPSS Software for Windows version 22 in 2015. The data obtained were also analyzed descriptively, and the data were also displayed with tables, figures, or graphs.

3. RESULT AND DISCUSSION

Fermented products are products produced with the help of beneficial microorganisms or bacteria. Wine is also a type of fruit juice-based beverage with a high sugar content, which is produced from the fermentation process with the help of yeast microbes in anaerobic conditions. The selection of raw materials, sugar content, and also the addition of different volumes of Wine and starters can determine the difference in taste and quality of a wine drink [7].

The results of research on the development of local banana-based wine products show that variations in sugar content and dilution have a significant effect on the characteristics of the final product. In general, the higher the initial sugar content, the higher the alcohol content produced. However, adding too much sugar can make the wine taste too sweet and unbalanced. Variations in dilution also affect the intensity of taste and aroma. Proper dilution can produce Wine with a softer and less sharp taste.

Statistical analysis shows that the treatment of sugar content in the fermentation medium has a very significant effect ($P < 0.01$) on the total sugar content, a significant effect ($P < 0.05$) on the alcohol content, and an insignificant effect ($P > 0.05$) on the pH, total acid, and total microbes of banana wine. The treatment of the number of dilutions in the media had no significant effect ($P<0.05$) on the pH value, total acid, total sugar, alcohol content, and total microbes of banana wine. The interaction of sugar content and the number of dilutions had no significant effect ($P<0.05$) on the pH value, total acid, total sugar, alcohol content, and total microbes of banana wine. The pH value, total acid content, total sugar content, alcohol content, and total microbes of banana wine due to the treatment of sugar content and the number of dilutions in the media can be seen in Table 1.

The pH value of banana wine in the treatment of sugar content in the fermentation media ranged from 2.36 to 2.37. The lowest pH value was obtained in the treatment with a 15% sugar content of 2.36, which was not significantly different from the other treatments. The total acid content of banana wine in the treatment of sugar content in the fermentation media ranged from 0.23 to 0.28%. The results showed that the higher sugar content in the fermentation media tended to increase the total acid content in banana wine, although statistically, it was not significantly different. The total sugar content of banana wine in the treatment of sugar content in the fermentation media ranged from 4.14 to 14.31%. The highest sugar content was obtained in the treatment of adding 25% sugar in the fermentation medium, which was 14.31%. The results showed that the higher the addition of sugar, the higher the total sugar content in banana wine.

The increase in sugar content is generally positively correlated with the increase in alcohol content. This shows that sugar is the main substrate for microorganisms in the alcohol fermentation process. The more sugar available, the more alcohol is produced. Furthermore, in terms of the pH value aspect, it tends to be stable at around 2.3, indicating that the fermentation environment tends to be acidic. These acidic conditions are generally favorable for the growth of yeast that plays a role in alcohol fermentation [8]. In addition, the total acid content tends to increase with increasing sugar content. This may be related to the production of organic acids as a by-product of fermentation. The total number of microbes also tends to increase with increasing sugar content, indicating that higher nutrient availability supports the growth of microorganisms [2].

The alcohol content of banana wine in the treatment of sugar content in the fermentation medium ranged from 3.89 to 8.22%. In this study, an increase in the alcohol content of banana wine was seen, which was directly proportional to the increase in sugar content in the fermentation medium. The highest alcohol content was obtained with the addition of 25% sugar, which was 8.22%. The total microbial content in banana wine ranged from 1.1 x 10^1 cfu/gram to 8.0 x 10^1 cfu/gram.

The pH value of banana wine in the dilution amount treatment ranged from 2.30 to 2.44. The pH value of the wine tended to decrease at smaller dilution amounts, although statistically, it was not significantly different. The total acid content of banana wine in the dilution amount treatment ranged from 0.23% to 0.26%. The total acid content of Wine tended to increase at smaller dilution amounts, although statistically not significantly different. The total sugar content of banana wine in the dilution amount treatment ranged from 8.56% to 10.85%. The dilution treatment did not affect the total sugar content of the Wine. The alcohol content of banana wine in the dilution

