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Preperation of Red Wine by Blending of Grape (*vitis vinifera* L.) and *Jamun (Syzygium cuminii* L. Skeels) Juices Before Fermentation

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Abstract

In food processing industry blending is an art to develop different colours, aroma, astringency, body, taste to suit the requirement. Due to presence of high amount of phenolic compound, the astringency of *Jamun* wine is higher as compared to grape wine. Considering perishable nature and therapeutic value of *Jamun* the present investigation was carried out with the objective to explore the production of acceptable red wine by blending of grape and *Jamun* juice in different proportions (100:0, 75:25, 50:50, 25:75, 0:100). During study blended juices were inoculated with 7.5% inoculum level of strain *Sachharomyces cerevisiae* 4787. Fermentation was carried out at 25^{o}C. Wine thus prepared was evaluated chemically as well as organoleptically. It was observed that wine blended in ratio 75:25 ratio was more acceptable as compared to the wine blended in other ratios.

Keywords: Red wine, inoculum level, *Sachharomyces cerevisiae*, fermentation.

1. Introduction

Fruits are natural and staple food of man. These are liked by people of all age groups. Fruits are excellent sources of minerals, vitamins and enzymes. They are easily digested and exercise a cleansing effect on blood and digestive tract. In India about 20 million tonnes of foods are produced annually. But hardly 1.2% of this is utilised for processing and preservation and about 30-33% of the total production is wasted due to spoilage during handling, transportation and lack of cold storage facility (Baisya, 1980). Due to high water or juice content, they are perishable. With increased production of particular fruit in a season, there is a glut in the market. In order to minimise postharvest losses and to avoid market glut, fruits are need to be effectively

utilised in processing industry (Sahota and Sunil, 2006). Hence, many products like jam, jelly, squash, RTS, syrup etc., are made from fruits with preservatives which increase their shelf life substantially. Most of these products contain high level of sugar. Which are considered to be harmful to human health, if taken in excess quantity. The technology of fermentation of fruit juices to produce wines seems to be promising in this respect. Being a fruit based beverage, wine provides minerals, vitamins and energy. Wine is a product of grape sugar metabolism through alcoholic fermentation of yeast having long shelf life. Ethanol, organic acids, glucose, fructose, glycerol, phenolic compounds, proteins, polysaccharides, volatiles and minerals such as potassium are listed among its basic constituents. Wine is a safe and healthful beverage. The alcohol in wine stimulates gastric secretions and depresses nervous system. The excess consumption of wine however, causes severe depression in coordination of movements and loss of consciousness (Chavan, 2008). It is not known when, by fortunate accident, man first discovered that the juice of grapes when allow to ferment become wine. Wine has been use as food and medicine since ages. Red wine has been shown to reduce the heart disease (Boucheron, 1995). The existence of phenolic compounds in red wine has positive health effect against cardiovascular disease, cancer and brain degenerative process due to their antioxidant activity (Budak and Guzel-Seydim, 2010). Low molecular weight organic acid largly contribute to composition, stability and organoleptic properties of wine (Glampedaki, 2010). The word wine is used to mean only grape wine as most of it is produce from grapes. The grape (*Vitis vinifera* L.) is a non-climacteric fruit belongs to family *vitaceae* and growing under variety of soil and climatic conditions. Grapevines are indeterminate, woody, perennial, deciduous, tree-climbing vines. Major grape growing states are Maharashtra, Karnatka, Andhra Pradesh, and Tamilnadu and northern western region covering Punjab, Haryana, Delhi, Western Uttar Pradesh, Rajasthan and Madhya-Pradesh (Prasad and Kumar, 2010). Grapes fall broadly into three classes of fruit colour: white, red and black. In red and black grapes, the colour is due primarily to anthocyanins. Grapes being perishable in nature increasing production level to heavy losses due to inadequate demand in domestic market and limitation of export opportunities. Here the grape wine processing is a ray of hope for grape grower (Pawar et al. 2007). Grapes are also used for making jam, jellies, juice, vinegar drugs, grape extract, raisins and grape seed oil. Wine is the important use of grapes. Grape phytochemical such as resveratrol (polyphenol antioxidant) have been positively linked to inhibiting cancer, heart disease, degenerative nerve disease, viral infection (Janick and Paull, 2008).

