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Original Research Article

PREPARATION AND QUALITY EVALUATION OF *JAMUN* (*SYZYGIUM CUMINI L*) WINE

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Abstract

The study aims to determine the effect of various strength of juice content (100%, 75%, 50% and 25%) on the chemical and sensory qualities of the wines. Sensory analysis showed that there was no significant difference among all the products with respect to colour but showed significant difference with other respect. The product prepared from 50% juice content got the highest mean score in sensory analysis. Changing pattern of pH, total sugar, TSS and acidity in all fermentations were similar but differed significantly with respect to their changing values. The average pH, Total soluble solids (TSS- ºBx), alcohol content (% m/v), acidity (% citric acid), total sugar (% dextrose) of the best product i.e juice content of 75% were found to be 3.53, 10, 6, 0.82, 6.12 respectively. Wine made from other formulations (juice content) were significantly different (at 5% level of significance) from the best formulation with respect to TSS, alcohol content, total sugar and pH but showed similarities with the product made from 100% juice content in respect of acidity. Fermentation mash containing 50% juice content, 50% water, 20ºBx TSS, and 3.4 pH was found to be optimum for wine preparation using wine yeast at ambient temperature. The optimized recipes were cost effective over other tested variations.

Keywords:quality evaluation, jamun, *Syzygium cumini L*,wine preparation.

INTRODUCTION

The term 'wine' is applied to the product made by alcoholic fermentation of grapes or grape juice, with an aging process. However, products of fermentation of other berries, fruits and honey are also called wines. These are designated by the substance from which they were made[1]. *Jamun* (In India: *Jambhul*) (*Syzygium cumini L*) is an indigenous minor fruit of Indian subcontinent. It is especially available in summer season[2]. Universally, this fruit is accepted for therapeutic values, especially for curing diabetes due to beneficial effect on pancreas. *Jamun* fruit and seeds are sweet, acid and sour. The fruit and seed contain glucoside jamboline and ellagic acids. These compounds have ability to convert sugar into starch in case of excess production of sugar. The other constituents of fruit are resin, albumen, gallic acid, essential oil and tannic acid. Seed is used in various alternative system of medicine like Ayurveda, Unani and Chinese system of medicine.

The fruit concentrate of *Jamun* has medicinal importance and has a large market for the treatment of chronic diarrhea and other enteric disorders, including its uses as an antimicrobial[3]. *Jamun* has prophylactic anti-septic effect that is associated with recruitment of activated neutrophils to the infectious site and to a diminished systemic inflammatory response[4]. Despite of its importance it is being underutilized. It is available wildly in many parts of Nepalese forest. As far as research concern, very little work has been attempted on this fruit[5]. In addition, appropriate technologies for transforming fruits in to new products are almost non-existent in Nepal. *Jamun* is perishable fruit and despite of its importance it deteriorates soon in its peak season of production. Therefore, this study aims to study on sensory and technological aspects of wine fermented by utilizing *Jamun* juice at various concentrations level.

MATERIALS AND METHODS

The total work was based on the analysis of wine made from different juice contents.

Preparation of must

Fully ripened and undamaged fruits of *Jamun* were cleaned lone seed were manually removed from the pulp. The pulp was crushed in a mixture grinder to extract juice and filtered through muslin cloth. Approximately 400 ml juice was extracted from 1 kilogram of pulp. Then analysis of TSS, pH, acidity, total sugar, reducing sugar and vitamin C was carried out. Then juice was treated with potassium metabisulphite (KMS) to inhibit growth of undesirable microorganisms. The level of free SO_2 (sulphur dioxide) now present was 100 ppm which was determined as per K. C and Rai[6].

The juice and water was varied according to the juice content of 100%, 75%, 50% and 25%. Sugar was added to maintain the TSS of 20 °Bx taking the sugar utilization property of extracted yeast into consideration and the fermentation was carried out at the same pH for all the juice and the pH of four varieties of mash was maintained at 3.4[6].

Inoculum build up

As the yeast for fermentation used was isolated from *murcha* (an indigenous Nepalese starter culture) and yeast count was maintained by inoculums build up as per K. C and Rai.

Pitching and Fermentation

Pitching was done with built inoculum. After 2 days of pitching, when the vigorous evolution of CO_2 was ceased, the necks of fermenting vessels were closed tightly with cotton plugs. The exact process followed in this was necessary to create an anaerobic environment inside vessels for improving the quality of product. The progress of fermentation was known by measuring the drop in degree brix of fermenting liquid. During the fermentation, the kinetics based on pH, TSS, acidity and total sugar were observed in every two days. The process is explained in the flow chart (Fig 1).

