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Effect of yeast strains and must types on quality of jamun wine

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ABSTRACT : Jamun (*Syzygium cumini* L.) is a tropical fruit rich in anthocyanin and having array of medicinal (antidiabetic) properties. The wine was prepared from jamun fruits by using two different yeast strains *i.e. Saccharomyces cerevisiae* var. *ellipsoideus* and *Saccharomyces cerevisiae* var. *bayanus* fermented on three different *must* types *i.e.* juice, pulp + skin and pulp + skin + seeds. TSS and pH of the *must* were adjusted to 24 ^{0}B and 3.2, respectively. The physic-chemical and sensory qualities of wine were evaluated at 3 and 6 months of ageing in cold (13±1^{0}C). The maximum ethyl alcohol of 7.92 per cent and wine recovery of 86.15 per cent was recorded in the treatment T_2 (pulp+skin+ *Saccharomyces cerevisiae* var. *ellipsoideus*). Tannin content was least when *Saccharomyces cerevisiae* var. ellipsoideus fermented with juice (T_1). Sensory evaluation of jumun wine indicated that wine is acceptable with fruity flavor, colour and body. Treatment T_2 (pulp+skin+ *Saccharomyces cerevisiae* var. *ellipsoideus*) secured the highest score of 15.86 out of 20.0 after six months of ageing.

KEY WORDS : Jamun, Must type, Yeast strain, Anthocyanin, Sensory quality

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Jamun fruits are a very rich source of antioxidants and have numerous health benefits. The fruits are abundant source of anthocyanins and also contain a biochemical called 'jamboline' which is believed to check the pathological conversion of starch into sugar in case of increased production of glucose.

Fruit wines are un-distilled alcoholic beverages which are nutritive, more tasty and mild stimulants. Wines made from fruits are often named after the fruits. The jamun fruits are also used to make wine during its short availability period and the fruit also has a very short shelf life (1-2 days). The jamun wine was reported to high in tannins and a strong astringent taste with 6 per cent alcohol (Chowdhury and Ray, 2007). The quality of wine differs with varying processing parameters. Hence, an attempt was made in this study to prepare wine from jamun by using two wine yeast strains, *Saccharomyces cerevisiae* var. *ellipsoideus* and *Saccharomyces cerevisiae var. bayanus* fermented on three *must* types *viz.*, juice, pulp plus skin and pulp, skin and seed. The physico-chemical and sensory qualities were studied in the prepared wine.

RESEARCH METHODS

The study on wine preparation from jamun fruit was carried out in the laboratory of Department of Post Harvest Technology, K.R.C. College of Horticulture, (University of Horticultural Sciences, Bagalkot), Arabhavi, Gokak taluk and Belgaum district of Karnataka during the period from 2011 to 2012. Ripe fruits were brought from the orchard of Fruits Science Department, K.R.C. College of Horticulture, Arabhavi. They were washed thoroughly in water to remove the dirt and foreign materials adhering to the fruits. The washed fruits were squeezed to extract the pulp. To separate seeds and skin, the extract was filtered through a clean muslin cloth to obtain juice.

Wine yeasts *viz.*, Y1*: Saccharomyces cerevisiae var ellipsoideus* and; Y2: *Saccharomyces cerevisiae var. bayanus* were rehydrated according to the manufacturers recommendations and inoculated at 0.2g/l after ameliorating the TSS to 240B and pH to 3.2. The flow chart for the preparation of wine is furnished in Fig. A.

The wine was prepared with different treatments (Fig. B) *viz.*, T_1 (Y_1 fermented with juice), T_2 (Y_1 fermented with pulp + skin), T_3 (Y_1 fermented with pulp + skin + seed), T_4 (Y_2

Ripe jamun fruits
↓
Washing and pulping
↓
Must type: Juice; Pulp+Skin; Pulp+Skin+Seeds
↓
Brix (24°B) and pH adjustment (3.2)
↓
.Addition of sodium benzoate at 100 ppm and leave of four hours
↓
Yeast inoculation (0.2 g/l of *must*) 1. *Saccharomyces cerevisiae var. Ellipsoideus* and; 2. *Saccharomyces cerevisiae var. bayanus.*
↓
Aerobic fermentation for 24 hours
↓
Anaerobic .fermentation for 14 days
↓
Siphoning and racking clear wine
↓
.Addition of bentonite (0.4 g/l)
↓
Siphoning (2-3times) to get clear wine
↓
Filling to sterile bottles & corking
↓
Pasteurization @ 65°C for 30 min
↓
Aging in cold storage (14±1°C)