amount treatment ranged from 5.67% to 6.25%. The total microbes of banana wine due to the dilution amount treatment in the media ranged from 1.1 x 10^1 cfu/gram to 2.5 x 10^1 cfu/gram. The dilution treatment did not affect the pH value, total acid, total sugar content, alcohol content, and total microbes of banana wine. Dilution of fermentation media tends to decrease pH value and increase total acid content, total sugar content, alcohol, and total microbial content. Based on the available data, it can be concluded that sugar content is a factor that greatly influences the quality of banana wine. The higher the sugar content, the higher the alcohol content produced. However, it should be noted that sugar content that is too high can also inhibit the growth of certain microorganisms [9]. The amount of dilution also has a significant effect, where excessive dilution can inhibit the fermentation process.

Table 1. pH value, total acid content, total sugar content, alcohol content, and total microbes of banana wine due to sugar content treatment and number of dilutions in the media.

Treatment	pH value	Total acid (%)	Total sugar (%)	Alcohol content (%)	Total microbes (cfu/gram)
Sugar content in the fermentation media					
Sugar content 10%	2.37 a	0.23 a	4.14 b	3.89 b	1,1 x10^1 a
Sugar content 15%	2.36 a	0.23 a	8.06 b	4.22 b	5,0 x10^1 a
Sugar content 20%	2.37 a	0.26 a	10.66 ab	8.03 a	1,4 x10^1 a
Sugar content 25%	2.37 a	0.28 a	14.31 a	8.22 a	8,0 x10^1 a
BNT 0,05	0.12	0.06	4.85	2.76	0.32
Number of dilutions in the media					
Dilution 1:3	2.44 a	0.23 a	8.46 a	5.67 a	1,1 x10^1 a
Dilution an 1:4	2.36 a	0.25 a	8.56 a	6.25 a	2,5 x10^1 a
Dilution an 1:5	2.30 a	0.26 a	10.85 a	5.83 a	2,5 x10^1 a
BNT 0,05	0.13	0.07	5.61	3.19	0.37

Description: The average value followed by the same letter in the same column indicates no significant difference in the 5% BNT test.

Based on statistical analysis, the treatment of sugar content and the amount of dilution in the media had no significant effect (P>0.05) on the assessment of the color and aroma of banana wine but had a very significant effect (P<0.01) on the assessment of the taste and overall acceptance of banana wine. The organoleptic value of color, aroma, taste, and overall acceptance of banana wine due to the treatment of sugar content and the amount of dilution in the media can be seen in Table 2. The results of the study with organoleptic testing using 15 somewhat trained panelists showed that the treatment of 25% sugar at a dilution of 1:4 tended to produce the highest color assessment of 5.67 (somewhat like), which was not significantly different from other treatments. This shows that the treatment of sugar content and the amount of dilution did not change the color of banana wine. The highest aroma value of banana wine was obtained in the treatment of 20% sugar content at a dilution of 1:4, which was 5.47 (somewhat like), which was statistically not significantly different from other treatments. This shows that the treatment of sugar content and the amount of dilution did not change the aroma of banana wine. The highest wine taste assessment was obtained in the treatment of 20% sugar at a dilution of 1:4, which was 5.67 (somewhat like) the same as the treatment of 25% sugar content at a dilution of 1:5. The highest overall wine acceptance assessment was obtained in the treatment of 20% sugar at a dilution of 1:4, which was 5.73 (somewhat favorable). The graph of the wine test results can be seen in Figure 1-6.

Table 2. Organoleptic test of color, aroma, taste, and overall acceptance of banana wine due to sugar content treatment and amount of dilution in the media.

Treatment	Color	Aroma	Color Aroma Taste Overall Acceptability	Overall Acceptability
G1P1	5.20 a	4.60 a	2.80 d	3.67 d
G1P2	4.93 a	4.00 a	3.60 cd	3.67 d
G1P3	5.00 a	4.33 a	2.93 d	4.13 cd
G2P1	5.13 a	4.40 a	4.07 bcd	4.33 bcd
G2P2	5.33 a	5.07 a	3.60 cd	4.87 abc
G2P3	3.53 a	4.07 a	5.00 ab	4.87 abc
G3P1	4.80 a	4.93 a	5.20 ab	5.00 abc
G3P2	5.20 a	5.47 a	5.67 a	5.73 a
G3P3	3.53 a	4.13 a	4.73 abc	4.53 bcd
G4P1	5.20 a	4.53 a	3.87 bcd	3.73 d
G4P2	5.67 a	4.87 a	5.47 a	5.13 abc
G4P3	5.33 a	5.40 a	5.67 a	5.60 a

Description: The average value followed by the same letter in the same column indicates no significant difference in the 5% BNT test.

