International Journal of Food Science and Nutrition
ISSN: 2455-4898; Impact Factor: RJIF 5.14
Received: 12-11-2019; Accepted: 13-12-2019
www.foodsciencejournal.com
Volume 5; Issue 1; January 2020; Page No. 60-63

Qualitative analysis of wine prepared from banana and orange

Kipa Tamrakar[1*], Avina Lama[2], Binita Dhakal[3], Luna Adhikari[4], Megha Shrestha[5], Jeena Amatya[6]
[1-6] Department of Microbiology, St. Xavier's College, Kathmandu, Nepal

Abstract
Fruits are very often used for wine preparation since the beginning of civilization. In recent years emphasis has been given to fruits such as banana and orange for the preparation of wine. Banana and Orange are highly perishable in nature, the fermentation is a low energy prevention process to increase the shelf life of these fruits. They have a good amount of sugar content that makes them a suitable substrate for the preparation of wine. Fermentation of banana and orange juices were carried out in the presence of wine yeast for about a month in a natural condition to obtain wine. A clear wine was obtained after siphoning. The amount of alcohol yield by banana wine was more than that of orange. In this study, both of the substrates yield much the same quality of the wine but banana wine was preferred over orange wine.

Keywords: fruits, wine, yeast, fermentation

1. Introduction
Various fruits have been used for the production of wine since the dawn of human civilization. The fermentation with yeast is used for the production of wine that is considered as one of the oldest alcoholic beverages [1]. Usually, grapes were taken as the substrate for winemaking but in recent years preferences have been given to other fruits such as apricot, banana, citrus fruits, and so on [2].
Banana (*Musa* spp) is a valued fruit across the world due to its flavor, high nutritional value, and availability throughout the year [3]. The bananas are abundantly cultivated in developing countries of Asia, Africa and Latin America which can bear fruit all-round the year providing an easy source of energy for people [4]. On the other hand, Orange (*Citrus* spp) is one of the commonly consumed citrus fruit that can grow throughout the tropical and subtropical regions [5]. The consumption of citrus fruits like orange offers significant protection against various cancers, diabetes, Parkinson's disease, and inflammatory bowel disease.
Banana and oranges, both are perishable fruits with high chances of being spoiled by their enzyme system or microorganisms. This creates plenty of economic setbacks for the farmer. So, after the maturity of the fruits followed by harvest, they need to be stored and preserved properly [6].
One of the methods to prevent the loss of ripe bananas and oranges are to subject them to fermentation. Among them, wine is the value-added product to the production of wine from fruits can be an economic benefit [7].
Fermentation has made it possible to obtain wine from the fruits with the application of a variety of microorganisms, especially yeasts. The microbial cell utilizes the nutrition present in the fruits to produce alcohol through fermentation. The alcoholic content in the wine is mainly due to ethanol production [8].

$$C_6H_{12}O_6 \rightarrow C_2H_5OH + 2CO_2$$

Banana and Oranges can be cultivated in tropical, subtropical to temperate areas that can bear fruits throughout the year. They are rich in sugar content, making them a suitable substrate for the wine preparation [3, 5]. So, this study focuses on the preparation of wine from banana and orange along with their physiochemical and organoleptic evaluation.

2. Materials and Methods
2.1 Collection of materials
The ripen bananas and oranges were bought from the local market of Kathmandu. The wine yeast present in the Microbiology Laboratory of St. Xavier's College was used for the preparation of wine.

2.2 Preparation of Prefermenter Culture
The diluted solution of banana juice extracted from the pulp was taken as a banana must. The must was treated with 0.05% amylase and 0.05% pectinase for 24 hours [2]. Then, the must was filtered and pasteurized. 0.05% of wine yeast was added to the pasteurized must. The must was incubated in normal room temperature for 4 days. This was the prefermenter culture for banana wine.
In the case of orange prefermenter culture, a similar process as of banana was carried out except that there was no dilution and the must was treated with 0.05% pectinase only.