Fig. A : Flow chart for the preparation of jamun fruit wine

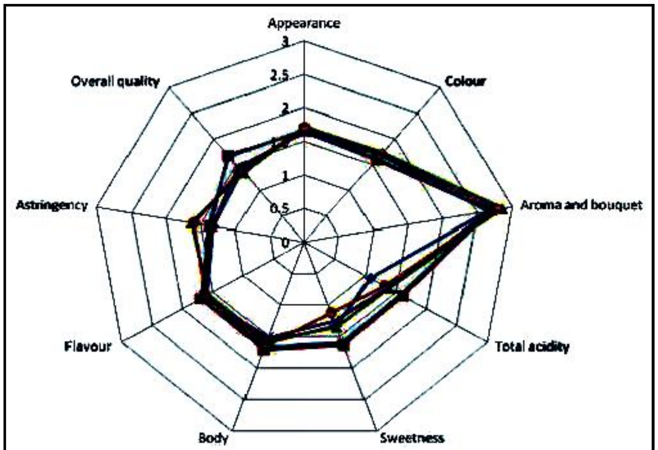

Fig. B : Effect of different yeast strains and *must* types on sensory qualities after six months of aging in jamun wine

fermented with juice), T_5 (Y_2 fermented with pulp + skin), and T_6 (Y_2 fermented with pulp + skin + seed). There were three replications for each treatment and the experiment laid in Completely Randomized Design.

Wine was analyzed for various physico-chemical characters as per the standard procedure given by (Ranganna, 1977) for fresh wine and after three and six months of ageing.

The sensory quality of coded samples of wine was determined by a group of five trained panel using a twenty point scale (Amerine *et al.*, 1972) which was based mainly on the appearance (0-2), colour (0-2), aroma and bouquae (0-4), acidity (0-2), sweetness(0-2), body (0-2), flavor (0-2), astringency (0-2) and overall acceptability (0-2). The wine was graded according to the score card *viz.*, 17-20 wines with outstanding characteristics and no marked defect; 13-16 wines of commercial acceptability, 09-12 wines of commercial acceptability but with a noticeable defect; 05-09 standard wines with neither an outstanding character nor defect; and 01- 04 completely unacceptable wines.

RESEARCH FINDINGS AND DISCUSSION

The effect of yeast strains and must types on physico-chemical parameters are presented in Table 1 and 2. There was a significant differences recorded with respect to TSS of fresh and aged wine. The TSS of the wine showed a declining trend during the ageing in all the treatments. The lowest TSS (7.40ºB) was recorded in the treatments T_2 (7.40ºB) and T_5 (7.40ºB) after 6 months of ageing. The reduction in the TSS during aging of wines is expected to be due to the slower yeast activity that may still prevail during aging which converts sugars into alcohol (Owen *et al.*, 2004). Post fermentation changes in cashew wine showed a decrease in TSS from 8.0 to 6.0 per cent. Joshi *et al.* (2005) reported TSS of 8 peach cultivars varied from 7.60 to 9.180B.

pH of the wine in fresh and during ageing recorded an increasing trend. The highest pH of 3.58 in fresh wine in T_2 increased to 3.81 and 3.91 during 3 and 6 months, respectively. During aging, all the treatments have recorded an increase in

Table 1 : Effect of yeast strains and must types on TSS (^{0}B), pH, reducing sugar(%), non reducing sugar(%) and total sugars(%) in jamun wine