Based on the results in Table 2, it can be seen that the results of the organoleptic test carried out on banana wine showed a significant effect of the sugar content treatment and the amount of dilution on the organoleptic characteristics of the final product. In general, most treatments produced banana wine with a fairly high color intensity (average value above 5.00). This indicates that the banana wine-making process has succeeded in extracting the color pigment from bananas [10]. However, there were some color variations between treatments, indicating that certain combinations of sugar content and dilution can affect the intensity of the color produced.

The aroma of banana wine also showed quite significant variations between treatments. Some treatments produced aromas that were preferred by panelists (average value above 4.50), while other treatments produced aromas that were less preferred. This shows that sugar content and dilution can affect the aroma profile formed during the fermentation process. The results of the taste test showed that there were quite significant differences between treatments. Some treatments produced flavors that were preferred by panelists (average value above 4.50), while other treatments produced flavors that were less preferred. This indicates that the right combination of sugar content and dilution is very important to produce a banana wine flavor that panelists prefer. The overall acceptance of banana wine also varied between treatments. Some treatments received good acceptance from panelists (average value above 5.00),

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while other treatments were less preferred. These results indicate that a harmonious combination of color, aroma, and taste is very important to increase consumer acceptance of the product [11].

From the results of this organoleptic test, it can be concluded that sugar content and the amount of dilution have a significant effect on the organoleptic characteristics of banana wine. The right combination of these two factors can produce banana wine with color, aroma, taste, and overall acceptance that is preferred by panelists [12].

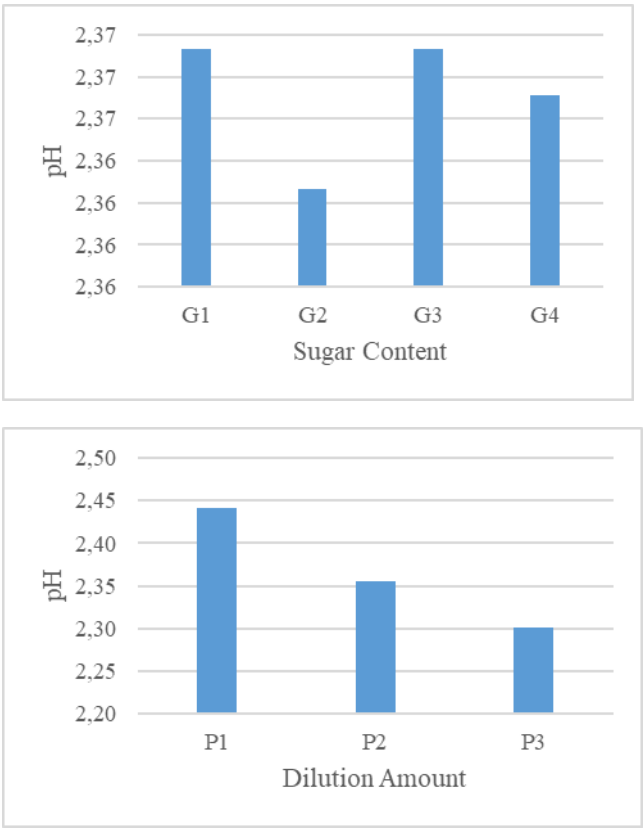

Figure 1. pH value of banana wine at different sugar content and dilution amounts.

Figure 1 illustrates the relationship between the pH value of banana wine with variations in sugar concentration and the amount of dilution. It can be seen that the higher the sugar concentration (G1, G2, G3, to G4), the higher the pH value tends to be. This shows that the addition of sugar increases the pH of banana wine. This can happen because sugar is a weak base, so when dissolved in water, it will slightly increase the pH of the solution. The graph shows that changes in the amount of dilution (P1, P2, and P3) also affect the pH value. However, the pattern of influence is not as clear as the influence of sugar concentration. Fluctuations in pH values in this dilution variation may be influenced by other factors such as the type of organic acid contained in banana wine.