2.3 Preparation of Wine
The juice extracted from a dozen bananas were diluted by the addition of a 2/3rd amount of distilled water. Its sugar concentration was maintained to 20°Brix by the addition of sugar as per Pearson's Square Law[9]. It was treated with amylase and pectinase for 24 hours then filtered and sterilized by the addition of 50ppm potassium metabisulphite[6]. To this 5% banana prefermenter culture was added which was then incubated at room temperature for about 3 weeks.
2kgs of oranges were taken for the must to prepare wine. The main process carried for the preparation of orange wine was similar to the banana wine. However, the must was not diluted and it was treated with pectinase only. By the end of

the incubation time, the wine was siphoned to another sterile container to leave behind the sediment.

2.4 Determination of the Physiochemical Characteristics of Wine

In the incubation period, its TSS, pH and titratable acidity were determined on each consecutive day. The alcohol content was determined only at the end of the fermentation. All these processes were carried out as per the methods in Manandhar and Sharma (2009) [10].

2.5 Study of Organoleptic Characteristics of wine

Color, Smell, Taste, Clarity, Texture, and Astringency of the wine were studied using 5 hedonic scalings following Idise and Odum, 2011. The sensory quality of banana, orange, and standard wine was examined by members of the selected panel in which six sensory assessors participated in the wine tasting panel. They were asked to give a score out of 5 with 1 point for bad quality and 5 points for excellent quality.

3. Results

The change in the value of Total Soluble Solid (TSS) during fermentation of banana and orange wine is shown in Figure 1. The initial TSS of banana was 16 which dropped down to 10 within a week; it further kept on decreasing until it was 6 at the end of fermentation. In the case of orange, the initial TSS was 10 which dropped down to 8 on the 9th day and remained constant till the end of fermentation.

The value of pH during the fermentation of banana and orange wine is shown in Figure 2. The initial pH of banana was 5 which dropped down to 4 till the end of fermentation. In the case of orange, the initial pH was 3 which remained constant till the end of fermentation.

Figure 3 shows the change in the value of titratable acidity during the fermentation of banana and orange wine. The initial titratable acidity of the banana was 0.23. The maximum titratable acidity 0.4 was observed on the 11th day. It decreased to 0.4 at the end of fermentation. In the case of orange, the initial titratable acidity was 0.41. The maximum titratable acidity 0.83 was observed on the 9th day that decreased to 0.32 at the end of fermentation. Also, there was a greater fluctuation of titratable acidity in orange wine.

Table 1 shows the different physiochemical analysis of wine at the end of fermentation. After the wine was siphoned, the TSS, pH, Titratable acidity and Alcohol content were measured whose values are given in the table.

The organoleptic characters were determined using 5 points of hedonic scaling. The orange and banana wine were compared along with standard wine. The average of individual points given to each wine was calculated and evaluated. It was found that all 6 testers preferred banana wine over orange wine. The results are shown in Figure 4.

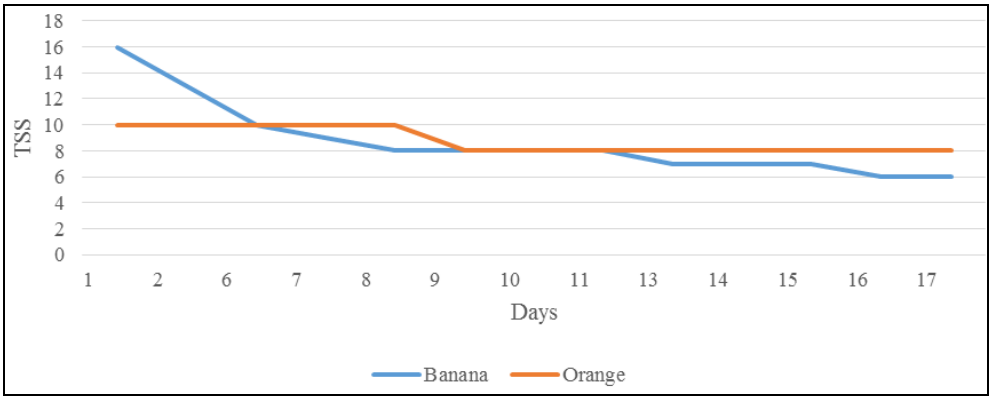

Fig 1: Changes in TSS during fermentation of Banana and Orange wine.

