

A Study on Quantitative and Qualitative Characteristics of Fruit Wine Produced from *Syzygium cumini* (Maadan)

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Abstract

Fruit wines with considerable health benefits are produced by the alcoholic fermentation of fresh fruits or fruit juices. "Maadan" (*Syzygium cumini*), an underutilized seasonal fruit was used in this study to produce fruit wine. The wine was produced using three concentrations of fruit juice namely low, medium and high (16.7%, 33.3% and 50%) according to the volume basis. All the fruit pulps were subjected to primary and secondary fermentation for 42 days. The produced wines were evaluated quantitatively and qualitatively and the values were compared with commercial "Merlot" wine to determine the most suitable fruit concentration. Quantitative evaluation of "Maadan" wine started with medium concentration of fruit juice showed 7 Brix^o, 1.04 Specific gravity, 4.13 pH, 0.7% Titratable acidity and 13% Ethanol amount. These values were closer to the scores of commercial "Merlot" with 7 Brix^o, 1.04 Specific gravity, 3.86 pH, 0.3% Titratable acidity and 13% Ethanol amount. Qualitatively, a sensory evaluation was carried out to evaluate appearance, aroma, taste, finish and overall acceptability of the produced wines and commercial wines. "Maadan wine" with medium concentration of (33.3%) fruit juice scored the highest median from the Friedman test. Among the three concentrations of fruit pulps used, it can be concluded that the medium fruit pulp concentration of "Maadan" (33.33 %) is qualitatively and quantitatively the most suitable for fruit wine production.

Keywords: Alcohol, "Maadan", Wine production

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Introduction

Wine has a long history of use as an early form of medication, being recommended as a safe alternative to drinking water, an antiseptic for treating wounds and as a cure for a wide range of ailments including lethargy, diarrhea, and pain from child birth. Today medical practitioners have proved that consumption of wine reduces depression, cancers and strokes. Mostly other alcoholic beverages do not have benefits like wine at moderately consumption level (Hanson, 2005).

In fruit wine production, fruit must or fresh juices, starter culture, nutrient substrate for starter culture, sugar and preservative agents are used. But, most people do not pay much attention to make fruit wines with exact amount of fruit must or juice in cost effective manner. When it is decided the final sugar level in the fruit wine, the relevant needy fruit amount could be known. In this research *Syzygium cumini* ("Maadan") was selected to produce fruit wines. This underutilized fruit has curative values and are widely used in indigenous medicine. "Maadan" fruit contains an appealing good colorant in its flesh and skin. It has good nutritional, medicinal and antioxidant properties (Shashikant *et al.*, 2012). Fermentation of fruits always gives a good commercial value addition to underutilized

fruit, and that itself increases the shelf life of the product.

In quantitative evaluation of fruit wine sugar level, acidity and alcohol levels are measured. It helps to understand whether the produced wine is up to the standard level or not and its suitability for human consumption. Wines are evaluated qualitatively by a series of sensory analysis during the process. During this sensory analysis it is expected to get an idea about the consumer's preference for wine. The quality improvement is also expected to reduce the spoilage of wine, to make the best wine by blending more wines and to get the export certifications. The present study was carried out to produce fruit wine from exact concentration of fruit must of *Syzygium cumini* in comparable to commercially available wine both quantitatively and qualitatively.

Materials and Methods

The experiment was carried out at Food Research Unit, Gannoruwa, Peradeniya, Sri Lanka. "Maadan" was brought from a vender from Trincomalee district in Sri Lanka.

Preparation of materials

Glassware was washed with detergent and rinsed severely with clean water. Cleaned glassware was dried and sterilized in hot air

oven at 160 °C for 2 hours. Working bench was cleaned with cotton wool soaked in an absolute ethanol. Fruits were washed, cut and seeds were removed with sterile knife without touching its flesh.

Production of fruit wines

"Maadan" wine was produced using following steps: washing, removing the seed, immersing in 5% salt (NaCl) solution for two days (Mohanty *et al.*, 2006), crushing the pulp with water (1:1 w/v ratio), extracting 1 L juice and dividing it into 1:2:3 (16.67%, 33.33% and 50%) volume basis ratio and chapterlization (Balancing Brix⁰ value). This ratio was taken due to the easiness of dividing the volumes into exact amounts. Finally the yeast 1 g and citric acid 1 g were added per each bottle at the same time. Each fruit juice bottle was kept at 26°C for 7 days for primary fermentation. After 7 days, the sediments were siphoned and the solutions were kept in new glass bottles again for 40days for secondary fermentation. Solution was filtered twice through Whattman number 1 filter papers in 15 days intervals. Finally bottles were pasteurized and sealed.

Quantitative analysis of wines

The Brix⁰ value, pH, ethanol content and specific gravity of commercial wine and "Maadan" wine were measured separately by using Brix⁰meter (CBX062, 28-62 Brix⁰), pH meter (Mi 150pH/temperature bench meter, Milwakuee, Martini Instruments, Hungary), ethanol meter (RHW-80VATC, 0-80%V/V alcohol) and hydrometer (range from 0.990-1.170, Peter King Trading, Australia) respectively. Titratable acidity of each wine was measured by titrating 5 ml of wine with 0.1M NaOH solution.

