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# Effect of yeast varieties on Jamun wine quality

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## Abstract

The primary objective of this study was to select the best yeast variety for the production of Jamun wine through chemical properties analysis, sensory evaluation and comparison with the commercial products and the standards of the Industrial Laboratory Center of Cambodia (ILCC). Three selective varieties of yeast including *Saccharomyces cerevisiae, Saccharomyces ellipsoideus,* and *Saccharomyces spp.* from supperfoods were used in the production of Jamun wine. The study showed that *Saccharomyces cerevisae* produced the highest alcohol content and was top scored for all sensory evaluation parameters. The relative preference of the wines based on the three varieties of yeast was 57% for wine produced by *Saccharomyces cerevisiae,* 23% for Saccharomyces *spp.* from supper foods, and 20% for Saccharomyces *ellipsoideus*. The comparison of the wine products with commercial wines showed that alcohol, methanol, ester, and tannin contents were significantly different ($P<0.05$). Nevertheless, there were no significant differences between total soluble solids, acetic and tartaric acid content. The comparison with the ILCC standards showed that the Jamun wines produced from these yeast varieties are safe for consumption, especially the product produced from the yeast *Saccharomyces cerevisae.* Therefore, the yeast *Saccharomyces cerevisae* is regarded as the most appropriate for the production of Jamun fermented wine, which it can be used at household level as well as by small and medium enterprises (SMEs).

**Keywords :** *Yeast, Jamun, wine, tannin*

## 1. Introduction

Jamun *(Syzgium cumini L.)* is a tropical evergreen tree in the flowering plant family Myrtaceae, a native plant to India and Indonesia. It is also grown in other areas of Southeast Asia, including Malaysia, Myanmar, Pakistan and Afghanistan (1). The scientific name of Jamun is *Syzygium cumini (S.cumini) (L.) Skeels*. Its common names are jambolan, black plum, java plum, Indian blackberry, Portuguese plum, Malabar plum, purple plum, Jamaica and damson plum (2).

Fruits are the major raw materials use for the production of fermented wine, which can be of high quality and attractive to the consumers because of its color and

nutritional values. Red wines are generally produced from grapes most commonly found in the tropics. Apart from these grapes, Jamun is well known as a major source of red wine. It is also considered as an underutilized fruit with potential for use for medicinal purposes, particularly for the treatment of diabetes, because of its effect on the pancreas. The fruits and seeds of Jamun contain a biochemical compound called 'jamboline', which is believed to reduce the pathological conversion of starch into sugar. Jamun fruit is also known to provide an effective treatment for bleeding piles and correcting liver disorders (3). Seed of jamun is useful for controlling diabetes, cardio-vascular and gastro-intestinal disorders (4). Juice of Jamun is also used for beverage production as well as the production of fermented wine.

Despite the general acceptance of the potential health benefits of Jamun fruit, the production season is short and price for the fruit is usually low. Therefore, this study was conducted to select the best yeast for the production of Jamun fermented wine as an alternative use for the fruit. The production of wine would potentially allow an extension of the shelf life of a product that would help reduce losses in the season of high production, while also giving better price stability during the period of high production. In order to evaluate the potential of the product on the market, Jamun wines were compared with two types of commercial wines (Randonal red and black label). It was also compared with the standard of the Cambodian Center for Industrial Laboratories (ILCC) for the safety of the product.

## 2. Materials and methods

### 2.1 Raw materials

Fully ripened Jamun furits were bought from a local market in Phnom Penh city, Cambodia, during May 2012. These fruits were stored and processed in the processing room at the Faculty of Agro-Industry, Royal University of Agriculture, Cambodia.

### 2.2 Yeast starter culture

The selective wine yeasts *Saccharomyces cerevisiae, Saccharomyces ellipsoideus,* and *Saccharomyces spp.* from supper foods were cultured in PDA tubes (Potato Dextrose Agar) overnight. When the yeasts had multiplied and mature, they were transferred from the PDA tube and immediately immersed into prepared E-flasks by using a loop. The yeast was therefore grown overnight before being to the Jamun fruit for the production of Jamun wine.

### 2.3 Fermentation of Jamun wine

Jamun fruits were de-stemmed, cleaned, and soaked in water for a day, after which the seeds were separated. The pulp was mixed with water in the ratio 1: 2 m / v (1 kg of Jumun, 2 liters of water). Sugar was added to be $22^0$ Brix to provide a potential alcohol content of 8-10% (5). Before transferring into the fermenters, sodium metabisulphite (SMS) (100 $\mu g.ml^{-1}$) was used to inhibit the growth of undesirable microorganisms such as acetic acid bacteria, wild yeasts and molds (1). Yeast in amounts of $10^6$-$10^7$ cell/ml from each yeast variety was added into the fermenters (6, 7). The fermentation was carried out for 3 weeks at room temperature.

