

Studies on development of carbonated pomegranate RTS beverage

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ABSTRACT

The attempts were made in the present investigation to develop a carbonated ready to serve (RTS) beverage from pomegranate juice. The matured and freshly harvested fruits of Cv. Ganesh and Bhagwa were washed and the arils were separated by using operated arils extractor developed by CIPHET, Ludhiana. The juice was extracted by using screw type juice press followed by filtration. The beverage was prepared by adjusting the sugar syrup 60 °Brix and 0.5% acidity by adding citric acid and then carbonated at 80, 100 and 120 psi pressure respectively. The resultant RTS beverage was then analyzed for various physico-chemical and organoleptic characteristics. The study revealed that the RTS beverage prepared by using 60 °Brix juice of 0.5% acidity and 80 psi CO₂ pressure in low temperature of bhagwa cultivar was found better in organoleptic characteristics as compared to the rest of treatment.

Key words : Pomegranate, Juice extraction, Carbonation, Ready-to-serve beverage, organoleptic evaluation.

Introduction

Pomegranate (*Punica granatum* L.) belongs to family Punicaceae, a favourite fruit of tropical and sub-tropical region. The pomegranate tree is native of Iran to the Himalayas in Northern India and has been cultivated since ancient times throughout the mediterian region of Asia, Africa and Europe. Pomegranate locally known as Anar and is one of the most favourite exotic fruit. It is one of the hardiest fruit plant that thrives well under arid and semi arid climatic conditions where climate is cool and hot (Wasker and Garande, 1997). India being the second largest producer of pomegranate has an area of 1.09 lakh hectares with a production of 8.07 lakh tons 'Ganesh' was a popular variety with a productivity of 25 tons per hectare which has been replaced with 'Bhagwa' known to have a productivity of 20 tons

per hectare (Anonymous, 2009).

On the basis of medicinal and therapeutic value, the pomegranate juice is considered for patient suffering from leprosy and high cholesterol. Fruit juice has been scientifically reorganized as the most effective natural antioxidant which guards our body against free radicals, the harmful molecules that cause premature aging and even cancer. The juice of pomegranate has digestive and refreshing properties and helps in reducing melody like fever, lack of appetite and asthma in humans (Singh, 1996). The nutritive value of real fruit juice beverage is greater than synthetic beverages. Hence if the fruit based carbonated beverages are prepared they will fulfill the demand of natural and nutritional beverage in combination with taste provided by carbonated soft drinks. Carbonated beverages are popular amongst people of all age groups and being con-

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sumed for its excellent taste, refreshment, relaxation, pressure, sociability and more commonly to quench the thirst (Philips, 1992).

Fruits are important nutritional protective foods, as these foods supply vitamins and minerals, which improve the quality of diet and maintain health. It is, therefore, necessary to ensure their availability throughout the year in fresh, processed or preserved forms. Only 1.3% of total fruits and vegetables produced in the country are processed against 40% in some of the developing and 70% in developed countries (Mehta 2002). Therefore, attempts were made in the present investigation to increase the shelf life of pomegranate juice by converting into carbonated RTS beverage.

Materials and Methods

Pomegranate fruits of Ganesh and Bhagwa varieties were obtained from cultivars field from Aurangabad. The fruits of uniform size, color, maturity were harvested and were brought to laboratory for further experimentation.

Physico-chemical analysis: The juice was analyzed for the various physico-chemical parameters like yield, waste indeed, moisture, total soluble solids (TSS) ascorbic acid and titratable acidity. The carbonated beverages were analyzed for TSS, titratable acidity, sugars and ascorbic acid content. All the parameters were determined as per standard procedures (Ranganna, 2000).

Preparation of RTS beverages: Fresh Pomegranate harvested at proper maturity was obtained from cultivars field from Aurangabad. The fruits were washed and the arils were separated by using operated arils extractor developed by CIPHET, Ludhiana. Juice was extracted with the help of screw type juice extractor and then clarified by filtration. The TSS of juice was adjusted to 60 °Brix were prepared by adding sugar. The acidity was then adjusted to 0.5% using citric acid. Comprising various treatments viz. T₀V₁ (Control without carbonation Ganesh cultivar), T₁V₁ (Juice 60°Brix + 0.5 % acidity + CO₂ 80 psi LT Ganesh cultivar), T₂V₁ (Juice 60°Brix + 0.5 % acidity + CO₂ 80 psi RT Ganesh cultivar), T₃V₁ (Juice 60°Brix + 0.5 % acidity + CO₂ 100 psi LT Ganesh cultivar), T₄V₁ (Juice 60°Brix + 0.5 % acidity + CO₂ 100 psi RT Ganesh cultivar), T₅V₁ (Juice 60°Brix + 0.5 % acidity + CO₂ 120 psi LT Ganesh cultivar), T₆V₁ (Juice 60°Brix + 0.5 %

acidity + CO₂ 120 psi RT Ganesh cultivar), T₇V₂ (control without carbonation Bhagwa cultivar), T₈V₂