Jamun fruits

↓

Washing and cleaning with tap water

↓

Separating seeds from fruit

↓

Crushing the fruit pulp in mixture cum grinder

↓

Pressing and extraction of juice; Add KMS(100 ppm)

↓

Must amelioration

(Adjust TSS to 18º Brix with cane sugar and acidify the must to pH 3.4 using acetic acid)

↓

Inoculation with starter culture

↓

Fermentation (at 30±2ºc for 8 days)

↓

Racking and decantation

(Carrying out first racking when the brix reaches 2-3ºB.

↓

More racking at 15 days intervals if sedimentation persists)

↓

Clarification (add 0.04% bentonite)

↓

Final racking

↓

Bottling and corking. Add 100 $\mu g.ml^{-1}$ SMS. Fill in bottle full.

↓

Cork and seal the bottle with bees wax

↓

Jamun wine

Figure 1. Flow chart for Jamun wine preparation.

Racking, Pasteurization and Bottling.

After fermentation, the clear wine was separated from the sediment. This was done using a SO_2 treated polythene pipe into a sterile second bottle and wine was pasteurized by heating up to 70°C and cooled to room temperature. The cooled wines were racked and filled into the pre-sterilized bottles and kept in room temperature until needed for further analysis.

Analytical methods

Although different authors have described different methods and parameters to analyze wine, only the parameters and related methods, which were feasible in this laboratory, were determined in the present study. The determinations were conducted in triplicates for all parameters. The TSS of the juice mashes and wine was measured by Hand sugar refractometer (Model WYT- 32, Zhongyou Optical Instruments) and pH was measured by pH meter (digital, portable, Japsin Industrial Instrumentation).The specific gravity, alcohol content of wine was determined, following the method of Egan et al.[7]. Alcohol % by volume was determined from the standard chart of specific gravity vs. Temperature. Acidity, vitamin C reducing sugar was determined following standard methods. The total sugar was determined by Lane and Eynon method. The total ascorbic acid content was measured by direct colorimetric method as explained by Ranganna [8].

Sensory analysis

Sensory evaluation of wine was carried out using 9 points hedonic rating (where 1 = dislike extremely and 9= like extremely) tests as per Rangana, [7]. 8 panelists (gender: 5 men: 3 women; age group: 20-55) selected from post-graduate students and teachers from Sunsari Technical college, Dharan Nepal were chosen. Written consignment was taken from each panelist and the quality of product was evaluated. Tasters were not allowed to discuss their scores with one another during the evaluation session. The time of sensory was around 12:00 pm afternoon and the room temperature were about 30^{o}C.

Statistical analysis

The data were analyzed by using statistical tool (Genstat Discovery Edition 3, 2008) at 5% level of significance. The means were compared using LSD methods. Two-way ANOVA was done for sensory analysis and fermentation kinetics and one-way ANOVA was done for product analysis.

RESULTS AND DISCUSSION

Chemical composition of *Jamun* juice

Chemical properties of juice including TSS, pH, acidity, total sugar, reducing sugar, and vitamin C as determined in the laboratory are tabulated in Table 1. For best wine fermentation normally grapes juice used to have pH 3.4[6] but in this case *jamun* juice have 3.9 which is higher. This makes addition of acid at lower level to maintain optimal pH for yeast growth in jamun juice than grapes juice.

Table 1. ***Chemical composition of Jamun juice***

Parameters	Values (Mean*±S.D)
pH	3.9±0.03
Acidity, % (gm tartaric acid per 100 ml^{-1})	1.07±0.01
TSS (^{o}Brix)	13±0.04
Reducing sugar (g/l)	90±0.89
Total sugar (g/l)	113.6±2.30
Vitamin C, mg/100 gm	51.16 (0.43)

The values are the means of triplicate.

During fermentation of fruit juices for the production of wine, utilization of sugars by the yeasts results in production of alcohol and fall in ^{o}Brix of the medium. Simultaneously, other chemical changes take place, production of organic acids results in fall in pH and increase in acidity. The viable yeast count also increases and at a certain stage it reaches a plateau and then decreases. Levels of other constituents of medium like total phenols and anthocyanins also undergo changes. These changes may vary depending on fruit juice composition, stages of fermentation, pH and temperature of incubation. All these factors are characteristics of yeast strain and composition of fermentation medium.