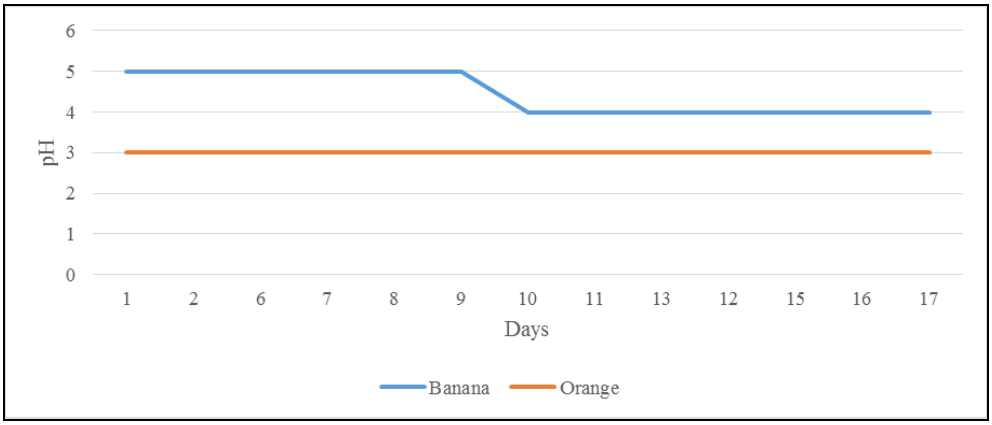

Fig 2: Changes in pH during fermentation of Banana and Orange wine.

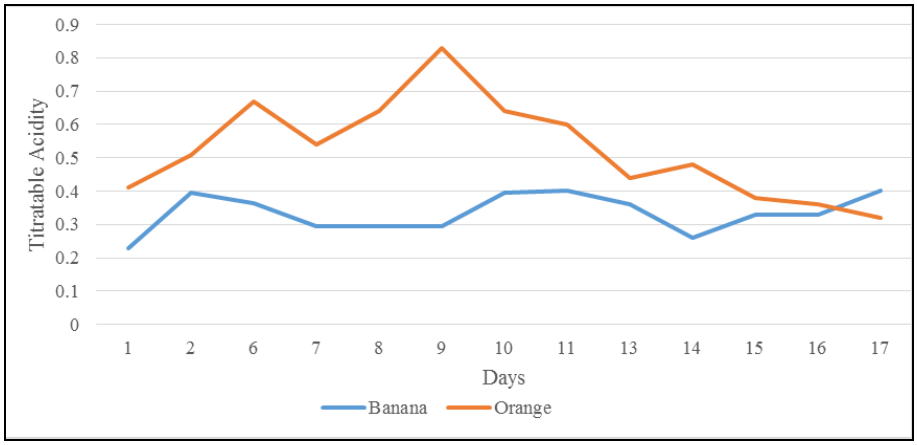

Fig 3: Change in Titratable acidity during fermentation of Banana and Orange wine.