Wine can also be prepared from other fruits. In India significant amount of work for wine making from minor fruit such as *Jamun* is underway because of importance of these fruit from therapeutic point of view. *Jamun* (*Syzygium cuminii* L. Skeels) of family *myrtaceae* is an important but underutilised fruit crop of India. The plant grows naturally in clayey loamy soil in tropical as well as in sub tropical zones of Indo-gangetic plains (Rai et al, 2011). Fruits are dark red purple, ovoid in shape, tasty and have pleasant flavour. The fruit is rich source of vitamin C and vitamin A. It comprises glucose and fructose as principle sugar. *Jamun* has received far more recognition in folk medicine and pharmaceutical trade than other field. Its fruits are known for

medicinal value like anti diabetic, astringent, stomatic, carminative, antiscorbatic and diuretic (Patel et al, 2005). The attractive colour due to anthocyanins pigment (antioxidant) is a major quality attribute in *Jamun* beverage. *Jamun* beverage is acidic, astringent and is therefore, not generally preferred for table consumption. The bright and brilliant purple coloured *Jamun* juice can, however be successfully used for blended beverage (Gehlot et al, 2008). In food processing industry blending is an art to develop different colours, aroma, astringency, body, taste to suit the requirement. Low grade product would be upgraded to product of superior quality by blending of two or more different types of food entities having desired attributes. Thus, end product possessing new, superior or more attractive colour, taste, aroma, flavour and nutritional quality can result from blending.

Due to presence of high amount of phenolic compound, the astringency of *Jamun* wine is higher as compared to grape wine. In present work an attempt has been made to prepare red wine by blending of grape and *Jamun* juice in different proportions before fermentation in order to reduce astringency and compare the acceptability of wine.

2. Materials and Methods

2.1 Grape and Jamun fruits and wine yeast

The fresh ripened Grape and *Jamun* fruits were procured from local market of Hisar and used for preparation of wine. Pure cultures of *Sachharomyces cerevisiae* strain 3304 and 3604 were obtained from National Chemical Laboratory, Pune and strain 4787 was obtained from IMTECH, Chandigarh.

2.2 Extraction of *Jamun* juice

Ripe fruits were washed thoroughly with tap water containing 200ppm of potassium metabisulphite and the pulp was separated manually from the seeds. The pulp was then homogenized in the blender to obtain fine pulp and juice was extracted by hand pressing through muslin cloth.

Jamun fruit
↓
Washing with tap water containing 200ppm of potassium metabisulphite
↓
Seed separation
↓
Homogenization
↓
Extraction of juice through muslin cloth
↓
Fruit juice

Fig. 1: Flow sheet for extraction of *Jamun* juice.

2.3 Extraction of grape juice

Ripe grape fruits were washed thoroughly in running water. The pulp was then homogenized in the blender to obtain fine pulp and juice was extracted by hand pressing through muslin cloth.

