

Preparation of Sour Grape (*Vitis Vinifera*) Beverages and Evaluation of their Storage Stability

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Abstract

'Thompson seedless' grapes (*Vitis vinifera*) possessing < 13° brix and > 1.0% acidity were used in the preparation of beverages with and without carbonation. Sour grape juice was extracted, bottled and clarified by racking for three months. Palatable blended grape beverages were also prepared using sour grape juice with phalsa / purple grape juice. Process parameters such as quantity of juice, blending proportions and brix / acid ratio for different beverages were optimized. Squashes were prepared by maintaining brix at 45° and acidity 0.75%. Ready-to-serve (RTS) beverages were standardized with brix 15° and acidity 0.14%. The appearance, color and flavor characteristics of sour grape beverages were improved by blending with purple grape juice and phalsa juice at 2:1 and 1:1 ratios respectively. A set of carbonated beverages in the above combinations were also prepared to check their compatibility and acceptability. A marginal rise in total sugars and decrease in acidity were observed in all beverages after 6 months of storage. Sensory evaluation indicated that carbonated beverages were highly acceptable than plain beverages throughout the storage period. Highest scores of 7.4 and 7.5 were recorded for blended grape beverages with purple grape and phalsa juice respectively even after a storage period of 6 months.

Keywords: Sour grapes; Phalsa; Purple grapes; Blended beverages; Carbonated beverages

Introduction

Fruit beverages are well relished by all age groups of the society. Sour grapes (*Vitis vinifera*) 'Thompson seedless' are grown in some parts of Punjab, Haryana, and Tamil Nadu possess low total soluble solids (< 13° brix) with higher titratable acidity (>1%) which are not suitable for consumption as table variety. Recently, sour grapes were explored in our laboratory for the production of various shelf stable products such as raisins, jam, spread, sweet chutney and canned grapes [1]. It was reported that consumption of grape products at moderate level helps in prevention of aging related diseases [2]. Since higher acidity is a major obstacle in fruits for consumption, fruit juices were subjected to de-acidification by electro dialysis [3], and palatable raisins were produced from sour grapes by osmo-air dehydration [4]. Literature review revealed various combinations of fruit juice, sugar and citric acid in preparation of ready - to - serve (RTS) beverages such as mango-papaya nectar, guava-lemon and papaya-passion fruit juice blends etc [5-7].

Blending of fruit juices is practiced to overcome the high cost of some exotic fruit juices, scarcity or seasonal availability, balancing of strong flavors, high acidity, astringency, or bitterness, improving total soluble solids, bland flavor, improving and stabilizing color. Nutritional or phytochemical properties can be improved by blending which offers to adjust sugar/acid ratios and compensate undesirable juice consistency [8].

Comminuted guava drinks were prepared maintaining the ratio of fruit bases to water at 100:200 and sugar to acid ratio at 450:7.6 to obtain superior organoleptic properties [9]. Guava beverages were prepared using 5, 10% peeled fruit pulp, with 12.5% total soluble solids and 0.25% acidity. The beverages were preserved using 70 ppm SO₂, 120 ppm sodium benzoate, and pasteurization at 85°C for 15 min [10]. The juices were also assessed for retention of vitamin C and flavor in presence of carbonated water. The effect of potassium metabisulfite (100 ppm) was studied in non-pasteurized muscadine grape juice during storage at 3°C for 9 weeks. It was observed that sulfitation

lightened the red color and lowered microbial levels [11]. Processes for extraction of lime juice and preparation of carbonated beverages were well documented in the literature [12]. Preservation of a carbonated lime drink in glass bottles prepared using a base in sugar syrup diluted with chilled carbonated water was described [13]. Blended muscadine grape beverages were prepared using 25% juice and addition of other juice namely, commercial grape juice, orange juice, and pineapple juice maintaining a brix/acid ratio of 30 [14]. Higher overall acceptability and enhanced vitamin C content was achieved by blending gooseberry juice with grape juice at 20:80 ratios [15]. Antioxidant capacity of soy-based beverages was enhanced by blending with strawberry or grape fruit juices [16]. A method of preparation of carbonated RTS beverages using pomegranate syrup was described [17]. The pomegranate syrup consisted of 100% fruit juice, 0.5% citric acid and brix was maintained at 65%. The syrup was diluted to 5 times and then carbonated. Carbonated RTS beverage from acidic tamarind pulp was developed by exposing the pulp to mixture of food enzymes [18]. Tamarind RTS beverage was prepared using 12.5% tamarind extract, 0.4% acidity and adjusting to 16° brix. It was demonstrated that carbonated coconut beverages packed in glass bottles with crown cork seal can be safely preserved for 6 months period at an ambient temperature range of 28-32°C [19].