Based on the graph, it can be concluded that sugar concentration is the dominant factor affecting the pH value of banana wine. The higher the sugar concentration, the higher the pH value. In addition, the amount of dilution also has an effect, but its effect is not as significant as the sugar concentration, and the pattern of change is less clear. The implications of the relationship between sugar concentration, dilution amount, and pH value of banana wine are very important in the banana wine production process [13]. By controlling these two variables, producers can regulate the acidity level of banana wine so that the fermentation process can take place properly.

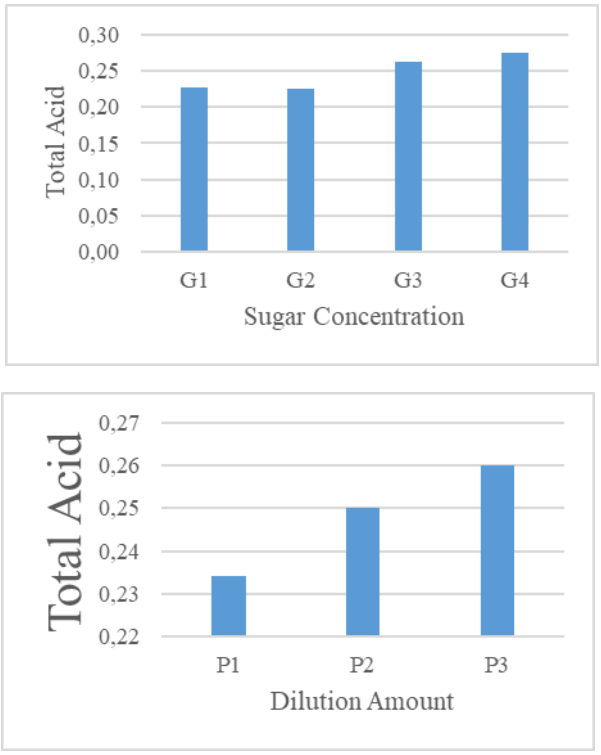

Figure 2. Total acidity of banana wine at different sugar content and dilution amount.

Figure 2 presents data on the effect of variations in sugar concentration and the amount of dilution on the total acid content of banana wine. It can be seen that the sugar concentration shows an increase in the total acid content along with the increase in sugar concentration (Figure 2). This indicates that the addition of sugar in the banana winemaking process can increase its total acid. Sugar concentration is a significant factor in influencing the total acid content of banana wine. The higher the sugar concentration, the higher the acid content. The amount of dilution in the range tested in this study did not have a significant effect on the total acid.

The results of this study have important implications for the banana wine-making process. Producers can use this information to control the total acid in the final product by adjusting the sugar concentration used. In addition, further research can be done to identify other factors that can affect acid levels, such as the type of banana variety, fermentation temperature, and fermentation time.

Figure 3 presents data on the total sugar in banana wine, which varies based on the sugar content and the amount of dilution. The graph on the left shows the effect of sugar concentration on the total sugar in banana wine. It can be seen that the higher the sugar concentration used, the higher the total sugar in banana wine. This shows that sugar concentration is a factor that greatly influences the total sugar in the final banana wine product produced.