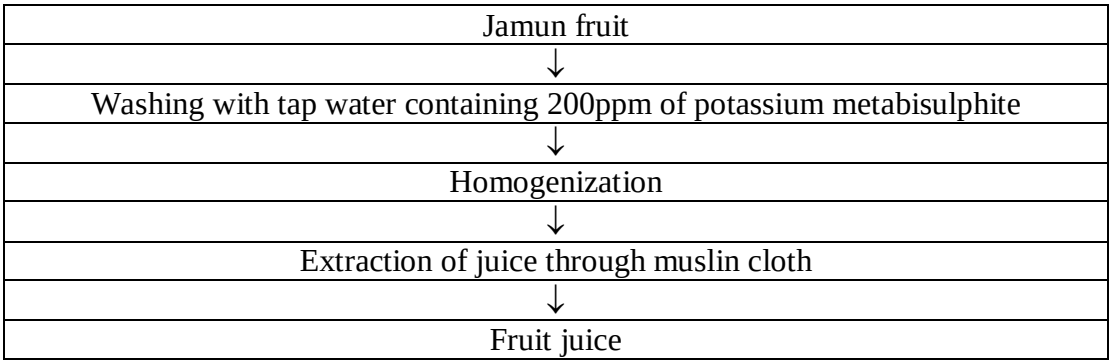

Fig. 2:Flow sheet for extraction of grape juice.

2.4 Fermentation of juice

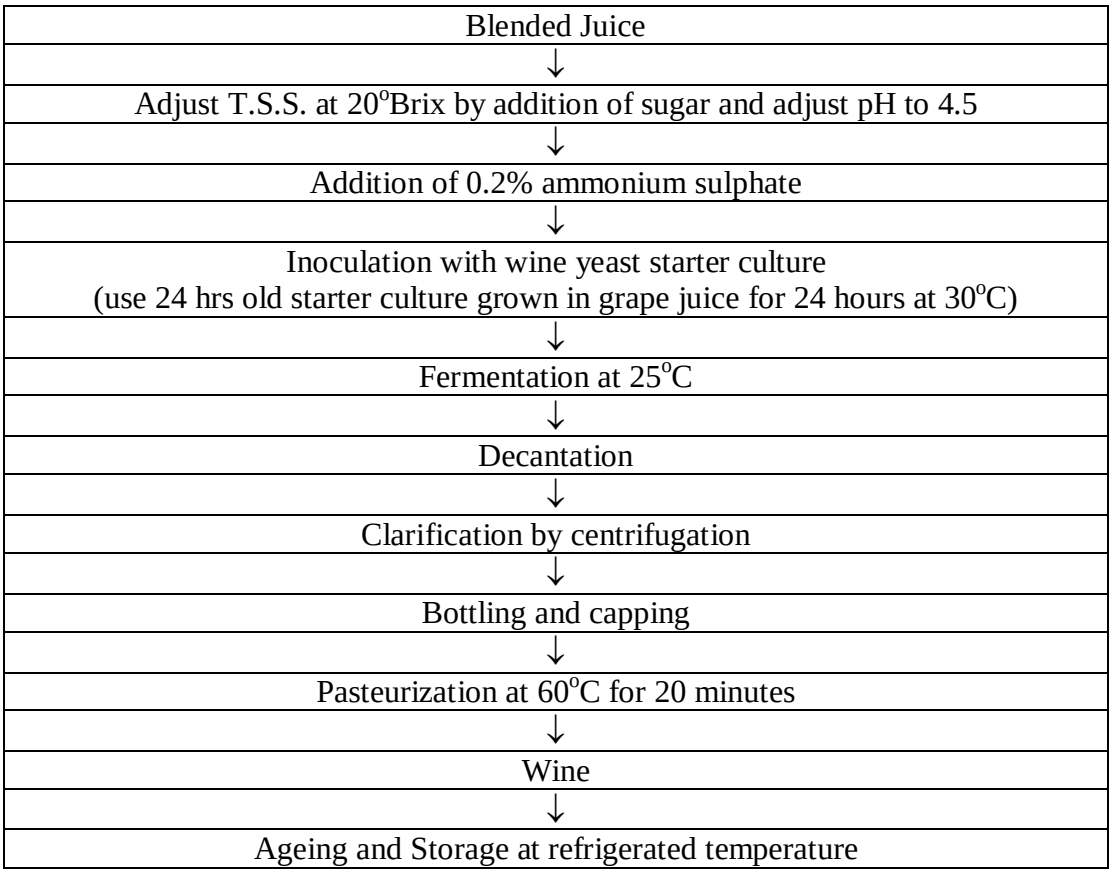

Fig. 3: Flow sheet for preparation of wine.