Racking was performed three times at 30 days intervals, in order to remove any sediment deposited in the wine. The wine after racking was bottled in the bottles treated with sodium metabisulphite (SMS) (100 $\mu g.ml^{-1}$). The flow diagram for the production of Jamun wine is presented in **Figure 1**.

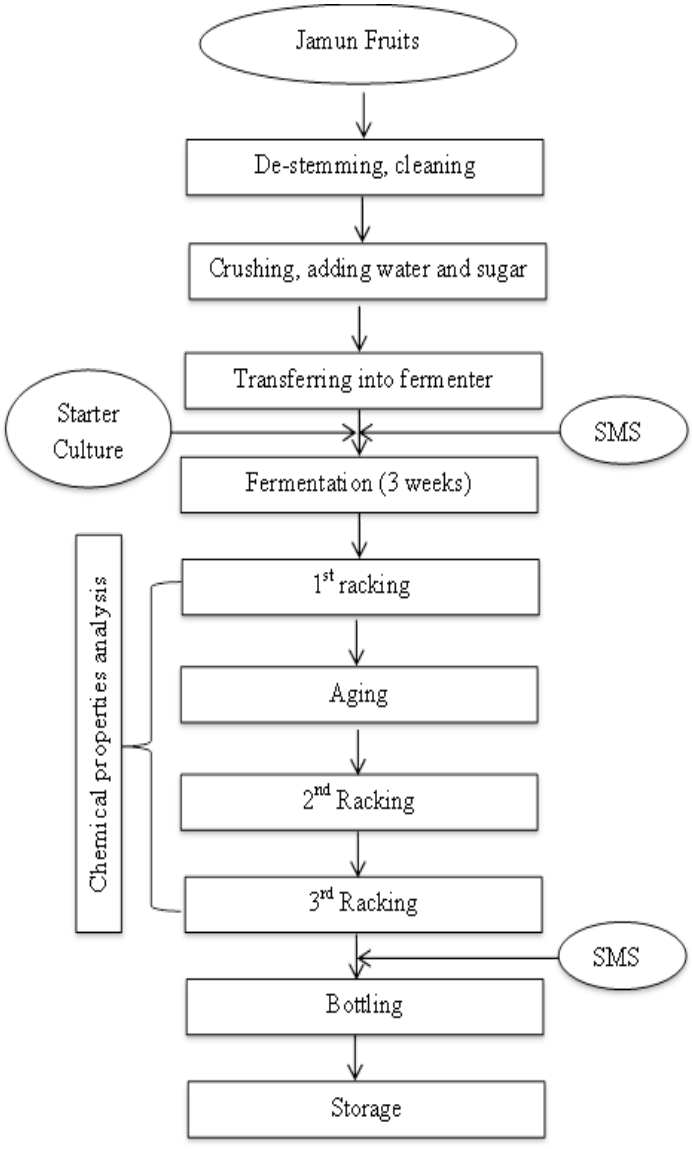


**Figure 1.** Product flow diagram of Jamun fermented wine

**2.4 Chemical properties analysis**

With respect to chemical properties analysis, pH, total soluble solids (TSS), ethanol, tartaric, acetic acid and ester, were analyzed using the methods of the Association of Official Analytical Chemists (AOAC 2005) using the modifications of Horowitz and Latimer (8). Methanol and tannin contents were determined by the method of OIV-MA-AS312-03B (9).

**2.5 Sensory Evaluation**

Jamun wine products were evaluated by 30 semi-trained taste panelists. They were asked to rate each attribute on 5 point hedonic scale with 1 = "dislike extremely"; and 5 "like extremely". Parameters assessed the sensory evaluation including color, transparency, smell, alcohol, sour taste, sweetness and bitterness taste, texture and buying level.

**2.6 Experimental design**

A completely randomized design (CRD) was used for the study, with three replicated treatments. Treatment 1 was Jamun wine produced by the yeast Saccharomyces cerevisia; treatment 2 was wine produced from Saccharomyces ellipsoideus and treatment 3 was wine produced using Saccharomyces spp. from supper foods. The ratio of pulp and water 1:2 (m/v); this means that 1 kg of pulp used 2 litters of water. The same amount of yeast was used in each treatment (106 - 107 cell/ml). Sugar was added in each treatment to reach 22 0Brix.