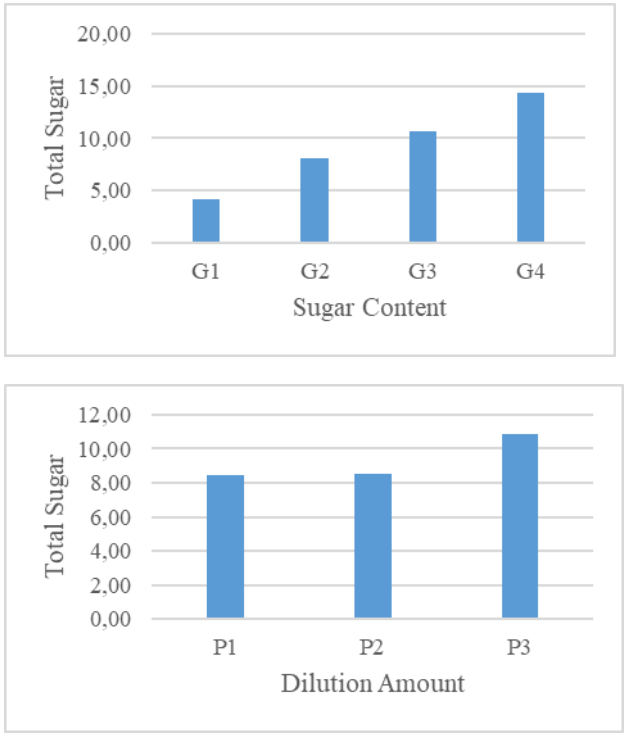

Figure 3. Total sugar of banana wine at different Sugar Content and dilution amounts.

Based on the analysis of Figure 3, it can be concluded that both the initial sugar content and the amount of dilution carried out during the banana wine-making process have a significant effect on the total sugar in the banana wine product. To obtain the desired sugar content in banana wine, adjustments need to be made to both variables.

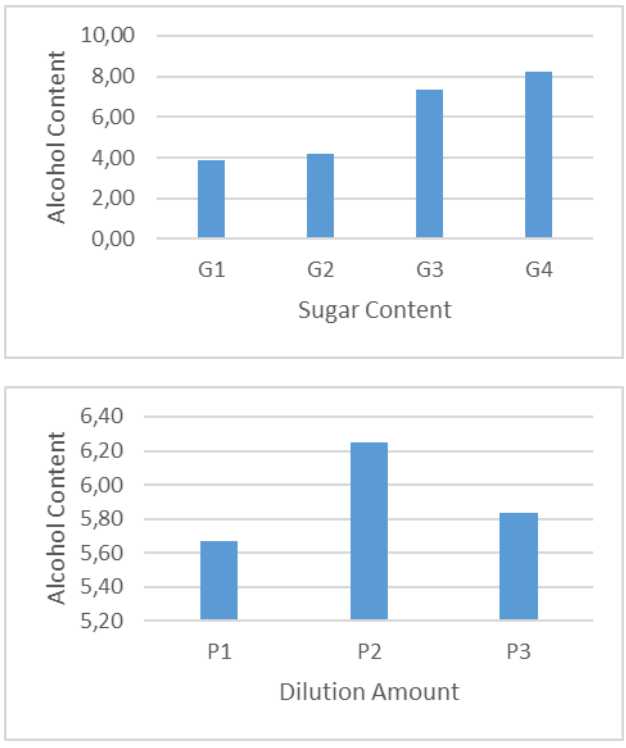

Figure 4. Alcohol content of banana wine at the different sugar content and dilution amount.

The graph above illustrates the relationship between the alcohol content in banana wine with variations in sugar concentration and the amount of dilution. These two factors have a significant effect on the alcohol content of banana wine.

It can be concluded that sugar content is a very important factor in determining the alcohol content of banana wine. The higher the sugar concentration, the higher the alcohol content produced. The amount of dilution also affects the alcohol content, but its effect is not as great as the sugar concentration. Other factors besides the amount of dilution also need to be considered to explain the variation in alcohol content in this group.

Understanding the relationship between sugar concentration, the amount of dilution, and alcohol content in banana wine has important implications for the production process. Manufacturers can use this information to control and regulate the alcohol content in their products according to consumer preferences or applicable standards [12].