The initial ^{o}Brix of grapes and *Jamun* juice were recorded with the help of hand refractometer. The fruit juice was then ameliorated to 20^{o}Brix by addition of sugar. pH of juices were recorded with the help of pH meter and adjusted to 4.5. The juices were than supplemented with 0.2% ammonium sulphate to provide additional nitrogen for the growth of yeast. Then, grape and *Jamun* juice were mixed in different proportions (100:0, 75:25, 50:50, 25:75, 0:100). This blended juice was inoculated with 7.5% inoculum level of strain *S. cerevisiae* 4787 and allowed to ferment at 25^{o}C in flasks. Samples were withdrawn at regular intervals for the chemical analysis. The observations were continued till fall in ^{o}Brix stayed. The wine was then clarified by centrifugation at 5700 rpm for 10 minutes. After that wine was bottled and pasteurized at 60^{o}C for 20 minutes and stored at refrigerated temperature. The blended red wine obtained from this treatment was analysed for organoleptic acceptability.

2.5 Chemicals

The chemicals used for investigation were of analytical grade reagents (A.R.) obtained from Glaxo India Ltd., Bombay, E. Merck, India and Himedia.

2.6 Chemical Analysis

T.S.S was recorded by hand refractometer (0-32 scale) and pH was recorded with the help of pH meter. Acidity (%) and total phenols (mg/100ml) were analyzed as per the procedure suggested by AOAC (1990).

Sugars were estimated by the method developed by Lane and Eynon (1923). Alcohol contents in beverage were determined by methods of Caputi et al. (1968). Yeast viable count (CFU/ml) was determined by total plate count method.

2.7 Organoleptic Evaluation

A 100 point score card was used to record organoleptic quality of wine. The wine samples were evaluated organoleptically by 10 semi trained judges.

2.8 Statistical Analysis

The data obtained was subjected to analysis of variance (ANOVA) technique and analyzed according to factorial completely randomized designs (CRD). The critical difference value at 5% level was used for making comparison among different treatments.

3. Results and Discussion

3.1 Chemical composition of fresh grape and *Jamun* juice

The data in table 1 depicts the results obtained for chemical composition of grape and *Jamun* juice used for wine making. The data show that average grape and *Jamun* juice recovery were (76.3 and 70.3%). Chemical constituents of grape and *Jamun* juice such as TSS, pH, acidity, total and reducing sugars were found to be (18.6 and 12.3ºBrix), (4.7 and 4.3), (0.9 and 1.07%), (151.3 and 113.6 g/l) and (140 and 83 g/l), where as phenols and anthocyanins were recorded to be (21.8 and 100 mg/100ml) and (130 and 140 mg/100ml) respectively. It was observed that *Jamun* juice contain high phenolic

content, as compared to grape juice, which is responsible for its astringency. In present work efforts have been made to prepare blended red wine from grape and *Jamun* juice having reduced astringency.

Table 1: Chemical analysis of grape and *Jamun* juice.

Parameters	Mean*±S.D	
	Grape juice	**Jamun Juice**
Juice recovery (%)	76.3±2.33	70.3±2.60
T.S.S(°Brix)	18.6±0.70	12.3±0.50
pH	4.7±0.04	4.3±0.03
Acidity	0.9±0.00	1.07±0.01
Total sugar(g/l)	151.3±3.50	113.6±2.30
Reducing sugar (g/l)	140±4.80	83±0.92
Phenols (mg/100ml)	21.8±2.5	100±11.5
Anthocyanins (mg/100ml)	130±0.45	140±0.64

* The values are mean of three replications.

During fermentation of fruit juices for the production of wine, utilization of sugars by the yeasts results in production of alcohol and fall in °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.

3.2 T.S.S

It can be interfered from table 2 that there was gradual decrease in °Brix during fermentation. The decline in °Brix was faster in case of juice blended in 100:0 (grapes: *Jamun*) ratios as compared to other combinations.