**Table 1.** Experimental design in the production of Jamun wine

| Treatment | Variety of yeast | Ratio (m/v) | Yeast (Cell/ml) | Sugar ($^0$Brix) |
|---|---|---|---|---|
| 1 | *Saccharomyces cerevisiae* | 1:2 | $10^6$ - $10^7$ | 22 $^0$Brix |
| 2 | *Saccharomyces ellipsoideus* | | | |
| 3 | *Saccharomyces spp.* from supper foods | | | |

2.7 Data analysis

Analysis of Variance (One-Way ANOVA) was conducted and Duncan's Multiple and Range Tests were applied to establish the differences between means of treatments. Significance was defined at $P \leq 0.05$ or 95% confidence level.

## 3. Result and discussion

### 3.1 Chemical properties of Jamun wine and its comparison with commercial wines

**Table 1.** Chemical properties of Jamun wine and its comparison with commercial products

| Chemical properties | Trt 1 | Trt 2 | Trt 3 | Rb | Rr |
|---|---|---|---|---|---|
| TSS ($^0$Brix) | 9.0 ±0.50 | 7.6 ±0.57 | 8.3±0.57 | 8.0±1.41 | 7.5±0.70 |
| Alc (%) | 10.6±0.05 $^a$ | 9.3±0.11 $^c$ | 9.9±0.20 $^b$ | 9.6±0.14 $^{bc}$ | 9.5±0.28 $^b$ |
| TA (g/l) | 0.38±0.01 | 0.38±0.01 | 0.39±0.00 | 0.37±0.02 | 0.37±0.02 |
| AA (g/l) | 0.52±0.06 | 0.52±0.06 | 0.60±0.12 | 0.36±0.16 | 0.54±0.08 |
| Est (g/l) | 0.26±0.05 $^a$ | 0.30±0.02 $^a$ | 0.28±0.03 $^a$ | 0.07±0.12 $^b$ | 0.24±0.12 $^a$ |
| Met (%) | 0.0046±0.00 $^b$ | 0.0037±0.00 $^b$ | 0.0041±0.00 $^b$ | 0.0175±0.00 $^a$ | 0.0185±0.01 $^a$ |
| Tan (mg/100ml) | 1.60±0.00 $^b$ | 2.06±0.80 $^b$ | 3.00±0.00 $^a$ | 3.00±0.00 $^a$ | 3.00±0.00 $^a$ |

Values are means ± SD. Values within each row with the same letter are not significantly different ($p<0.05$).
Rb = Radonal black, Rr = Randonal red label

The analysis of chemical properties of Jamun wine showed that TSS, tartaric acid and acetic acid, ester and methanol content of products produced from different yeasts were not significantly different. However, the alcohol and tannin contents of each treatment were significantly different ($P<0.05$). Treatment 1 contained the highest content of alcohol (10.6 ± 0.05%) followed by treatments 3 and 2 (9.9 ± 0.20 and 9.3 ± 0.11%), typically. The differences in the results could be due to differences in the capacity of the yeast varieties to convert the sugars, thereby resulting in different alcoholic contents (10). Yeasts play an important role in the food industry as they produce enzymes that support desirable chemical reactions, such as the leavening of bread and the production of alcohol and invert sugar. The most beneficial yeasts in term of desirable food fermentation are from the Saccharomyces family, especially *Saccharomyces cerevisiae* (11). Generally, total soluble solid about 22-24 $^0$Brix are able to produce an alcohol content of about 8-10% (12). Treatment 3 was associated with the highest tannin contents (3.00±00 mg/100ml). The reason for this might have been that during crushing of Jamun fruits, seed fragments were broken and presented in the wine solution and not effectively removed in the racking process, or because of fruits may have not been sufficiently ripe. Another potential contributing factor to the differences might have been due to the hydrolysis of gallic acid esters and hydrolysable tannins to glucose and free gallic acid (13, 14).

The comparison of Jamun wine products with commercial wines indicated that the alcohol, methanol, ester, and tannin contents were significantly different ($P<0.05$). The uses of different raw materials, yeast variety and technical considerations, may have contributed to these differences. However, there were no significant differences in total soluble solids, acetic and tartaric acid among the treatments.

### 3.2 Comparison of chemical properties of Jamun wine with the standard of ILCC

The Industrial Laboratory Center of Cambodia (ILCC) sets the standards for some chemical properties of fermented wine, these standards being presented in Table 3. Alcohol content of fermented wine must be between 7-15%. Acetic, methanol

and ester content of fermented wine are also restricted to <1.2 g/l, <0.15% and <0.4 g/l, respectively. The results of the analysis of Jamun wine produced in this study indicate that all treatments passed the alcohol, acetic, methanol and ester content standards of ILCC. This means that the Jamun wines were safe for human consumption despite the fact they were produced by using different yeast varieties.