Fermentation kinetics

Fermentation kinetics of wine was studied in every two days. All parameters taken for the study is described as follows:

pH

In all four formulations, pH-changing pattern with increasing day of fermentation is biphasic and is almost the same (Fig 4.1). The reason to decrease the pH at first stage is that there is always decrease in pH at sugar metabolism except alkaline fermentation where protein metabolism occurs. Likewise, increase in pH at second phase of the graph is due to the utilization of acid compounds by yeast on fermentation process.

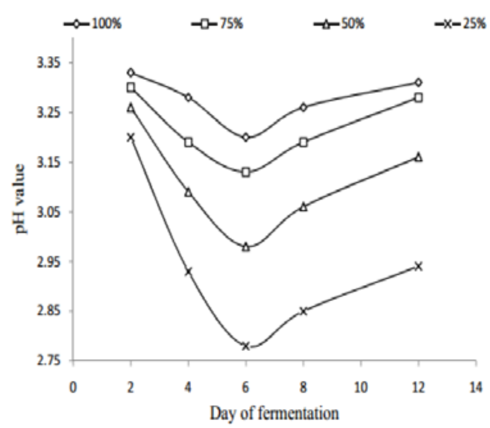

Figure 1. Graph for pH value vs Day of fermentation

The ANOVA result showed that there is significant difference in pH value among fermentation days and among formulations at 5% level of significance and LSD test was conducted to analyze the individual difference among them. pH drops down significantly in first 6 days of fermentation, which was according to findings by Banwart et al[1] for grape wine.

Acidity

All the formulations showed similar biphasic pattern of acidity change (Fig. 3.2). Acidity of all formulation increased from second day to sixth day of fermentation. Then, acidity started to decrease from sixth day to the final day of fermentation.

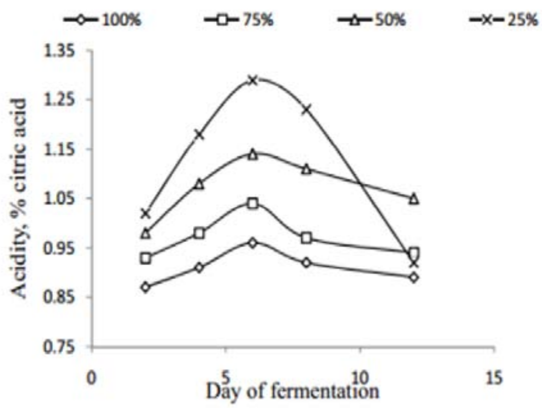

Figure 2. Acidity vs day of fermentation

Two-way ANOVA result of acidity showed that there is significant difference in acidity with reference to both fermentation days and formulations and LSD test was conducted to identify the particular difference among them.

Total Soluble Solids (TSS)

Figure 3 shows that initial TSS was decreased continuously up to the 12th day of fermentation and then it remained constant. This is the indication of alcoholic fermentation occurred continuously up to 12 days and then fermentation was supposed to be stopped.

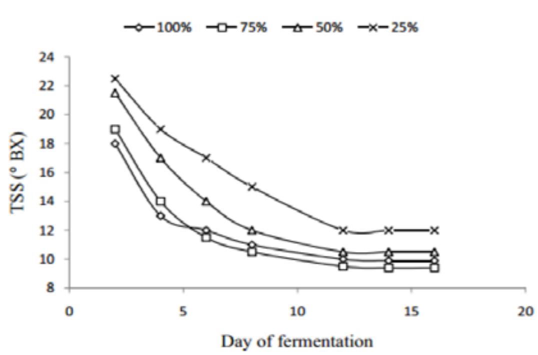

Figure 3. TSS vs Day of fermentation

Two-way ANOVA result of TSS showed that there is significant difference in TSS with reference to both fermentation days and formulations and LSD test was conducted to identify the particular difference among them. Significant difference in TSS might be due to all soluble sugars of fermented mash have been used by yeast and utilizing soluble sugar between every two days is drastically different. This means sugars been converted to alcohol in effective manner and the findings are accordance with some previous studies[1].

Total Sugars

Figure 4 shows that there was continuous decrease in total sugar until the fermentation was completed. This is because of continuous utilization of sugar by yeast to produce alcohol.