(Juice 60°Brix + 0.5 % acidity + CO₂ 80 psi LT Bhagwa cultivar), T₉V₂ (Juice 60°Brix + 0.5 % acidity + CO₂ 80 psi RT Bhagwa cultivar), T₁₀V₂ (Juice 60°Brix + 0.5 % acidity + CO₂ 100 psi LT Bhagwa cultivar), T₁₁V₂ (Juice 60°Brix + 0.5 % acidity + CO₂ 100 psi RT Bhagwa cultivar), T₁₂V₂ (Juice 60°Brix + 0.5 % acidity + CO₂ 120 psi LT Bhagwa cultivar), T₁₃V₂ (Juice 60°Brix + 0.5 % acidity + CO₂ 120 psi RT Bhagwa cultivar). The beverages were evaluated for physic-chemical analysis of carbonated beverage and sensory quality on the basis of color, flavor, taste, mouthfeel and overall acceptability score. The carbonated juice with CO₂ by using chilled water and sealed immediately by corking as per the procedure of (Khurdiya 1989).

Organoleptic evaluation: the organoleptic evaluation of carbonated beverage was carried according to the method of Kapse (1976) rated on 9 point hedonic scale. The average score of the semi trained panel of judges for different quality characteristics was suggested by Amerine *et al.* (1965)

Storage of carbonated beverages: Storage of the carbonated beverages was done at low conditions viz. ambient storage (12.2 to 33.1°C) and cool storage (5 to 8°C) for two months. The beverages were then analyzed for physico-chemical and sensory characteristics at 15 days interval.

Statistical analysis: The data recorded during the experimentation were subjected to statistical analysis by the method of Panse and Sukhatme (1985) and then significance was drawn at 5% level of probability.

Results and Discussion

The good quality pomegranate fruits of Ganesh and Bhagwa were obtained from cultivars field. The fruits were then analyzed as per standard procedures given by Ranganna, (2000). The results obtained are presented in Table 1.

The data presented in Table1 indicated that, the colour of fruits of cultivar Ganesh was pale yellow where as cultivar Bhagwa was redish in colour. The average weight and volume of fruits of cultivar Ganesh and Bhagwa was 230 and 210 g. The fruits contained on an average 60 per cent arils and 40 per cent peels in both the varieties. The average recovery on fruit basis was 43 per cent and 45 per cent in

Table 1. Physical characteristics of Pomegranate fruit*

Physical characteristics	Cultivar of pomegranate	
	Ganesh	Bhagwa
Colour of fruit	Pale yellow	Redish
Avg. wt. of each fruits (g)	230	210
Proportion of arils to to whole fruits (%)	60	60
Proportion of peels to whole fruits (%)	40	40
Recovery of juice on whole fruit basis (%)	43	45
Recovery of juice from arils (%)	66	68

* Each value is average of three dimensions.

cv. Ganesh and Bhagwa respectively while it was 686 per cent and 68 per cent respectively on arils basis (Sood *et al.*, 1982) also reported 62 per cent edible portion.

The data with respect to chemical composition of juice of the cultivar Ganesh and Bhagwa are presented in Table 2. The data clearly indicates that the TSS of fruits of cultivar Ganesh (12.1 °Brix) was considerably higher than cultivar Bhagwa (11.3 °Brix). The acidity of cultivar Ganesh was lower (0.27 per cent) than that of cultivar Bhagwa (0.35 per cent). The Brix:acid ratio of cultivar Ganesh was higher than that of cultivar Bhagwa i.e, 44.81, 32.28 mg/100 gms and Ascorbic acid of cultivar Bhagwa was

Table 2. Physico-chemical analysis of Pomegranate juice*

Parameters	Cultivars of Pomegranate	
	Ganesh	Bhagwa
TSS (°Brix)	12.1	11.3
Acidity (%)	0.27	0.35
Brix:Acid ratio	44.81	32.28
Ascorbic acid (mg/100 gm)	14.00	16.00
Total sugar (%)	13.88	12.00

*Each value is average of three dimensions.

higher than that of cultivar Ganesh i.e 1600, 14.00 mg/100 gms respectively. The Total sugar was found higher in Ganesh (13.88 %) than that of Bhagwa (12.00 %) the finding also correlated with (Patil *et al.*, 2003).