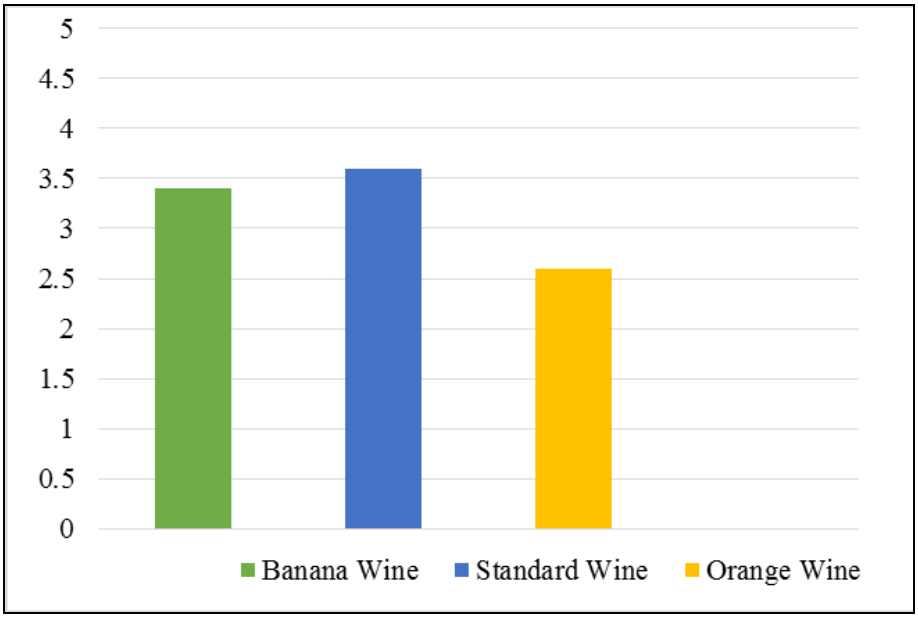

Fig 4: Result of Hedonic Scaling

Table 1: Physiochemical analysis of wine prepared from banana and orange

S.N	Substrate	TSS	pH	Titratable Acidity	Alcohol Content
1.	Banana	6° Brix	3.9	0.33	7.2 %
2.	Orange	8° Brix	3.7	0.26	11.2 %

4. Discussion

Banana and Orange wines were successfully prepared along with the study of different parameters of the prepared wine. In the preparation of wine, the must was treated with different enzymes and chemicals. The banana must was treated with amylase and pectinase to hydrolyze starch and pectin respectively as suggested by Cheirsilp and Umsakul (2008) [12]. The two enzymes act synergistically to enhance the hydrolysis of the complex carbohydrates present on the fruit. It was also found that pretreatment of banana with enzymes before wine fermentation resulted in a higher level of reducing sugars and clarity than that of the control i.e. untreated banana wine during fermentation. According to the study of Satav and Pethe (2017) in India, pectinase was added to decrease the viscosity of banana must. On the other hand, orange must was only treated with amylase. In the same study, Potassium metabisulfite was added to prevent browning and inhibit the growth of unwanted microflora the must.

During the fermentation period, the decrease in total soluble solid of banana must and orange juice was observed. The faster rate of fermentation at an initial period may also be due to the presence of a lower level of alcohol at the beginning of fermentation. The fermentation rate decreases later due to the increased quantity of alcohol exerted an effect on the fermentation process by hindering the activity of yeast. A similar fall in TSS was observed in the study conducted by Gavimath *et al* (2012) in India where TSS of the banana wine decreased from 14^0Brix to 8^0Brix and the orange wine from 14^0Brix to 12^0Brix during a month-long fermentation.

In this study, there was a decrease in the pH of banana wine whereas the pH of orange wine remained the same throughout the fermentation. As per the study of Idise (2011), wine tends to get more acidic as the fermentation process gets underway because sugar is utilized for the growth of microorganisms. Another study conducted by Shweta *et al* (2016) in Ambernath states that the pH of banana wine reduced from 3.5 to 3.3 with the increase in fermentation time. According to the study by Gavimath *et al* (2012), the pH of banana and orange wine varied between 5 to 3. This was observed in the banana wine but pH remained constant i.e. 3 in case of orange. At the end of fermentation, the final pH for banana wine was 3.9 and orange wine was

3.7 which is comparable to the pH of standard wine i.e between 3 to 3.9 as per Shrestha (2009).

The titratable acidity (TA) of the wine was calculated regarding the principle of organic acid, malic acid found in both banana and orange. During the fermentation period, there was a high variation in the TA of both wine. This was different than the findings of Gavimath *et al* (2012) in India which involved preparation of wine from different fruits including banana and orange. In the experiment, there was an increase in acidity initially which then decreased till the end of 30 days fermentation. The final TA of banana wine showed an agreement with the report of Idise and Odum (2011) and Satav and Pethe (2017) in India. In the case of TA of orange wine, it agrees with the TA calculated by Idise (2011) in orange wine prepared by natural fermentation. However, TA of both wines was too low as compared to the study carried out by Gavimath *et al* in 2012.

The total alcohol content of finished banana and orange wine were 7.2% and 11.2% respectively. The standard alcohol percentage of wine on average is 8%-13% by volume according to Shrestha (2009). So, the wine prepared lies near to the standard value. The alcohol percentage of banana wine and orange wine agrees with the report of Selli *et al* (2007) and Satav and Pethe (2017) respectively. Despite this, the finding is in contrast with the study conducted by Idise and Odum (2011) which was 1.413%.

The wines were tested along with the standard wine through hedonic scaling. Banana wine seemed to be more close to standard wine in terms of different characters as the wine tasters concluded the wine to be more appetizing and luscious. The banana wine was generally accepted in comparison to the orange wine, thus suggesting a better quality of the wine.