In the present study, products such as squash and ready to serve (RTS) beverages were prepared from grapes possessing low total soluble solids and high acidity which are hitherto not reported. Blended grape

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RTS beverages were prepared with purple grape and phalsa juices to improve the organoleptic attributes. Carbonated RTS beverages were also prepared for comparison with non-carbonated RTS beverages during storage.

Materials and Methods

‘Thompson seedless’ sour grapes with less than 13° brix and acidity more than 1.0 % were procured directly from grape orchards, Theni, Tamil Nadu, India. Purple grapes were purchased from the local fruit market, Hyderabad. Fully ripe and fresh phalsa (*Grewia asiatica* L.) fruits were procured from orchards situated at Acharya N.G. Ranga Agricultural University, Hyderabad. Carbonated water (Bisleri, Mumbai, India) was procured from a local market for use in preparing carbonated RTS beverages. Chemicals of laboratory grade were procured from S.d. fine Chemicals, Mumbai, India. Glass bottles of 200 and 750 ml capacities were collected from M/s Associated Glass Works, Hyderabad.

Grape bunches were cleaned in running water and the berries were manually separated. Grape juice was extracted in a motorized juice extractor (Jassica, Mumbai, India). The juice was strained through muslin cloth and bottled in 750 ml pre-sterilized glass bottles along with 1000 ppm SO₂, crown corked and kept for racking for 3 months. Similarly juice from purple grapes was extracted, bottled by heat sterilization and kept for racking. The clarified grape juices were carefully decanted and used for the preparation of beverages. Clear phalsa fruit juice was extracted using basket press and used for blending with grape juice. The extracted and racked juices and beverages were analyzed for ° brix, acidity, pH, reducing sugars and total sugars as per standard methods [20].

Preparation of squash and ready-to-serve (RTS) beverages

Squash and RTS beverages were prepared by following standard procedures. Grape squashes were prepared with 45° and 50° brix using 25% fresh juice and potassium metabisulphite (350 ppm) was added as preservative. After a storage period of 10 days, the squashes were diluted with chilled water at 1:3 ratios for preliminary sensory analysis. RTS beverages and blended beverages with purple grape and phalsa juice were prepared by heat preservation. Carbonated beverages were also prepared using chilled carbonated water. Grape RTS beverages were prepared using 10% and 15% strained juice and adjusting the brix to 15°, 18° and 20° for preliminary evaluation. The beverages were boiled and filled into pre-sterilized 200 ml glass bottles and crown corked. In the case of carbonated beverages, chilled base was prepared by using 10 and 15% clear juice and calculated quantity of sugar to get 15°, 18° and 20° brix in the final product. The chilled base was further diluted with chilled carbonated water and bottled immediately. Clarified grape juice was blended with purple grape and phalsa juices separately at 2:1 and 1:1 ratios respectively to improve the colour and flavour of the final RTS beverages. These blended juices namely grape-purple grape and grape-phalsa were bottled as above to prepare plain (by heat preservation) and carbonated RTS beverages. Then, all the beverages were evaluated initially to optimize the juice content, °brix and acidity for the preparation of beverages in bulk for storage studies.

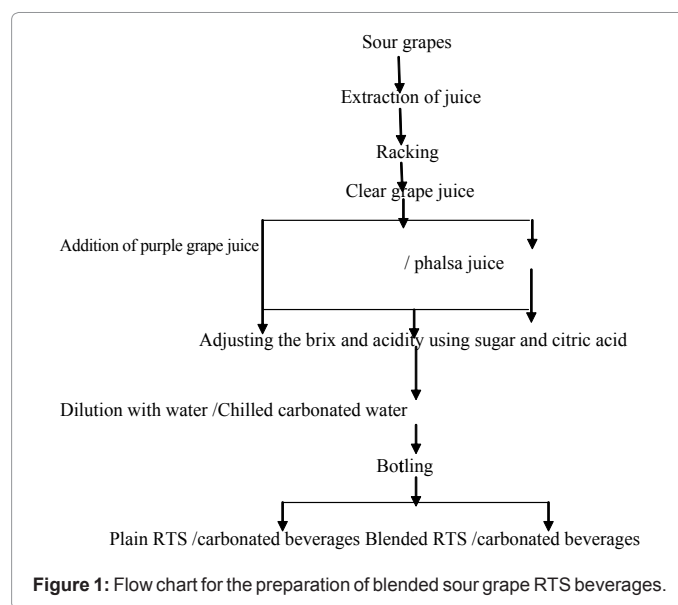
Storage studies

RTS beverages were subjected to storage studies at room temperature for a period of 6 months by drawing samples at bi-monthly intervals to evaluate changes in chemical and organoleptic parameters. The products were also evaluated for sensory qualities viz., colour, flavour, taste and overall acceptability by a panel of 10 judges

using a 9-point Hedonic scale where, score 1 is for ‘dislike extremely’ and 9 for ‘like extremely’ [21]. Sensory scores were analysed statistically by ANOVA using SPSS 15.0 to evaluate the significance at P<0.05.