Table 2: Effect of blending of grape and *Jamun* juice on brix during fermentation at 25°C

Treatments			**Fermentation time (Days)**			
Grapes:Jamun	**0**	**2**	**4**	**6**	**8**	**Mean**
100:0	20	14	10	6	6	**11.2**
75:25	20	14	11	8	6	**11.7**
50:50	20	15	12	9	6	**12.4**
25:75	20	15	10	9	6	**12.0**
0:100	20	16	12	8	6	**12.4**
Mean	**20.0**	**14.8**	**11.0**	**8.0**	**6.0**	

CD at 5%

Fermentation Time (F.T): 0.00 Blend ratio (B.R): 0.00F.T×B.R: 0.00

It was observed that as the percentage of grape juice decreased in other combinations, decline in Brix was slower. The probable reason could be the presence of *Jamun* juice in which conversion factor is lower as compared to the grape juice, due to presence of some compounds which inhibits the growth of yeast strain. However, the final brix was same at the end of the fermentation in all the treatments. The fermentation was faster during second to sixth day of fermentation. The reason probably could be the high nutrient level and low alcohol content in fermentation medium during this period.

3.3 pH

Table 3 reveals that there was significant effect of Fermentation Time and Blend ratio on the pH of the fermentation medium during fermentation. It was observed that there was gradual decrease in pH of fermentation medium during fermentation. This observation is in accordance with those of Chowdhury and Ray (2007). In case of blend ratio 75:25 the pH decreases from 4.5 to 3.7 which were lower as compared to other ratios. In other ratios, pH value at the end of fermentation was comparable.

Table 3: Effect of blending of grape and *Jamun* juice on pH during fermentation at 25^{o}C

Treatments			**Fermentation time (Days)**			
Grape:Jamun	**0**	**2**	**4**	**6**	**8**	**Mean**
100:0	4.5	4.43	4.34	3.90	3.90	**4.2**
75:25	4.5	4.39	4.29	3.76	3.70	**4.1**
50:50	4.5	4.41	4.32	3.88	3.81	**4.2**
25:75	4.5	4.41	4.37	3.93	3.87	**4.2**
0:100	4.5	4.44	4.39	4.00	4.00	**4.3**
Mean	**4.5**	**4.4**	**4.3**	**3.9**	**3.8**	

CD at 5%

Fermentation Time (F.T): 0.007 Blend ratio (B.R): 0.007 F.T× B.R: 0.017

3.4 Alcohol (%)

As the fermentation was progressed, the alcohol content was increased (table 4). It was observed that alcohol production was faster in case of fermentation medium of ratio 75:25 and 25:75 on the second to sixth day of fermentation as compared to other combinations. The increase in alcohol content was proportionate with decline ^{o}Brix. In case of ratio 0:100 (grape: *Jamun*) alcohol content observed was 9.7%. This observation is in agreement with reports of Borate et al. (2008). The probable reason could be the fruit juice having relatively lower levels reducing sugars. The final alcohol content of blended juice in ratios 75:25, 50:50 and 25:75 after fermentation was found to be around 12%.

Table 4: Effect of blending of grape and *Jamun* juice on alcohol (%) during fermentation at 25ºC

Treatments		Fermentation time (Days)			
Grape:Jamun	**2**	**4**	**6**	**8**	**Mean**
100:0	3.0	3.5	7.8	10	**6.0**
75:25	4.9	6.1	11.0	12.0	**8.50**
50:50	1.0	5.7	12.0	12.1	**7.72**
25:75	3.8	6.5	12.0	12.0	**8.56**
0:100	1.6	2.0	7.0	9.7	**5.1**
Mean	**2.9**	**4.9**	**9.9**	**11.1**	

CD at 5%
Fermentation Time (F.T): 0.12 Blend ratio (B.R): 0.14 F.T× B.R: 0.27

3.5 Yeast viable count (CFU/ml)

The result presented in table 5 indicates that the growth rate of yeast was higher in the initial stage of fermentation and it was higher in case of juice blended in ratio of 75:25.The growth rate of yeast decreased at the end of the fermentation decreased probably due to low level of nutrients and inhibitory action of alcohol. Similar observations have also been reported by Charoenchai et al. (1998).