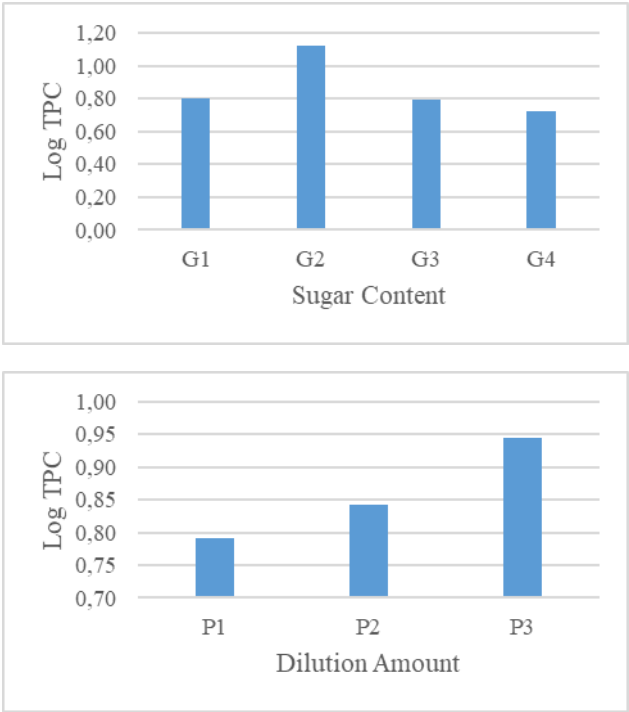

Figure 5. Total microbes of banana wine at different sugar content and dilution amount.

Figure 5 shows the effect of sugar content and the number of dilutions on the total microbes in banana wine. There are two bar graphs presented, namely the sugar concentration graph shows that the total number of microbes varies at each sugar concentration (G1, G2, G3, and G4). There are fluctuations in the number of microbes at each sugar level, indicating that the sugar concentration affects microbial growth. The dilution graph shows that the total number of microbes also varies and tends to increase with increasing dilution (P1, P2, and P3). It can be seen that at the P3 dilution, the total number of microbes is the highest. This indicates that dilution can affect the number of microbes present [14].

Based on the graph, it can be concluded that both sugar concentration and the number of dilutions affect the total microbes in banana wine.

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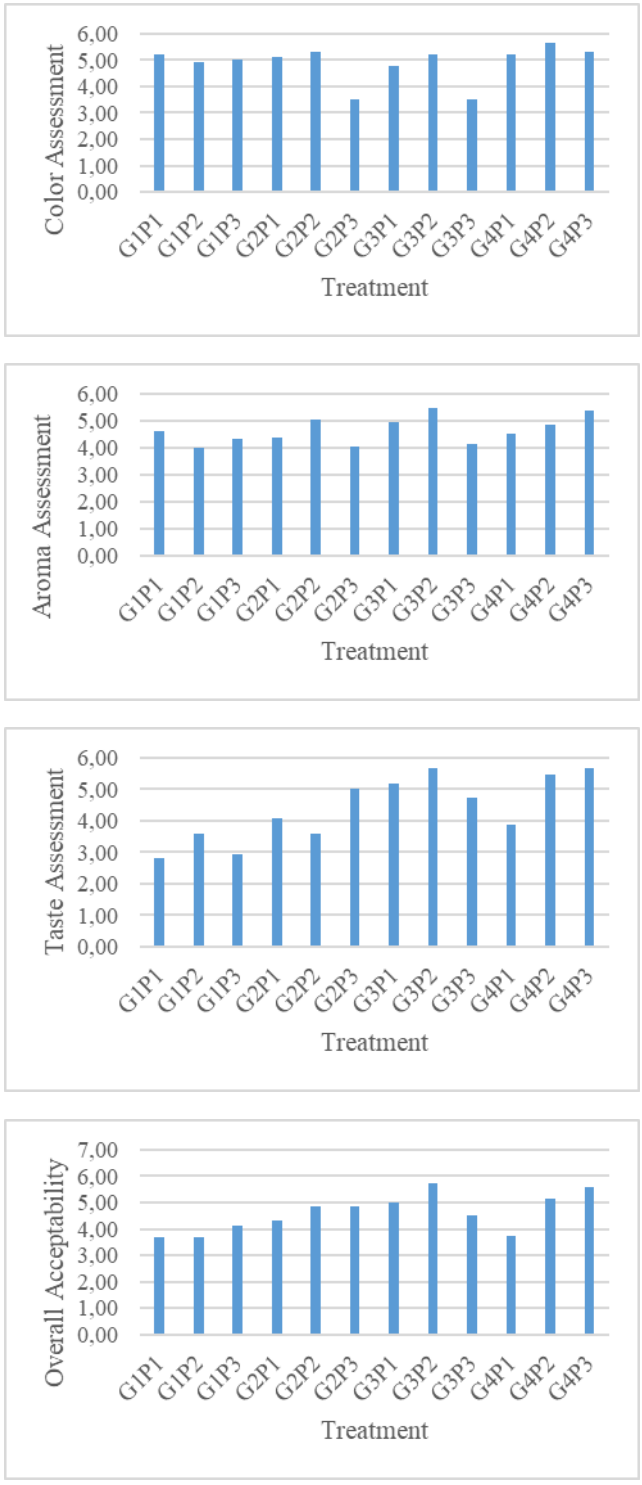

Figure 6. Organoleptic assessment of banana wine at different concentrations and dilution rates.