Results and Discussion

Schematic representation of the preparation of blended sour grape RTS beverages is presented in Figure 1. Analytical data of racked juices from sour grapes and purple grape juice, fresh phalsa juices is presented in Table 1. Various combinations of sugar, citric acid and juice contents were tested for the preparation of plain RTS, blended RTS and carbonated beverages to optimize their quantities by sensory analysis. The optimum conditions for RTS beverages were 15% juice and 15° brix in case of plain RTS, 15% juice and 18° brix for blended RTS with purple grape juice, 10% juice and 18° brix for blended RTS with phalsa. For squash 45° brix was the optimum level. The beverages were prepared according to the standardized recipes and kept for storage



Parameter	Sour grape juice	Purple grape juice	Phalsa juice
Colour	Greenish	Purple	Pink
°Brix	12.40 ± 0.1	13.2 ± 0.1	10.0 ± 0
Acidity, %	1.05 ± 0.01	1.20 ± 0.05	2.86 ± 0.07
pH	3.16 ± 0.02	2.11 ± 0.05	2.79 ± 0.12
Reducing sugar, %	11.92 ± 0.12	9.66 ± 0.16	5.6 ± 0.02
Total sugars, %	12.15 ± 0.05	11.7 ± 0.20	6.0 ± 0.04

Values are mean of triplicates ± SD

Table 1: Physico-chemical analysis of racked fruit juice.

Parameter	Plain grape RTS		Grape-purple grape blend		Grape-phalsa blend	
	1	2	1	2	1	2
°Brix	15	15	18	18	18	20
Acidity, % (as citric acid)	0.14	0.15	0.2	0.2	0.19	0.21
Quantity of juice, %	15	15	15	15	10	10
Proportion of blending (Sour grape juice : purple grape / phalsa fruit juices)	-	-	2:1	2:1	1:1	1:1

1 = plain, 2 = carbonated

Table 2: Optimized conditions for preparation of plain RTS, blended RTS beverages.

Parameter	Squash	Plain grape RTS		Grape-purple grape blend		Grape-phalsa blend	
		1	2	1	2	1	2
0 days							
°Brix	45.0 ± 0.2	15.0 ± 0.1	15.0 ± 0.1	18.0 ± 0.10	18.0 ± 0.1	18.0 ± 0.11	20.0 ± 0.22
Acidity, %	0.75 ± 0.01	0.14 ± 0.02	0.15 ± 0.02	0.22 ± 0.04	0.23 ± 0.01	0.19 ± 0.01	0.21 ± 0.03
pH	2.45 ± 0.01	2.94 ± 0.02	3.02 ± 0.01	3.01 ± 0.01	3.13 ± 0.01	3.25 ± 0.02	3.17 ± 0.02
Reducing sugars, %	42.1 ± 0.25	13.80 ± 0.02	13.90 ± 0.36	6.74 ± 0.05	5.85 ± 0.01	5.29 ± 0.05	6.82 ± 0.04
Total Sugars, %	44.8 ± 0.25	13.80 ± 0.05	13.46 ± 0.11	17.87 ± 0.12	17.80 ± 0.04	18.0 ± 0.07	19.1 ± 0.06
6 months							
°Brix	46.0 ± 0.2	15.0 ± 0.1	15.0 ± 0.1	18.0 ± 0.05	18.0 ± 0.07	18 ± 0.05	20.2 ± 0.12
Acidity, %	0.72 ± 0.03	0.14 ± 0.01	0.14 ± 0.02	0.20 ± 0.01	0.22 ± 0.06	0.18 ± 0.10	0.20 ± 0.11
pH	2.35 ± 0.02	3.26 ± 0.01	3.16 ± 0.01	3.01 ± 0.01	3.12 ± 0.03	3.20 ± 0.07	3.11 ± 0.02
Reducing sugars, %	42.6 ± 0.4	14.31 ± 0.07*	14.27 ± 0.4*	9.74 ± 0.05*	8.92 ± 0.11*	8.29 ± 0.02*	9.12 ± 0.04*
Total Sugars, %	45.2 ± 0.2	14.76 ± 0.24	14.92 ± 0.32	17.87 ± 0.12	17.90 ± 0.14	18.0 ± 0.12	20.1 ± 0.057

Values are mean of triplicates ± SD

Table 3: Chemical analysis of squash and RTS beverages from sour grapes during storage.