The data present in Table 3 on physic-chemical analysis of carbonated pomegranate RTS beverages indicate a TSS, acidity and pH of all treatment remain same by adjusting the Brix and acidity level. The ascorbic acid content of the fresh carbonated beverage was observed highest (1.56 mg/100 gm) in the treatment T₈V₂ (Juice 60°Brix + 0.5 % acidity + CO₂ 80 psi LT Bhagwa cultivar), however it was at par with all over the treatments. The total sugar content of the fresh carbonated beverage was observed highest (14.64%) in the treatment T₁V₁ (Juice 60°Brix + 0.5 % acidity + CO₂ 80 psi LT Ganesh cultivar), however it was at par with all over treatments resulted in most acceptable carbonated apple / pear fruit juice beverages observed by (Kaushal and Sharma 2004).

The data presented in the Table 4, result indicate that the increase in TSS was observed in all the treatments. The score for TSS °Brix of carbonated bever-

Table 3. Physico-chemical analysis of carbonated pomegranate RTS beverage

Treatments	TSS (°Brix)	Acidity (%)	pH	Ascorbic acid (mg/100 g)	Total sugar (%)
T ₀ V ₁	12.00	0.30	2.90	1.14	14.58
T ₁ V ₁	12.00	0.30	2.90	1.20	14.64
T ₃ V ₁	12.00	0.30	2.90	1.15	14.62
T ₅ V ₁	12.00	0.30	2.90	1.15	14.60
T ₇ V ₂	12.00	0.30	2.90	1.52	14.52
T ₈ V ₂	12.00	0.30	2.90	1.56	14.56
T ₁₀ V ₂	12.00	0.30	2.90	1.55	14.54
T ₁₂ V ₂	12.00	0.30	2.90	1.52	14.50
SE ±	—	—	—	0.026	0.032
CD at 5%	—	—	—	0.077	0.096

Table 4. Effect of storage conditions on TSS of carbonated pomegranate beverage

Treatments	Storage period (days)				
	Initial	15	30	45	60
T ₀ V ₁	12.00	12.12	12.23	12.44	12.68
T ₁ V ₁	12.00	12.12	12.22	12.38	12.62
T ₂ V ₁	12.00	12.23	12.31	12.53	12.71
T ₃ V ₁	12.00	12.12	12.24	12.44	12.65
T ₄ V ₁	12.00	12.21	12.43	12.65	12.83
T ₅ V ₁	12.00	12.14	12.25	12.43	12.64
T ₆ V ₁	12.00	12.21	12.42	12.64	12.82
T ₇ V ₂	12.00	12.11	12.22	12.45	12.64
T ₈ V ₂	12.00	12.11	12.23	12.33	12.52
T ₉ V ₂	12.00	12.22	12.34	12.55	12.73
T ₁₀ V ₂	12.00	12.11	12.23	12.42	12.63
T ₁₁ V ₂	12.00	12.23	12.32	12.64	12.82
T ₁₂ V ₂	12.00	12.14	12.25	12.43	12.61
T ₁₃ V ₂	12.00	12.23	12.32	12.54	12.82
SE ±	-	1.074	0.053	0.056	0.064
CD at 5%	-	0.132	0.152	0.162	0.185

age was observed highest (12.83 °Brix) in the treatment 60 °Brix juice of 0.5 % acidity and 100 psi CO₂ pressure in room temperature of Ganesh variety (T₄V₁). However it was at par with T₆V₁ (12.82 °Brix), T₁₁V₂ (12.82 °Brix) and T₁₃V₂ (12.82 °Brix) but it was significantly superior over all treatments under study.

The score for acidity of carbonated beverage was observed significantly more (0.26) in the treatment 60 °Brix juice of 0.5 % acidity and 80 psi CO₂ pres-

Table 5. Effect of storage conditions on acidity of carbonated pomegranate beverage

Treatments	Storage period (days)				
	Initial	15	30	45	60
T ₀ V ₁	0.30	0.29	0.28	0.27	0.25
T ₁ V ₁	0.30	0.28	0.28	0.27	0.25
T ₂ V ₁	0.30	0.28	0.27	0.25	0.23
T ₃ V ₁	0.30	0.29	0.28	0.27	0.25
T ₄ V ₁	0.30	0.28	0.27	0.25	0.23
T ₅ V ₁	0.30	0.29	0.28	0.27	0.25
T ₆ V ₁	0.30	0.28	0.27	0.25	0.23
T ₇ V ₂	0.30	0.29	0.28	0.27	0.25
T ₈ V ₂	0.30	0.29	0.28	0.27	0.26
T ₉ V ₂	0.30	0.28	0.27	0.25	0.24
T ₁₀ V ₂	0.30	0.29	0.28	0.27	0.25
T ₁₁ V ₂	0.30	0.28	0.27	0.26	0.24
T ₁₂ V ₂	0.30	0.29	0.28	0.27	0.25
T ₁₃ V ₂	0.30	0.28	0.27	0.25	0.23
SE ±	-	0.037	0.042	0.047	0.055
CD at 5%	-	0.110	0.126	0.141	0.164

sure in low temperature of Bhagwa variety (T₈V₂). However it was at par with T₀V₁ (0.25), T₁V₁ (0.25), T₃V₁ (0.25), T₅V₁ (0.25), T₇V₁ (0.25), T₁₀V₂ (0.25), T₁₂V₂ (0.25), but it was significantly over all other treatments.