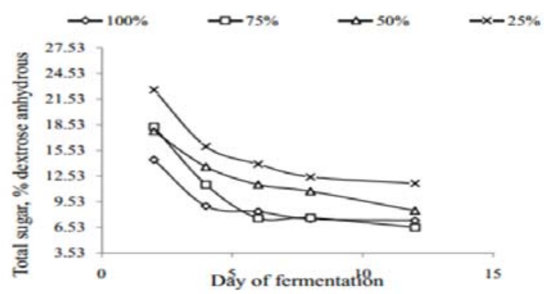

Figure 4. Total sugar % dextrose anhydrous vs Day of fermentation

Two-way ANOVA of results for total sugar showed that there is significant difference in total sugar with reference to both fermentation days and formulations. LSD test was conducted at 5% level of significance to identify the particular difference among them. This may be due to decrease in sugar utilization capacity of yeast with age[6].

Sensory Analysis

There was no significant difference in formulations based on appearance but remains indifferent based on other parameters. In sensory evaluation, the significant difference in products based on specified parameters is in the sense of liked or disliked of the product as judged by the panelists but not in sense of physicochemical characteristics of the products.

Mean score of the products in all parameters as obtained from sensory analysis is plotted in bar diagram and is given in Figure 5.

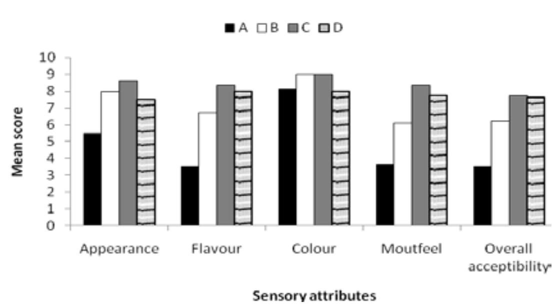

Figure.5 Mean score of the products

The statistical analysis showed that all samples A, B, C and D are significantly different (F.pr<0.05) from each other in terms of all of the sensory parameters viz. appearance, flavor, colour, mouth feel and overall acceptability.. Higher level of juice might give more acidic taste to wine and this may affect the acceptability as supported by previous study[9.] Lower level of juice concentration might be able to provide distinct flavour to wine. Adding more pure sugar to maintain TSS might not help to produce good wine instead of replacing *Jamun* juice.

Chemical properties of the product

Chemical characteristics of all four wines are given in Table 2.

Table 2. Chemical properties of wine made from varied juice content

Formulation → / parameter ↓	100%	75%	50%	25%
Alcohol content (% m/v)	4^{a}(0.11)	6^{b}(0.13)	6^{c}(0.08	6.5^{d}(0.1)
TSS (ºBx)	10.6^{a} (0.1)	10^{b}(0.2)	10.8^{ac} (0.1)	13.4^{d}(0.1)
Total sugar (% dextrose)	7.05^{a}(0.05)	6.12^{b}(0.03)	7.68^{c}(0.04)	9.73^{d}(0.06)
Acidity (% citric acid)	0.79^{a}(0.02)	0.82^{ab}(0.04)	0.89^{c}(0.01)	0.92^{cd}(0.03)
pH	3.6^{a}(0.03)	3.53^{b}(0.02)	3.37^{c}(0.01)	3.29^{d}(0.02)

*values are the means of three determinations; Figures in the parenthesis are the standard deviation. Means having same superscripts in a row are not significantly different.

From the Table, it can be concluded that there was no any similarities among the products in all parameters except in TSS and acidity. Similarities were seen in between 100% and 50% of juice content in case of TSS. Likewise there was no significant difference in acidity of 100% with 75% and 50% with25% of juice content.

CONCLUSIONS

From the sensory evaluation, it can be concluded that wine made from 75% juice and 25% water by volume is the best product among four formulation variations. However, this is not significantly different with formulations having 100% and 50% juice content in case of colour. Wine got little score in flavour having high juice content which may be due to high tannin content of *Jamun* where wine having low juice content doesnot give distinct flavour of *Jamun* Hence, the conclusion is that the wine made from formulation having 75% juice content with 25% water by volume keeping TSS at 18ºBx and pH at 3.4 was the best product.

Jamun find little application at present despite their many pharmaceutical and anti-oxidant (high anthocyanin content) properties especially against diseases like diabetes (Joshi, 2001)[10]. Asian and African countries require food-processing technologies that will meet the challenges of the peculiar food security combined with health benefits in these continents. Such technologies should be low-cost to be affordable by the poor sectors of the community and uses locally available raw materials like *Jamun*. However, more research may be conducted to find out the method for reduction of tannin concentration in *Jamun* must and consequently in wine to minimize the astringent flavour.

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