Storage period (Days)	Squash	Plain grape RTS		Grape-purple grape blend		Grape-phalsa blend	
		1	2	1	2	1	2
0	7.8 ± 0.37	7.5 ± 0.24	8.0 ± 0.41	8.0 ± 0.33	8.5 ± 0.53	8.5 ± 0.53	8.7 ± 0.30
60	7.5 ± 0.33	7.1 ± 0.16	8.0 ± 0.41	7.5 ± 0.33*	8.0 ± 0.47*	8.0 ± 0.37*	8.2 ± 0.35*
120	7.5 ± 0.28	7.0 ± 0.16*	7.6 ± 0.32*	6.8 ± 0.42*	7.5 ± 0.41*	7.5 ± 0.58*	7.5 ± 0.41*
180	7.0 ± 0.24*	6.8 ± 0.26*	7.0 ± 0.24*	6.5 ± 0.58*	7.4 ± 0.52*	7.5 ± 0.55*	7.5 ± 0.41*

(n = 10 panelists), 1= plain, 2=carbonated, * indicates significant difference compared to 0 days at P≤0.05

Table 4: Overall sensory score of sour grape beverages.

studies. Similarly, carbonated RTS beverages were also prepared using 15% juice and 15°brix in case of grape RTS, 15% juice and 18° brix in case of purple grape and 10% juice and 20°brix in case of phalsa (Table 2). Data on chemical analysis of beverages during 6 months storage period is given in Table 3. Squash prepared from sour grapes contained 45° brix, 0.75% acidity and total sugars 44.8% and remained constant during the storage period. Plain RTS beverage showed 15° brix, 0.15% acidity and pH 3.9 and reducing sugars 13.96%. No significant changes in parameters were observed during 2 and 4 months storage and hence the data was not presented in the table. However, changes in acidity, brix, pH were negligible and reducing sugars increased significantly (P≤0.05) after 6 months storage period in all RTS beverages. Similar observations were noticed in the study carried out on apple and apricot blended juices [22]. Sensory evaluation revealed that all the beverages tasted good initially and stored well during storage for 6 months (Table 4). Squashes were highly acceptable with characteristic grape flavour. A decrease in overall acceptability for RTS beverages prepared by grape juice alone is mainly due to absence of flavour or colour. Initial blending of grape juice with purple grape juice and phalsa juice improved appearance, colour and flavour characteristics and hence scored good. Similar studies on utilization of *Bhokri* grapes which were highly acidic, astringent with low sugar contents in the preparation of blended beverages with coloured and high brix juice of seedless grapes were reported earlier [23]. The sensory scores of blended juices were higher than the plain juices and further scores improved in carbonated beverages. The overall acceptability scores were differed significantly after 60 days storage in all the beverages.

In the present study, panelists preferred carbonated RTS beverages by giving higher scores when compared to non-carbonated beverages. Blended beverage with purple grape juice maintained its colour and flavour in both plain and carbonated beverages. The results are in agreement with the literature wherein carbonation of blueberry flavored milk beverages improved the sensory ratings of sweetness and blueberry flavor [24]. Visually, no colour changes were observed in carbonated

beverages prepared from Roselle calyces (*Hibiscus sabdariffa*) during 3 months storage period at ambient temperature [25]. In the present study, minimal loss of visual color was found in blended beverages with phalsa, but scored well in terms of overall acceptability after 4 months storage period. It was observed the color deterioration (non-enzymatic browning) was at a faster rate in red grape juice concentrate during of 3 months storage at 10 to 30°C [26]. Similarly, losses in color was also observed in blueberry juice blends prepared with different proportions of apple juice, concord grape and venus grape juices and cranberry juice after storage of 3 months at 37°C [27].

Conclusion

The present study revealed that palatable and shelf stable beverages can be prepared from low valued sour grape juice by adjusting the juice quantity and sugar-acid ratio. Beverages blended with purple grape juice and phalsa juice yielded eye appealing products and received good scores throughout the storage period. Carbonation of blended beverages has an added advantage in improving the palatability during storage period. The study demonstrated that value added beverages from sour grapes could be prepared for commercial exploitation.

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