Treatments	TSS (^{0}B)			pH			Reducing sugar (%)			Non reducing sugar (%)			Total sugar (%)		
	Fresh wine	Ageing 3MS	Ageing 6MS	Fresh wine	Ageing 3MS	Ageing 6MS	Fresh wine	Ageing 3MS	Ageing 6MS	Fresh wine	Ageing 3MS	Ageing 6MS	Fresh wine	Ageing 3MS	Ageing 6MS
T_1	11.40	11.20	8.70	3.30	3.48	3.52	7.36	6.79	5.86	3.76	4.17	3.73	11.12	10.96	9.20
T_2	8.03	7.80	7.40	3.58	3.81	3.91	3.98	3.74	3.71	3.70	3.38	3.13	7.68	7.12	7.03
T_3	9.71	8.80	8.40	3.28	3.64	3.72	4.82	4.79	4.70	4.28	3.80	3.34	9.10	8.59	8.04
T_4	12.62	11.40	11.26	3.26	3.32	3.46	7.98	7.87	7.72	4.15	3.22	2.13	12.13	11.09	9.85
T_5	8.61	8.40	7.40	3.48	3.98	4.02	4.49	4.01	3.92	3.95	4.22	3.24	8.44	8.23	7.16
T_6	9.48	9.13	9.01	3.36	3.42	3.62	5.79	5.03	4.72	3.27	3.83	3.07	9.06	8.86	8.79
Mean	9.96	9.45	8.69	3.41	3.61	3.70	5.73	5.37	5.10	3.85	3.77	3.23	9.58	9.14	8.33
S.E.±	0.21	0.19	0.14	0.04	0.06	0.07	0.16	0.13	0.23	0.11	0.09	0.05	0.34	0.36	0.29
C.D. (P=0.01)	0.71	0.68	0.48	0.16	0.19	0.24	0.54	0.46	0.81	0.36	0.29	0.18	1.05	1.16	0.98

the pH. Similar observations of increase in pH after fermentation and during aging have been recorded by Shankar *et al.* (2004) in guava wine. The pH of the jambal wine was ranged from 3.5 to 3.4 (Shukla *et al.*, 1991). The increase in pH was due to reduction in acidity through precipitation of potassium tartrate salts from wine or due to enhanced synthesis of esters from ethyl alcohol and volatile acids.

The treatment T_2 recorded the lowest total sugar content at three and six months of aging (7.12% and 7.03%), respectively. Similar trend was observed with respect to change in the reducing and non reducing sugar level of jamun fruit wine before and after aging. The low content of residual sugars of litchi wines indicates that almost all the reducing sugars were consumed during fermentation (Singh and Kaur, 2009). The variation in the residual sugars of wine due to treatment differences have been reported by Somesh *et al.* (2009) in strawberry wine. Kotecha (2010) recorded total residual sugar of 4.30 per cent in pomegranate wine to 7.17 per cent in banana wine.

The titratable acidity is an important parameter used to measure the quality of wine (Olasupo and Obayori, 2003). The ideal acidity in the wine is dependent on the style and preferences of the consumer. The mean titratable acidity contents were 1.34 %, 0.97 % and 0.80 %, for fresh and after 3 and 6 months, respectively. Titratable acidity of litchi wine was 0.78 per cent and pH 3.05. Titratable acidity of any fruit wine is an important characteristic varying between 0.5-1.0 per cent (Joshi, 1998). The acidity of fruit wine is dependent upon a number of factors like type of fruit, method of preparation and type of yeast used. The decrease in the acidity during aging might be due to combination of acids with alcohol to form esters which adds aroma to the wine during aging (Shankar *et al.,* 2004). The variation in the titratable acidity level due to treatment differences have been accounted in strawberry wine (Somesh *et al.*, 2009).

Tannins are one of the important parameters in wine which gives subtle aroma and bouquet during aging. The level of tannins recorded non significant differences among the treatments. There was a decrease in the per cent of tannins in all the treatments, this may due to hydrolysis of poly phenols to isoprenoid (Jackson, 1994). The similar trend was recorded by Sharma and Joshi (2003) in strawberry wine.

The colour of jamun wine (OD value) in fresh and aged wine showed significant variation among the treatments. The treatment T_6 recorded higher OD value of 2.32 after six months of aging. The colour in general was more in all the cases, where skin is used as the *must* along with the pulp. In many fresh including jamun, the majority of the water-soluble anthocyanins is located in the skins and gets extracted into the wine during alcoholic fermentations (Zoecklein *et al.*, 1995). The change in colour of wine made from guava at different stages of maturity was attributed to variation in the pigmentation of fruits (Anderson and Badrie, 2005).

The high ethyl alcohol content of 7.45 per cent in the fresh wine was noticed in the treatment T_2. It can be attributed to the higher amount of available sugars and the favorable *must* conditions for fermentation. During aging, the alcohol level increased slightly in all the treatments. This increase might have been due to very slow fermentation that occurred during aging. The treatment T_2 continued to exhibit significantly higher ethanol content of 7.73 and 7.92 per cent after three and six months of aging, respectively. Kotecha (2010) recorded a similar range of alcohol content in wines of jamun (8.40%), and sapota (7.20%). In some treatments, there was decrease in the alcohol content. Auto oxidation of alcohol to esters or aldehydes or due to combining ability of alcohol with acidity of wine to form esters was observed in guava wine (Shankar *et al.,* 2004).