Figure 6 presents the results of the organoleptic assessment using panelists on banana wine in various sugar and dilution treatments that are most likely related to different sugar levels and dilution amounts. Each bar on the graph represents the assessment score for each treatment [15].

There is a significant variation in scores between treatments, both for the assessment of taste, color, aroma, and overall acceptance. This indicates that changes in sugar content and the amount of dilution have different effects on the organoleptic characteristics of banana wine [16].

Certain treatments tend to get higher scores than other treatments. This shows that certain combinations of concentration and amount of dilution produce banana wine with organoleptic responses that panelists prefer.

The assessment was carried out on several aspects, namely taste, color, overall acceptance, and aroma. By looking at the scores on each aspect, we can identify which treatment produces banana wine with the most preferred taste, the most attractive color, and the most preferred aroma.

Based on the graph above, it can be concluded that the variation in concentration and amount of dilution has a significant effect on the organoleptic response of banana wine. By conducting further analysis of this data, we can identify which combination of treatments can produce banana wine with organoleptic characteristics preferred by panelists.

4. CONCLUSION

The results of the study showed that banana wine with sugar content treatment in the fermentation media objectively had a very significant effect on the total sugar content, a significant impact on the alcohol content, and no significant effect on the pH, total acid, and total microbes of banana wine. The treatment of the amount of dilution in the media had no significant effect on the pH value, total acid, total sugar, alcohol content, and total microbes of banana wine. The results of the study also showed that there was no interaction between sugar content and the amount of dilution on the pH value, total acid, total sugar, alcohol content, and total microbes of banana wine. Subjective testing with organoleptic tests using 15 fairly trained panelists showed that the treatment of sugar content and the amount of dilution in the media did not affect the panelists' assessment of the color and aroma of banana wine but greatly influenced the assessment of the taste and overall acceptance of banana wine. Panelists' assessments of all these sensory assessment variables were in the hedonic scale range between somewhat like and like.

Based on the results of objective observations of the banana wine produced, treatment with 20% sugar content produced the best banana wine with the characteristics of total sugar 10.66%, alcohol content 8.03%, total acid 0.26%, acidity level (pH) 2.37, and total microbes 1.4 x 101 CFU/g, with the highest panelist assessment and normal odor and taste. Subjective research results with organoleptic tests showed that the treatment of sugar content and dilution amount did not change the color and aroma of banana wine. The highest wine taste assessment was obtained in treating 20% sugar at a dilution of 1:4, which was 5.67 (somewhat like it). The highest overall wine acceptance assessment was obtained in the treatment of 20% sugar at a dilution of 1:4, which was 5.73 (somewhat like it), and the methanol content test results were <0.0036% so in making banana wine from local bananas, it is recommended to use 20% sugar with a dilution of 1:4 fermentation media.

After successfully conducting initial trials on local banana-based Wine and analyzing several test parameters, the next stage of this research is a follow-up study to determine the length of fermentation and aging required to obtain Wine that meets wine quality standards. Several indicators that are required and have been tested in this initial stage of research have met the wine quality requirements. Likewise, it is necessary to conduct microbiological testing by the wine quality standards according to SNI 01-4018-1996, namely testing for coliform bacteria,

Escherichia coli, Salmonella sp, Staphylococcus aureus, Vibrio species, Clostridium perfringens, total mold, and yeast. Product Prototype Development: Making a prototype of a wine product with attractive packaging and complete label information, by applicable regulations. Production cost analysis, namely conducting a comprehensive production cost analysis to determine a competitive selling price. Product registration by carrying out the wine product registration process to the relevant institutions to obtain a distribution permit.

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