The decrease in ascorbic acid content was observed in case of all treatments. The score for ascorbic acid of carbonated beverage was observed highest (1.48) in the treatment 60 °Brix juice of 0.5 % acid-

Table 6. Effect of storage conditions on ascorbic acid content of carbonated pomegranate beverage

Treatments	Storage period (days)				
	Initial	15	30	45	60
T ₀ V ₁	1.14	1.12	1.10	1.07	1.04
T ₁ V ₁	1.20	1.18	1.15	1.12	1.07
T ₂ V ₁	1.20	1.17	1.13	1.10	1.05
T ₃ V ₁	1.15	1.13	1.11	1.09	1.06
T ₄ V ₁	1.15	1.11	1.09	1.07	1.03
T ₅ V ₁	1.15	1.12	1.10	1.08	1.06
T ₆ V ₁	1.15	1.11	1.09	1.07	1.04
T ₇ V ₂	1.52	1.48	1.44	1.42	1.40
T ₈ V ₂	1.56	1.54	1.52	1.50	1.48
T ₉ V ₂	1.56	1.52	1.48	1.44	1.40
T ₁₀ V ₂	1.55	1.53	1.52	1.49	1.47
T ₁₁ V ₂	1.54	1.50	1.46	1.44	1.40
T ₁₂ V ₂	1.52	1.48	1.44	1.40	1.38
T ₁₃ V ₂	1.52	1.46	1.42	1.38	1.34
SE ±	0.024	0.010	0.124	0.107	0.049
CD at 5%	0.072	0.029	0.361	0.310	0.143

Table 7. Effect of storage conditions on overall acceptability score of carbonated pomegranate beverage.

Treatments	Storage period (days)				
	Initial	15	30	45	60
T ₀ V ₁	7.7	7.7	7.6	7.5	7.3
T ₁ V ₁	8.0	8.0	7.9	7.8	7.7
T ₂ V ₁	8.0	7.9	7.8	7.6	7.4
T ₃ V ₁	7.6	7.6	7.5	7.4	7.2
T ₄ V ₁	7.6	7.5	7.4	7.2	7.1
T ₅ V ₁	7.8	7.8	7.7	7.6	7.4
T ₆ V ₁	7.8	7.7	7.6	7.4	7.2
T ₇ V ₂	7.5	7.5	7.4	7.3	7.1
T ₈ V ₂	8.4	8.4	8.2	8.0	7.8
T ₉ V ₂	8.4	8.3	8.1	7.0	7.6
T ₁₀ V ₂	8.0	8.0	7.9	7.8	7.6
T ₁₁ V ₂	8.0	7.9	7.8	7.6	7.4
T ₁₂ V ₂	8.1	8.1	8.0	7.9	7.7
T ₁₃ V ₂	8.1	8.0	7.9	7.7	7.5
SE ±	0.037	0.040	0.049	0.044	0.056
CD at 5%	0.111	0.120	0.144	0.129	0.165

ity and 80 psi CO₂ pressure in low temperature of Bhagwa variety (T₈ V₂). However it was at par with T₁₀ V₂ (1.47) but it was significantly superior over all other treatments.

The overall acceptability score of carbonated beverage during storage are decreased. The score for overall acceptability was observed significantly higher (7.8) in the treatment 60 °Brix juice of 0.5 % acidity and 80 psi CO₂ pressure in low temperature of Bhagwa variety (T₈ V₂). However it was at par with T₁ V₁ (7.7) and T₁₂ V₂ (7.7) but it was significantly superior over all other treatments (Khurdiya 1996) also reported low temperature of carbonated beverage was found acceptable with respect to colour, flavor and overall quality..

Conclusion

The study revealed that the average juice yield of bhagwa cultivar more than ganesh cultivar and the organoleptic acceptable and good quality carbonated beverage prepared by using 60 °Brix juice of 0.5% acidity and 80 psi CO₂ pressure in low temperature of bhagwa variety was found better in organoleptic characteristics as compared to the rest of treatment.

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