The wine recovery showed significant differences due to the influence treatments. The wine recovery recorded a wide range from 73.47 to 86.15 per cent which may be attributed to the difference in the composition in the *must*. The treatment T_2 exhibited the highest recovery percentage of 86.15. Saravana *et al.* (2001) in strawberry reported differences in wine yield due to treatment differences. The fermentation potential of each organism varies from strain to strain and also depends

Table 2 : Effect of yeast strains and must types on titratable acidity (%), tannin (%), colour (OD), ethyl alcohol (%) and wine recovery (%) in jamun wine

Treatments	Titratable acidity (%)			Tannin (%)			Colour (OD)			Ethyl alcohol (%)			Wine recovery (%)
	Fresh wine	Ageing 3MS	Ageing 6MS	Fresh wine	Ageing 3MS	Ageing 6MS	Fresh wine	Ageing 3MS	Ageing 6MS	Fresh wine	Ageing 3MS	Ageing 6MS	
T_1	1.54	1.13	0.98	1.01	0.84	0.72	1.61	1.52	1.42	6.21	6.43	6.67	75.30
T_2	1.01	0.71	0.49	1.39	1.27	1.14	1.72	1.63	1.51	7.45	7.73	7.92	86.15
T_3	1.56	1.14	1.01	4.96	4.71	4.43	2.39	2.28	2.14	6.76	6.84	6.94	67.70
T_4	1.42	1.09	0.91	1.09	0.96	0.83	1.55	1.43	1.39	6.62	6.76	6.87	73.47
T_5	1.12	0.74	0.56	1.56	1.34	1.28	1.69	1.53	1.48	7.23	7.56	7.85	84.60
T_6	1.39	1.02	0.89	5.02	4.94	4.78	2.48	2.36	2.32	6.56	6.73	6.92	65.65
Mean	1.34	0.97	0.80	2.50	2.34	2.19	1.90	1.79	1.71	6.80	7.00	7.19	75.47
S.E.±	0.07	0.08	0.12	0.97	0.99	0.87	0.20	0.23	0.25	0.17	0.26	0.09	3.42
C.D. (P=0.01)	0.23	0.29	0.38	2.94	3.01	2.78	0.69	0.71	0.78	0.54	0.81	0.32	10.56

upon the type of the substrate used for fermentation in litchi wine (Singh and Kaur, 2009).

Organoleptic evaluation:

Effect of different yeast strains and *must* types on sensory qualities after six months of aging in jamun fruit wine is depicted in Fig. 2. Treatment, T_2 secured the highest score of 15.45 and 15.86 out of 20.00 at three and six months of aging, respectively. Acidity, sweetness and general quality obtained the highest score in the treatment T_2 whereas; astringency in T_3 was found highest score due to the presence of seed. The wine produced from T_2 was found to be superior in characteristics like acidity, sweetness, flavour and astringency. This is attributed the fact that a vast number of volatile compounds are also formed and modulated by yeast during alcoholic fermentation that have a significant impact on the flavour and overall quality of wines (King *et al.*, 2008). Not all Saccharomyces strains have the same capacity to reveal these compounds Swiegers and Pretorius (2005).

The use of different Saccharomyces strains for wine fermentation has been shown to result in wines with differing secondary metabolites, through varied relative concentrations of acetic acid esters, fatty acids, ethyl esters, higher alcohols which are sensorially important (Rapp, 1998). The scores in all the treatments showed an increasing trend at six months of aging than at three months. Higher alcohols formed during fermentation decrease with maturation as they are used for the formation of esters. Thus, loss of higher alcohols to form esters is desirable for better sensory properties of wines (Zoeckein *et al.,* 1995). Esters have fruity and floral impact and are important in sensory property of wines. Somesh *et al.* (2009) in strawberry wine observed an increase in total esters during maturation and they attribute it to the phenomenon of aging that is desirable for the development of proper flavour.

In conclusion, good quality wine can be prepared from jamun fruits. The wine produced from *must* containing pulp + skin + *Saccharomyces cerevisiae* var. *ellipsoideus* resulted in organoleptically acceptable wine.

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