5. Conclusion

Hence, banana and orange both were taken as a substrate with different properties and nutritional value which resulted in the production of different concentrations of alcohol along with TSS, pH and titratable acidity although same yeast culture was used. From the result obtained through this study, there was no significant difference in the wine prepared from banana and orange. Also, both of the fruits are readily available throughout the season with a high production rate in Nepal so banana and orange wineries can flourish in the country.

6. Data Availability

The data that supports the findings of this study will be made available to the readers and interested people on request through the mail from the corresponding author.

7. Acknowledgment

We would like to acknowledge our supervisor, Lecturer Ms. Jeena Amatya for her constant encouragement, patience and valuable supervision at every stage of our work. We also owe deep gratitude to Lecturer Mr. Prakash Manandhar who also continuously provides us his knowledge and wisdom and encouraged us in every step. Similarly, we are grateful to our Head of Department, teachers and staff members of the Microbiology Department of St. Xavier's College, Maitighar, who, in their innate ways contributed their effort for the outcome.

Finally, we would like to express the deepest gratitude to our family members and friends for encouragement, support, and all the group members for their effort, time and sincerity with this project.

8. References

1. Gavimath CC, Kalsekar DP, Raorane CJ, Kulkarni SM, Gavade BG, Ravishankar BE, Hooli VR. Comparative Analysis of Wine from Different Fruits. International Journal of Advanced Biotechnology and Research, 2012, 3(4); 810–813.
2. Satav PD, Pethe AS. Production and Optimization of Wine from Banana Fruits. International Journal of Pharma and Bio Sciences. 2017, 8(2); 790–794.
3. Syriac GM, Mishra S, Prasad VM, Saravanan S and Topno SE. Response of different sources of sugar on production and quality analysis of banana (*Musa paradisiaca*) peel wine CV. Grand Naine. Journal of Pharmacognosy and Phytochemistry, 2017, 6(4); 591–595.
4. Aurore G, Parfait B, Fahrasmane L. Bananas, raw materials for making processed food products. Trends in Food Science and Technology, 2009, 20(2); 78–91.
5. Jagtap UB and Bapat VA. Wines from fruits other than grapes: Current status and future prospectus. Food Bioscience, 2015, 9; 80–96.
6. Akubor PI, Obio SO, Nwadomere KA, Obiomah E. Production and quality evaluation of banana wine. Plant Foods for Human Nutrition, 2003.
7. Syriac GM, Babychan M, Mishra S. Response of Different Sources of Sugar on Production and Quality Analysis of Banana (*Musa paradisiaca*) Fruit Wine cv. Grand Naine. International Journal of Pure & Applied Bioscience, 2017, 5(4); 1883–1889.
8. Production of wine from the fermentation of orange juice by *Saccharomyces Cerevisiae*. https://www.academia.edu/2539675/PRODUCTION_OF_WINE_FROM_THE_FERMENTATION_OF_ORANGE_JUICE_BY_Saccharomyces_cerevisiae. 5 August, 2018
9. Shrestha B. Practical Biochemistry and Biotechnology. SNEMP, Swoyambhu, Kathmandu, 2009, 128-131
10. Manandhar S, Sharma S. Practical Approach to Microbiology. 2nd edition, National Book Centre, Kathmandu, 2013, 144-213
11. Idise OE. Studies on wine production from orange (*Citrus sinensis*). Nigerian Journal of Science and Environment, 2007, 10; 96-100
12. Cheirsilp B, Umsakul K. Processing of banana-based wine product using pectinase and α- amylase. Journal of Food Process Engineering, 2008, 31(1); 78-90.
13. Idise OE, Odum EI. Studies of wine produced from banana (*Musa sapientum*). International Journal for Biotechnology and Molecular Biology Research, 2011, 2(12); 209-214.
14. Shweta H, Joshi P,Valmiki S. Wine production from over ripened banana. World journal of pharmacy and pharmaceutical sciences, 2016, 5(6); 1461-1466.
15. Selli S, Cabaroglu T, Canbas A. Volatile flavour components of orange juice obtained from the cv. Kozan of Turkey. Journal of Food Composition and Analysis, 2004, 17; 789–796