**Table 2.** Comparison of chemical properties with ILCC standard

| Treatment | Alcohol content | Acetic acid content | Methanol content | Ester content |
|---|---|---|---|---|
| 1 | 10.6 % | 0.52 g/l | 0.0046 % | 0.26 g/l |
| 2 | 9.3 % | 0.52 g/l | 0.0037 % | 0.30 g/l |
| 3 | 9.9 % | 0.60 g/l | 0.0041 % | 0.28 g/l |
| ILCC standard | 7-15 % | <1.2 g/l | <0.15 % | <0.4 g/l |
| Result | (✓) Passed | (✓) Passed | (✓) Passed | (✓) Passed |

### 3.3 Sensory evaluation

The results of sensory evaluation showed that treatment 1 produced by *Saccharomyces Cerevisiae,* had the top score for all parameters related to f sensory evaluation. It scored 3.93 points for color, 3.90 points for transparency, 3.90 points for smell, 3.97 points for alcohol content, 3.96 points for sour taste, 3.80 points for sweetness, 3.63 points for bitterness, 3.63 points for likeable texture, and 4.06 points for potential retail attractiveness (buying level) (Figure 2).

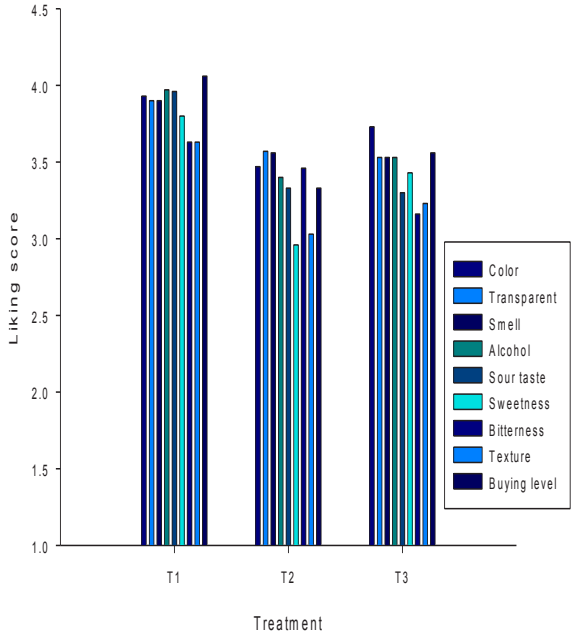


**Figure 2.** Sensory evaluation of Jamun wine

Chemical properties data and sensory evaluation of the products were compared. Treatment 1 scored in aspect of alcohol level liking, while it had the highest alcohol content and lowest acid content. Sweetness taste of the product also received the highest score, reflecting the higher total soluble solids (TTS) in the treatment 1 when compared with other treatments. However, bitterness taste was also received the highest scored while its tannin content was low. Overall, 57% of consumers indicated a preference for Jamun fermented wine produced from *Saccharomyces cerevisae,* followed by 23% for wine produced from *Saccharomyces spp*. from supper food (23%) and 20% for wine produced from *Saccharomyces ellipsoideus* (refer to Figure 3).

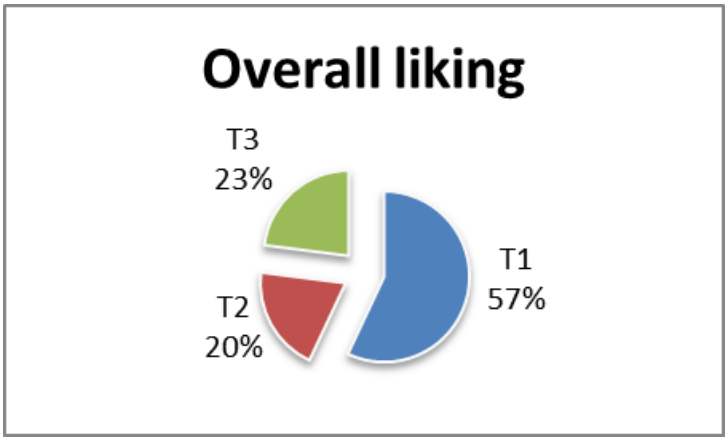


**Figure 3.** Overall liking of Jamun wine

## 4. Conclusion

Based on the analysis of chemical properties of Jamun wine, sensory evaluation, and a comparison with the commercial products available in the marketplace and the standard of ILCC, it is concluded that the yeast *Saccharomyces Cerevisiae* is the best yeast for the production of Jamun fermented wine. It is the most appropriate yeast variety for the production of fermented wine for either household use or in small and medium enterprises (SMEs).

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