Table 5: Effect of blending of grape and *Jamun* juice on viable yeast count (CFU/ml) during fermentation at 25ºC

Treatments			Fermentation time (Days)		
Grape:Jamun	**0**	**2**	**4**	**6**	**8**
100:0	6.7×10^{6}	5.8×10^{7}	1.0×10^{8}	7.0×10^{7}	9×10^{6}
75:25	9.8×10^{6}	5.0×10^{7}	9.8×10^{7}	7.6×10^{7}	6.7×10^{7}
50:50	1.0×10^{7}	2.6×10^{7}	4.7×10^{7}	8.6×10^{7}	6.0×10^{7}
25:75	1.0×10^{7}	1.1×10^{8}	1.4×10^{8}	3.0×10^{7}	2.5×10^{7}
0:100	9.3×10^{6}	1.3×10^{8}	1.2×10^{8}	9.8×10^{7}	8.0×10^{6}

4. Organoleptic Quality

Clarity, colour/appearance, taste and body are the characters responsible for acceptance and rejection of any wine (Shukla et al, 1991). From table 6 it is clear that blended red wines for sensory attributes viz. Colour/appearance, taste, body, aroma, astringency and overall acceptability parameter got good scores of good acceptability. But it was observed that the acceptability of wine prepared from blending of juice in 75:25 (85.6) was slightly higher as compared to 100:0 (83.9) and 0:100 (81.6) or we can say that individual wines. The probable reason could be the reduction in astringency due to grape juice and enhancement in colour, aroma and flavour due to *Jamun* juice, which are mixed together before fermentation. Patil et al. 2006 observed that wine prepared by blending of pomegranate variety Ganesha with Arakta in 2:1 ratio got 16.5 overall acceptability score out of 20 as compared to wine prepared only from Ganesha (11).

Table 6: Effect of blending of juice in different proportions before fermentation on organoleptic quality of wine

(Grapes:Jamun)	Color/ Appearance (20)	Taste (20)	Body (20)	Aroma (20)	Astringency (20)	Overall acceptability (100 Max)
100:0	17.5 ± 0.7	16.4 ± 0.4	17.1 ± 0.7	16.7 ± 0.4	16.2 ± 0.9	83.9 ± 2.4
75:25	17.9 ± 0.3	16.7 ± 0.3	18.0 ± 0.3	17.2 ± 0.2	15.8 ± 0.6	85.6 ± 0.9
50:50	18.2 ± 0.2	16.4 ± 0.3	18.0 ± 0.3	16.9 ± 0.2	15.6 ± 0.7	85.1 ± 1.3
25:75	17.7 ± 0.3	15.8 ± 0.4	17.8 ± 0.3	17.0 ± 0.2	14.8 ± 0.7	82.9 ± 0.9
0:100	17.7 ± 0.3	15.5 ± 0.4	18.1 ± 0.3	16.9 ± 0.3	13.40 ± 0.9	81.6 ± 1.2
CD (≤ 0.05%)	**N.S**	**N.S**	**N.S**	**N.S**	**N.S**	**N.S**

5. Conclusions

It can be concluded from present investigation that blending of grape juice with *Jamun* juice before fermentation helps in reduction of astringency with improvement in taste, body, color and aroma of final wine. It was observed that acceptable red wine can be prepared by mixing of grape and *Jamun* juice but acceptability of red wine was more when juices were blended in 75:25 (grape: *Jamun*) ratios before fermentation due to presence of *Jamun* contents in little amount which enhance the taste and color of wine after blending with grape juice. Considering neutroclinical value and perishable nature of grape and *Jamun* fruits, these can be better utilized for preparation of red wine by blending in appropriate ratios.

Finally, it can be concluded that blending of juices provide a product with different taste, flavor and aroma, this process can be further used for production of wine with particular sensory attributes.

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