Qualitative analysis of wines

Sensory attributes such as appearance, aroma, taste, finish and overall acceptability were evaluated using a 5 point Hedonic scale by 15 semi trained panelists selected from the Food Research Unit, Gannoruwa, Peradeniya to compare the produced wines with commercial products.

Statistical analysis

Quantitative measurements were graphically represented. Friedman test was used to analyze the sensory data to evaluate the more preferable "Maadan" wine type by using MINITAB 14 software.

Results and Discussion

The main purpose of using 5% NaCl solution to immerse "Maadan" fruits is to reduce the tannin content (Mohanty *et al.*, 2006). "Maadan" seed

was manually removed to avoid its bitterness that comes to the juice. The baker's yeast "*Saccharomyces cerevisise*" was used in this study because of its high resistance to the higher ethanol concentrations than other species.

Quantitative parameters: As the quantitative parameters Brix⁰, pH, ethanol and specific gravity were measured from initial stage to final product.

At the initial stage, "Maadan" wine had low pH which accompanies its natural sour taste. Therefore in chapterlization (Balancing the Brix⁰ value) process, "Maadan" needs more sugar to

Table 1: Quantitative parameters developed in the initial stage of fruit juice

	pH	Brix ⁰	TA %	Specific gravity
Maadan juice	3.00	6.50	1.30	1.028

balance the final alcohol content according to the standard hydrometer tables. Juice of "Maadan" is reddish color due to the Anthocyanin pigment in "Maadan" flesh. Extracted anthocyanin was relatively unstable during frozen storage and is greatly affected by pH, organic acids content, and sugar content. Anthocyanin was more stable under acidic conditions like lower total soluble solids and higher titratable acidity conditions.

Brix⁰ value

In "Maadan" concentrations of fruit amounts positively related to its Brix⁰ values. Brix⁰ values decreased dramatically in primary fermentation within first 7days but in secondary fermentation, there is slight decrease. After siphoning at the end of the secondary fermentation Brix⁰ values became constant due to reduction of activity and growth of yeasts to ferment the remaining sugars in solutions. Yeast amount decreased due to siphoning, filtration and high ethanol content in solutions.

Specific Gravity (SG)

Change of specific gravity is mostly related with Brix⁰ values in same pattern. The final specific gravity obtained was within the specific gravity range 1.000 and 0.990 which is specified for a wine.

pH and Titratable Acidity %

pH and Titratable acidity did not show direct relationship. This nature was further reported by Roger Boulton in 1980. The drop of pH and

corresponding increased titratable acidity of juice in the aerobic phase and increased pH and decreased titratable acidity during anaerobic phase are attributable to yeast metabolism. The increase of titratable acidity at early stage of fermentation was due to the production of acid during fermentation of sugar. At the end of the fermentation, it decreases as a result of the acid being used up by the fermenting yeast to bring about desirable flavor in the wine (Omojasola and Ademuyiwa, 1975). These also show acidification of the medium during the fermentation stages, which is crucial to wine production. Usually, acidity of wines lies between pH 3 and 7 for dry wine and 3.5 to 4.5 for sweet wine.

Ethanol %

The daily aeration of the fermenting juice will also have aided rapid multiplication of the yeast cells. This causes to increase the ethanol production due to the reaction of yeast with the ingredients. This reaction occurs through many intermediary biochemical steps.

During the anaerobic fermentation stage, yeast was noted to have stopped its growth rather decreasing towards the end of the fermentation. This is likely due to higher alcohol levels in the fermenting medium. During anaerobic growth the yeast utilizes intermediate products like acetaldehydes as hydrogen acceptors for alcohol production (Okafor, 1975). At the end of juice fermentation, both fruit juices produced fruit wines. But their different concentrations of fruit amount gave different quantitative measurement values for each wine produced (Table: 2).

Qualitative parameters

The median values of sensory attributes for the treatments were analyzed. Results showed that there were significant differences among the treatments for all attributes of color, clarity, legs, aroma, taste, finish and overall acceptability at 5% significance level. No significant difference showed for "bubbles" in the all wine types. "Maadan" wine from medium concentration of fruit juice showed higher median values

Conclusion

"Maadan" wine from medium concentration of fruit juice (33.3%) had the closest quantitative

parameters to the commercial wine. According to the Friedman analysis, the consumer preference was also mostly towards the "Maadan" wine which was produced using medium concentration level (33.3%) of "Maadan" fruit juice.

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Table 2: Quantitative parameters of different "Maadan" wines produced from different concentrations of fruit juice

Wine Type	Concentration	Brix ^o	Specific gravity	pH	Acidity%	Ethanol %
Maadan	Low (16.7%)	5	1.0197	3.94	0.5	11
	Medium (33.3%)	8	1.04	4.13	0.7	13
	High (50%)	4.2	1.04	4.2	0.5	25
Merlot(Commercial)	—	7	1.04	3.86	0.3	13